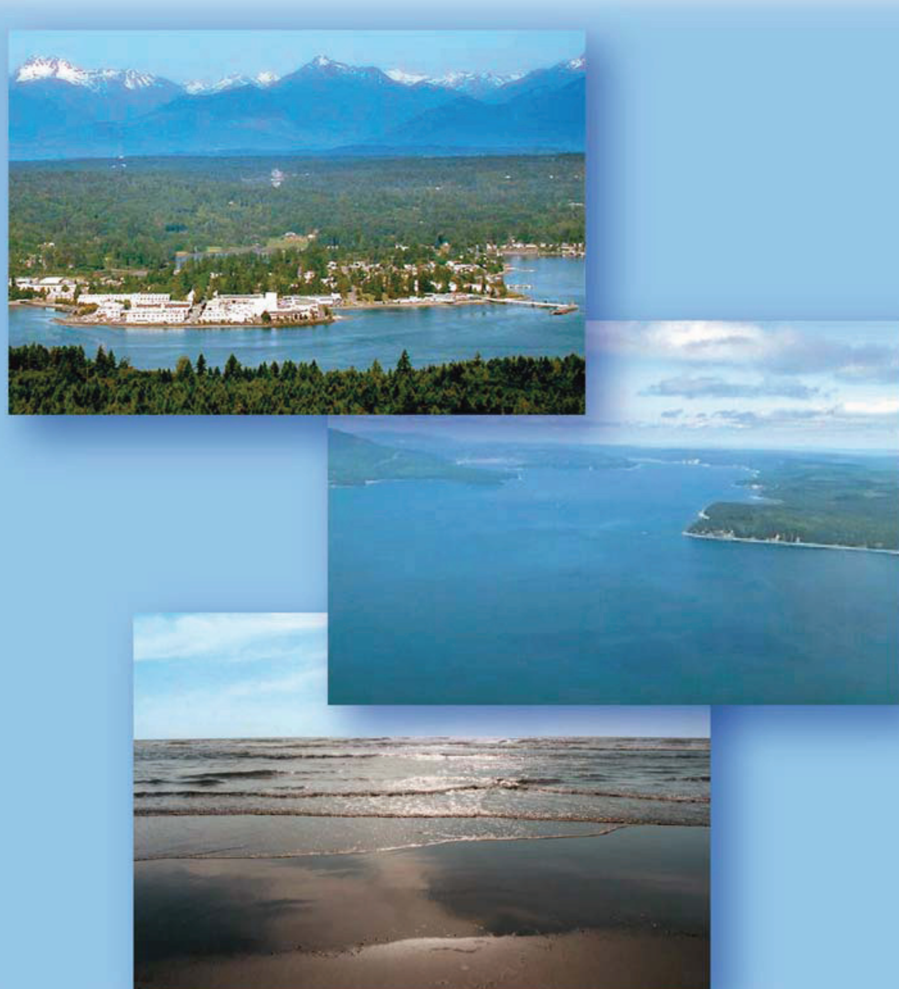
Final

NAVSEA NUWC Keyport Range Complex Extension

Environmental Impact Statement/ Overseas Environmental Impact Statement



May 2010

KEYPORT

Undersea Warfare Center Division

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Final

NAVSEA NUWC KEYPORT RANGE COMPLEX EXTENSION

ENVIRONMENTAL IMPACT STATEMENT/

OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

May 2010

Prepared by

Naval Facilities Engineering Command Northwest

For

Naval Undersea Warfare Center, Keyport

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FINAL

ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

Lead Agency:	Department of the Navy
Title of Proposed Action:	Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension
Affected Jurisdictions:	Grays Harbor County, Jefferson County, Kitsap County, Mason County
Designation:	EIS/OEIS

Abstract

This Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) has been prepared to analyze the potential impacts of actions associated with the proposed Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex extension in Washington State. The NAVSEA NUWC Keyport Range Complex is composed of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach (also known as Port Orchard Narrows) and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the coast of Jefferson County. Portions of the QUTR Site fall outside the 12-nautical mile (22-kilometer) Territorial Waters boundary established by Presidential Proclamation 5928. Therefore, in addition to the National Environmental Policy Act (NEPA), this EIS/OEIS has been prepared in accordance with Navy procedures implementing Executive Order 12114 addressing components of the Proposed Action beyond the Territorial Waters boundary. The Navy is the lead agency for the EIS/OEIS, and the National Marine Fisheries Service (NMFS) is a cooperating agency.

The three range sites within the NAVSEA NUWC Keyport Range Complex are geographically distinct; although activities conducted at the various range sites may be related operationally, each test is conducted solely at a single range site location. The set of alternatives for one range site is independent of the set of alternatives for another range site. Therefore, action alternatives are presented for each range site separately. For each range site, one or more action alternatives have been identified in addition to the No-Action Alternative: *Keyport Range Site* – Alternative 1 (Preferred Alternative – range extension and associated activities); *DBRC Site* – Alternative 1 (southern range extension and associated activities) and Alternative 2 (Preferred Alternative – southern and northern range extensions and associated activities); and *QUTR Site* – Alternative 1 (range extension, surf-zone access at Kalaloch, and associated activities), Alternative 2 (Preferred Alternative – range extension, surf-zone access at Pacific Beach, and associated activities), and Alternative 3 (range extension, surf-zone access at Ocean City, and associated activities). The Keyport Range Site alternatives are located in Kitsap County, the DBRC Site alternatives are located in Kitsap, Mason, and Jefferson counties, and the QUTR Site alternatives are located in Jefferson and Grays Harbor counties.

None of the action alternatives would result in any substantial short- or long-term impacts on physical or socioeconomic resources. Minimal cumulative impacts would occur and natural or cultural resources would not be irreversibly or irretrievably committed as a result of implementation of the Proposed Action. The Navy is working with NMFS through the Marine Mammal Protection Act (MMPA) permitting process to ensure compliance with MMPA regarding Level B exposures to marine mammals. In accordance with the Endangered Species Act, the Navy has completed consultation with the U.S. Fish and Wildlife Service (USFWS) and is in the process of concluding consultation with NMFS regarding effects on federally listed species and designated critical habitat. Based on the final Biological Opinion (BO) from USFWS and draft BO from NMFS, the action would not jeopardize the continuing existence of any listed species, or result in the destruction or adverse modification of critical habitat. To the extent practicable, the Navy will implement any reasonable and prudent measures and related terms and conditions resulting from the consultations to minimize potential adverse effects. Although it is the Navy's conclusion that none of the alternatives would have an adverse effect on Essential Fish Habitat (EFH) that would require mitigation under the Magnuson-Stevens Fishery Conservation and Management Act, the Navy has considered NMFS' EFH conservation recommendations and has formally responded to NMFS regarding the implementation of appropriate EFH conservation measures. In compliance with the Coastal Zone Management Act,

the Navy has prepared and submitted a Coastal Consistency Determination to the Washington Department of Ecology (WDOE) for proposed activities occurring on the shoreline or in-water as required by federal implementing regulations. The WDOE concurred with the determination that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management program and would not result in any significant impacts to the State's coastal resources.

Prepared By: Department of the Navy
Point of Contact: Mrs. Kimberly Kler, Naval Facilities Engineering Command Northwest

Final

NAVSEA NUWC KEYPORT RANGE COMPLEX EXTENSION EIS/OEIS

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Acronyms and Abbreviations

3-D	three dimensions/three-dimensional
ASW	antisubmarine warfare
ATF	Acoustic Test Facility
AUV	Autonomous Underwater Vehicle
BA	Biological Assessment
BE	Biological Evaluation
°C	degrees Celsius
CAA	Clean Air Act
CCD	Coastal Consistency Determination
Cd	cadmium
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter(s)
CO	carbon monoxide
COA	Certificate of Authorization
COMSUBPAC	Commander Submarine Force, U.S. Pacific Fleet
CPS	Coastal Pelagic Species
CSL	Cleanup Screening Level
Cu	Copper
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibel(s)
dB re 1 µPa @ 1 m	decibel(s) reference 1 microPascal at 1 meter
DBRC	Dabob Bay Range Complex
DDE	Dichlorodiphenyl dichloroethylene
DFOC	Department of Fisheries and Oceans Canada
DIAL	Differential Absorption LIDAR
DO	dissolved oxygen
DoD	Department of Defense
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFDL	energy flux density level
EFH	Essential Fish Habitat
EMATT	Expendable Mobile Anti-Submarine Warfare Training Target
EMF	electromagnetic field
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FMP	Fisheries Management Plan
ft	foot/feet
FY	fiscal year
GPS	Global Positioning System
ha	hectare(s)
HAPC	Habitat Area of Particular Concern
HFA	high-frequency active
HMS	"highly migratory species"
HPA	hypothalamic-pituitary-adrenal
Hz	Hertz
ICE	International Council for Exploration of the Sea
ICRMP	Integrated Cultural Resources Management Plan
in	inches
INRMP	Integrated Natural Resources Management Plan
IOAG	Interim Operations Approval Guidance
kHz	kiloHertz
kg	kilogram(s)
km	kilometer(s)
kph	kilometers per hour
lbs	pounds
LFA	low frequency active
Li	lithium
LIDAR	laser imaging detection and ranging
LOA	Letter of Authorization
m	meter(s)
MBTA	Migratory Bird Treaty Act
MFA	mid-frequency active
mi	mile(s)
mg	milligrams
MHHW	mean higher high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MOA	Military Operating Area
MPA	Marine Protected Area
mph	miles per hour
MRTFB	Major Range Test Facility Base
MSAT	Marine Species Awareness Training
MTCA	Model Toxics Control Act
MWR	Morale, Welfare, and Recreation
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
NATO	North Atlantic Treaty Organization
NAVSEA	Naval Sea Systems Command
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Association
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Lab
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOTMAR	Notice to Mariners
NPS	National Park Service
NRC	National Research Council of the National Academies
NRHP	National Register of Historic Places
NUWC	Naval Undersea Warfare Center
NWFSC	Northwest Fisheries Science Center
NWR	National Wildlife Refuge
O_3	ozone
OAHP	Office of Archeology and Historic Preservation
OASIS	Organic Airborne and Surface Influence Sweep
OCNMS	Olympic Coast National Marine Sanctuary
OEIS	Overseas Environmental Impact Statement
OHS	Oil and Hazardous Substance
OPAREA	Operating Area
OPNAVINST	Chief of Naval Operations Instruction
ORCAA	Olympic Region Clean Air Agency
Pb	lead
PCB	polychlorinated biphenyl
PCE	primary constituent element
PFMC	Pacific Fishery Management Council
PL	public law
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
PSCAA	Puget Sound Clear Air Agency
PSMFC	Pacific States Marine Fisheries Commission
PSWQAT	Puget Sound Water Quality Action Team
PTS	Permanent Threshold Shift
QTNR	Quileute Tribe Natural Resources
QUTR	Quinault Underwater Tracking Range
RCRA	Resource Conservation and Recovery Act
RCW	Regulatory Code of Washington
RDT&E	Research, Development, Test, and Evaluation
RF	radio frequency
RL	received level
rms	root mean square
ROD	Record of Decision

ROP	Range Operating Policies and Procedures Manual
ROV	Remotely Operated Vehicle
sec	second(s)
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMA	Shoreline Management Act
SMS	Sediment Management Standards
SNS	sympathetic nervous system
SO_2	sulfur dioxide
SONAR (sonar)	Sound Navigation and Ranging
SORD	Submerged Object Recovery Device
SPCC	Spill Prevention Control and Countermeasures
SPL	sound pressure level
SQS	Sediment Quality Standards
SR	State Route
SSC	Space and Naval Warfare Systems Center
SURTASS-LFA	Surveillance Towed Array Sonar System – Low Frequency Active
TMDL	Total Daily Maximum Load
TS	Threshold Shift
TTS	Temporary Threshold Shift
U&A	Usual and Accustomed
UAS	Unmanned Aerial System
UME	unusual mortality events
µPa	microPascal(s)
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	United States Census Bureau
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UUV	Unmanned Undersea Vehicle
W	Warning Area
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington State Department of Ecology
WDOH	Washington State Department of Health
WQS	Water Quality Standards
WRCC	Western Regional Climate Center
WSBPD	Washington State Business and Project Development
WSDOT	Washington State Department of Transportation
XBT	Expendable Bathymetric Thermograph
Zn	zinc
Zr	zirconium

Glossary

Term	Definition
Acoustics	The scientific study of sound, especially of its generation, transmission, and reception.
Active sonar	Detects objects by creating a sound pulse, or ping, that transmits through the water and reflects off the target, returning in the form of an echo. This is a two-way transmission (source to reflector to receiver).
Action Area	In this document, the term "Action Area" for each range site refers to the combined area of the existing range site boundary and the proposed extension.
Alternative	A different method for accomplishing the Proposed Action. An alternative can consist of the same action in a different location, or a modification to the Proposed Action.
Ambient noise	The typical or persistent environmental background noise present in the ocean.
Anadromous	Species of fish that are born in fresh water migrate to the ocean to grow into adults, and then return to fresh water to spawn.
Anthropogenic noise	Noise related to, or produced by, human activities.
Antisubmarine warfare (ASW)	Naval operations conducted against submarines, their supporting forces, and operating bases.
Baleen	In some whales (see Mysticete below), the parallel rows of fibrous plates that hang from the upper jaw and are used for filter feeding.
Bathymetry	The measurement of water depth at various places in a body of water; the information derived from such measurements.
Behavioral effect	Defined in this EIS/OEIS as a variation in an animal's behavior or behavior patterns that results from an anthropogenic acoustic exposure and exceeds the normal daily variation in behavior.
Benthic	Referring to the bottom-dwelling community of organisms that creep, crawl, burrow, or attach themselves to either the sea bottom or such structures as ships, buoys, and wharf pilings (e.g., crabs, clams, worms).
Biologically important activities/behaviors	Those activities or behaviors essential to the continued existence of a species, such as migration, breeding/calving, or feeding.
Cetacean	An order of aquatic mammals such as whales, dolphins, and porpoises.
Critical Habitat	Critical habitat is defined in section 3 of the Endangered Species Act (ESA) as—(1) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (i) essential to the conservation of the species and (ii) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.
Decibel (dB)	A unit used to express the relative difference in power, usually between acoustic or electrical signals, equal to 10 times the common logarithm of the ratio of the two levels. Since the decibel scale is exponential and not linear, a 20-dB sound is 10 times louder than a 10-dB sound, a 30-dB sound is 100 times louder than a 10-dB sound.
Demersal	Living at or near the bottom of a waterbody, but having the capacity for active swimming. Term used particularly when describing various fish species.
Distinct population segment (DPS)	A vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The ESA provides for listing species, subspecies, or distinct population segments of vertebrate species.

Glossary

Term	*Definition*
Endangered species	Any species that is in danger of extinction throughout all or a significant portion of its range (ESA §3[6]).
Energy flux density level (EFDL)	The energy traversing in a time interval over a small area perpendicular to the direction of the energy flow, divided by that time interval and by that area. EFDL is stated in dB re 1 μPa^2-s for underwater sound.
Epifauna	Organisms living on the surface of the sediment/sea bed.
Essential Fish Habitat (EFH)	Those waters and substrate that are defined within Fishery Management Plans for federally-managed fish species as necessary to fish for spawning, breeding, feeding, or growth to maturity.
Evolutionary Significant Unit (ESU)	A Pacific salmonid stock that is substantially reproductively isolated from other stocks of the same species and which represents an important part of the evolutionary legacy of the species. An ESU is treated as a species for purposes of listing under the ESA. NMFS uses this designation.
Exclusive Economic Zone (EEZ)	A maritime zone adjacent to the territorial sea that may not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.
Federal Register	The official daily publication for actions taken by the Federal government, such as Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential documents.
Frequency	Description of the rate of disturbance, or vibration, measured in cycles per second. Cycles per second are usually referred to as Hz, the unit of measure.
Harassment	There are two definitions of harassment used in this document, depending on context. Under the Endangered Species Act, harassment is an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Under the Marine Mammal Protection Act as applicable to military readiness activities, harassment is any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment].
High frequency	As defined in this document, frequencies greater than 10 kHz.
Hydrography	The characteristic features (e.g., flow, depth) of bodies of water.
Hydrophone	An underwater receiver used to detect the pressure change caused by sound in the water. That pressure is converted to electrical energy. It can then be translated to something that can be heard by the human ear. Sometimes the detected acoustic pressure is outside the human range of hearing.
Impact Testing	Infrequently used to determine where the placement of the weapon on the target will be.
Infauna	Animals living within the sediment.
Isobath	A line on a chart or map connecting points of equal depths; bathymetric contour.
Isotherm	A line on a chart or map connecting points of equal temperatures.

Glossary

Term	*Definition*
Letter of authorization (LOA)	The Marine Mammal Protection Act provides for a "small take authorization" (i.e., letter of authorization) for maritime activities, provided NMFS finds that the takings would be of small numbers (i.e., taking would have a negligible impact on that species or stock), would have no more than a negligible impact on those marine mammal species not listed as depleted, and would not have an unmitigable adverse impact on subsistence harvests of these species.
Level A harassment	Level A harassment includes any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild. Injury is identified as the destruction or loss of biological tissue. The destruction or loss of biological tissue will result in an alteration of physiological function that exceeds the normal daily physiological variation of the intact tissue.
Level A harassment zone	Extends from the source out to the distance and exposure at which the slightest amount of injury is predicted to occur. The acoustic exposure that produces the slightest degree of injury is therefore the threshold value defining the outermost limit of the Level A harassment zone.
Level B harassment	Level B "harassment" is any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where the patterns are abandoned or significantly altered. Unlike Level A harassment, which is solely associated with physiological effects, both physiological and behavioral effects have the potential to cause Level B harassment.
Level B harassment zone	Begins just beyond the point of slightest injury and extends outward from that point. It includes all animals that may potentially experience Level B harassment. Physiological effects extend beyond the range of slightest injury to a point where slight temporary distortion of the most sensitive tissue occurs, but without destruction or loss of that tissue. The animals predicted to be in this zone experience Level B harassment by virtue of temporary impairment of sensory function (altered physiological function) that can disrupt behavior.
Laser imaging detection and ranging or light detection and ranging (LIDAR)	An optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target. The prevalent method to determine distance to an object or surface is to use laser pulses. Like the similar radar technology, which uses radio waves instead of light, the range to an object is determined by measuring the time delay between transmission of a light pulse and detection of the reflected signal.
Lithium Boiler	A system that produces high heat for the purposes of electric power.
Low frequency	As defined in this document, frequencies less than 1 kilohertz (kHz).
Masking	The obscuring of sounds of interest by interfering sounds, generally at the same frequencies.
Mid-frequency	As defined in this document, frequencies between 1 and 10 kHz.
Mitigation measure	Measures that will minimize, avoid, rectify, reduce, eliminate, or compensate for significant environmental effects.
Mysticete	Any whale of the suborder Mysticeti having plates of whalebone (baleen plates) instead of teeth. Mysticetes are filter-feeding whales, also referred to as baleen whales, such as blue, fin, gray, and humpback whales.
Notice of intent (NOI)	A written notice published in the Federal Register that announces the intent to prepare an EIS. Also provides information about a proposed federal action, alternatives, the scoping process, and points of contact within the lead federal agency regarding the EIS.
Odontocete	Any toothed whale (without baleen plates) of the suborder Odontoceti such as sperm whales, killer whales, dolphins, and porpoises.

Glossary

Term	*Definition*
Onset permanent threshold shift (onset PTS)	PTS (defined below) is non-recoverable and, by definition, must result from the destruction of tissues within the auditory system. PTS therefore qualifies as an injury and is classified as Level A harassment under the wording of the Marine Mammal Protection Act. In this EIS/OEIS, the smallest amount of PTS (onset PTS) is taken to be the indicator for the smallest degree of injury that can be measured. The acoustic exposure associated with onset PTS is used to define the outer limit of the Level A harassment zone
Onset temporary threshold shift (onset TTS)	A threshold shift (TS) represents an increase in the auditory threshold, i.e. a reduced ability to hear, at a particular frequency. TTS (defined below) is recoverable and is considered to result from the temporary, non-injurious distortion of hearing-related tissues. In this EIS/OEIS, the smallest measurable amount of TTS (onset TTS) is taken as the best indicator for slight temporary sensory impairment. Because it is considered non-injurious, the acoustic exposure associated with onset TTS is used to define the outer limit of the portion of the Level B harassment zone attributable to physiological effects. This follows from the concept that hearing loss potentially affects an animal's ability to react normally to the sounds around it. Therefore, the potential for TTS qualifies as a Level B harassment that results from physiological effects upon the auditory system.
Passive sonar	Detects the sound created by an object (source) in the water. This is a one-way transmission of sound waves traveling through the water from the source to the receiver.
Pelagic	Pelagic is a broad term applied to species that inhabit the open, upper portion of marine waters rather than waters adjacent to land or near the sea floor.
Permanent threshold shift (PTS)	Exposure to high-intensity sound may result in auditory effects such as noise-induced threshold shift, or simply a threshold shift (TS). If the TS becomes a permanent condition, generally as a result of physical injury to the inner ear and hearing loss, it is known as PTS.
Physiological effect	Defined in the EIS/OEIS as a variation in an animal's physiology that results from an anthropogenic acoustic exposure and exceeds the normal daily variation in physiological function.
Ping	Pulse of sound created by a sonar.
Pinger	A pulse generator using underwater sound transmission to relay data such as subject location.
Pinniped	Any member of a suborder (Pinnipedia) of aquatic carnivorous mammals (i.e., seals and sea lions) with all four limbs modified into flippers.
Platform	A vessel, pier, barge, etc. from which test systems can be deployed.
Received level	The level of sound that arrives at the receiver, or listening device (hydrophone). The received level is the source level minus the transmission losses from the sound traveling through the water.
Record of Decision (ROD)	A concise summary of the decision made by the project proponent (e.g., Navy) from the alternatives presented in the Final EIS. The ROD is published in the *Federal Register*.
Resonance	A phenomenon that exists when an object is vibrated at a frequency near its natural frequency of vibration – the particular frequency at which the object vibrates most readily. The size and geometry of an air cavity determine the frequency at which the cavity will resonate.
Riprap	Is rock or other material used to armor shorelines against water erosion.
Scoping	An early and open process with federal and state agencies and interested parties to identify possible alternatives and the significant issues to be addressed in an EIS.

Glossary

Term	*Definition*
Sonobuoy	A device launched from an aircraft to determine environmental conditions for determination of best search tactics, to communicate with friendly submarines, and to conduct search, localization, tracking, and, as required, attack of designated hostile platforms. Sonobuoys provide both a deployable acoustical signal source and reception of underwater signals of interest.
Sound **Na**vigation and **R**anging (Sonar)	Any anthropogenic (man-made) or animal (e.g., bats, dolphins) system that uses transmitted acoustic signals and echo returns for navigation, communication, and determining position and bearing of a target. There are two broad types of anthropogenic sonar: active and passive.
Sound pressure level (SPL)	A measure of the root-mean square, or "effective," sound pressure in decibels. SPL is expressed in dB re 1 µPa for underwater sound and dB re to 20 µPa for airborne sound.
Source level	The sound pressure level of an underwater sound as measured one meter from the source.
Static Testing	When the item being tested is held in one place.
Substrate	Any object or material upon which an organism grows or to which an organism is attached.
System	The combined aspects of communication, instrumentation, propulsion, electronics, hardware, and computer components of a vehicle under test. The system includes the interconnection and communication components of the support craft associated with any system under test.
Tactical Sonar	A category of sonar emitting equipment that includes surface ship and submarine hull-mounted active sonars.
Take	Defined under the MMPA as "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect."
Temporary threshold shift (TTS)	Exposure to high-intensity sound may result in auditory effects such as noise-induced threshold shift, or simply a threshold shift (TS). If the TS recovers after a few minutes, hours, or days it is known as TTS.
Test vehicle	A device such as a torpedo or UUV that is being tested within the range complex as part of Research Development Test and Evaluation (RDT&E) activities.
Threatened species	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (ESA §3[20]).
Transmission loss	Energy losses that occur as the pressure wave, or sound, travels through the water. The associated wavefront diminishes due to the spreading of the sound over an increasingly larger volume and the absorption of some of the energy by water.

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SUMMARY

Name of Action: Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension

Type of Action: Operational

Description of Action:

The Department of the Navy (Navy) proposes to extend the operational areas associated with the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex in Washington State. The Keyport Range Complex is composed of three geographically distinct range sites: the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and the Quinault Underwater Tracking Range (QUTR) Site. The Proposed Action would provide additional operating space at each of the three range sites to better support current and evolving test requirements and range activities conducted by NUWC Keyport. The action would also include small increases in the average annual number of tests and days of testing at the Keyport Range Site and the QUTR Site. This Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) addresses potential effects associated with the Proposed Action and alternatives. Portions of the QUTR Site and proposed extension fall outside the 12-nautical mile (nm) (22-kilometer [km]) Territorial Waters established by Presidential Proclamation 5928. Therefore, in addition to the National Environmental Policy Act (NEPA), this EIS/OEIS has been prepared in accordance with Navy procedures implementing Executive Order 12114 addressing components of the Proposed Action beyond U.S. Territorial Waters. The Navy is the lead agency for the EIS/OEIS, and the National Marine Fisheries Service (NMFS) is a cooperating agency.

The Keyport Range Site is located within Kitsap County and includes portions of Liberty Bay and Port Orchard Reach. The DBRC Site is located in Hood Canal and Dabob Bay, within Jefferson and Kitsap counties. The QUTR Site is located in the Pacific Ocean off the coast of Jefferson County, Washington. Activities conducted at the various range sites may be related operationally in that certain tests are run interdependently and are used in tandem (e.g., one asset may be at DBRC Site and another may be simultaneously at the Keyport Range Site). However, each test is conducted solely at a single range site location, and each site is independently monitored for safety and operational purposes.

The purpose of the Proposed Action is to enable NUWC Keyport to continue fulfilling its mission of providing test and evaluation services and expertise to support the Navy's evolving manned and unmanned undersea vehicle program. NUWC Keyport has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare. Technological advancements in the materials, instrumentation, guidance systems, and tactical capabilities of manned and unmanned vehicles continue to evolve in parallel with emerging national security priorities and threat assessments. In response, range capabilities and vehicle test protocols must also evolve in order to provide effective program support for such advancements.

The Proposed Action to extend range operational areas is needed because the existing Range Complex is becoming increasingly incapable of satisfying the existing and evolving operational capabilities and test requirements of next-generation manned and unmanned vehicles. The Navy requires a range complex with assets that provide a broader diversity of sea state conditions, bottom type, deeper water, and increased room to maneuver and combine activities. Extending the Range Complex operating areas as proposed would enable the Navy to better support current and future vehicle test requirements in multiple marine environments.

Description of Alternatives Considered in Detail

As the three range sites within the NAVSEA NUWC Keyport Range Complex are geographically distinct, the set of alternatives for one range site is independent of the set of alternatives for another range site. One or more action alternatives have been identified for each range site (in addition to the No-Action Alternative):

- *Keyport Range Site*: Keyport Range Alternative 1 (Preferred Alternative) – extend range boundaries to the north, east, and south, increasing the size of the range from 1.5 nm^2 to 3.2 nm^2 (5.2 km^2 to 11.0 km^2). The average annual days of use would increase from 55 to 60 days.
- *DBRC Site*: DBRC Alternative 1 – extend the southern boundary of this range approximately 10 nm (19 km). DBRC Alternative 2 (Preferred Alternative) – extend the southern boundary approximately 10 nm (19 km), and the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge, increasing the size of the range from 32.7 nm^2 to 45.7 nm^2 (112.1 km^2 to 156.7 km^2). There would be no increase in average annual days of use under either DBRC alternative.
- *QUTR Site*: QUTR Alternative 1 – extend the range boundaries to coincide with the overlying special use airspace of W-237A plus locate an 8.4 nm^2 (28.8 km^2) surf zone at Kalaloch. The total range area under QUTR Alternative 1 would increase from approximately 48.3 nm^2 (165.5 km^2) to approximately 1,840.4 nm^2 (6,312.4 km^2). QUTR Alternative 2 (Preferred Alternative) – extend the range boundaries the same as Alternative 1 but locate a 7.8 nm^2 (26.6 km^2) surf zone at Pacific Beach instead of at Kalaloch. The total range area under QUTR Alternative 2 would be 1,839.8 nm^2 (6,310.2 km^2). QUTR Alternative 3 – extend the range boundaries the same as Alternative 1 but locate a 22.6 nm^2 (77.6 km^2) surf zone at Ocean City instead of at Kalaloch. The total range area under QUTR Alternative 3 would be 1,854.6 nm^2 (6,361.2 km^2). For all three alternatives, the average annual use for offshore activities would increase from 14 days to 16 days and activities in the selected surf zone would occur an average of 30 days per year.

At the conclusion of the EIS/OEIS process, the Navy decision maker will sign a Record of Decision (ROD). The ROD will identify the selected action alternative for each of the three range sites.

Alternatives Considered but Eliminated from Detailed Consideration

Over the course of planning, the Navy considered a number of alternatives that were potentially able to support the NUWC Keyport mission. These testing alternatives were initially screened and evaluated to determine their ability to meet the minimum operational selection criteria but were eliminated from consideration due to their inconsistency with the mission and strategic vision for NUWC Keyport and with the purpose and need for the Proposed Action. Three additional surf zone alternatives were initially considered but eliminated from consideration because they did not meet the screening criteria for the Proposed Action. Therefore, these alternatives were not carried forward for analysis in the EIS/OEIS.

Section 1502.14(d) of the CEQ guidelines requires that the alternatives analysis in the EIS "include the alternative of no action." In its NEPA's Forty Most Asked Questions, CEQ identifies two distinct interpretations of "no action." The interpretation selected by the action proponent depends on the nature of the proposal being evaluated. One interpretation of the No-Action alternative is that the proposed activity would not take place. This would mean that Navy would not conduct test or training activities in the Range Complex. This interpretation does not meet the purpose and need of the Proposed Action and would neither be reasonable nor practical. The other interpretation of the No-Action alternative is "no change from current management direction or level of management intensity." This interpretation would meet the purpose and need of the Proposed Action and would allow the Navy to compare the potential impacts of the Proposed Action to the impacts of maintaining the status quo. With regard to this

EIS/OEIS, the No-Action Alternative represents the regular and historic level of activity on the Range Complex. Thus, the No-Action Alternative serves as a baseline "status quo" when studying levels of range use and activity. The potential impacts of the current level of RDT&E and fleet activity on the NAVSEA NUWC Keyport Range Complex (defined by the No-Action Alternative) are compared to the potential impacts of activities proposed under the action alternatives.

Environmental Impacts and Mitigation Measures

None of the action alternatives would result in substantial short- or long-term impacts on physical or socioeconomic resources. Minimal cumulative impacts would occur, and natural or cultural resources would not be irreversibly or irretrievably committed as a result of implementation of the Proposed Action. Implementation of the No Action Alternative or any of the proposed alternatives would not disturb, adversely affect, or result in any takes of bald eagles. None of the alternatives would result in a significant adverse effect on the population of a migratory bird species. The Navy is working with NMFS through the Marine Mammal Protection Act (MMPA) permitting process to ensure compliance with MMPA regarding Level B exposures to marine mammals. In accordance with the Endangered Species Act, the Navy has completed consultation with the U.S. Fish and Wildlife Service (USFWS) and is in the process of concluding consultation with NMFS regarding effects on federally listed species and designated critical habitat. Based on the final Biological Opinion (BO) from USFWS and draft BO from NMFS, the action would not jeopardize the continuing existence of any listed species, or result in the destruction or adverse modification of critical habitat. To the extent practicable, the Navy will implement any reasonable and prudent measures and related terms and conditions resulting from the consultations to minimize potential adverse effects. Although it is the Navy's conclusion that none of the alternatives would have an adverse effect on Essential Fish Habitat (EFH) that would require mitigation under the Magnuson-Stevens Fishery Conservation and Management Act, the Navy has considered NMFS' EFH conservation recommendations and has formally responded to NMFS regarding the implementation of appropriate EFH conservation measures. In compliance with the Coastal Zone Management Act, the Navy has prepared and submitted a Coastal Consistency Determination to the Washington Department of Ecology (WDOE) for any new activities occurring on the shoreline or in-water as required by the federal implementing regulations. The WDOE concurred with the determination that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management program and would not result in any significant impacts to the State's coastal resources. Appendix H of the EIS/OEIS contains relevant communications associated with regulatory compliance.

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CHAPTER 1
PURPOSE AND NEED

1.1 INTRODUCTION

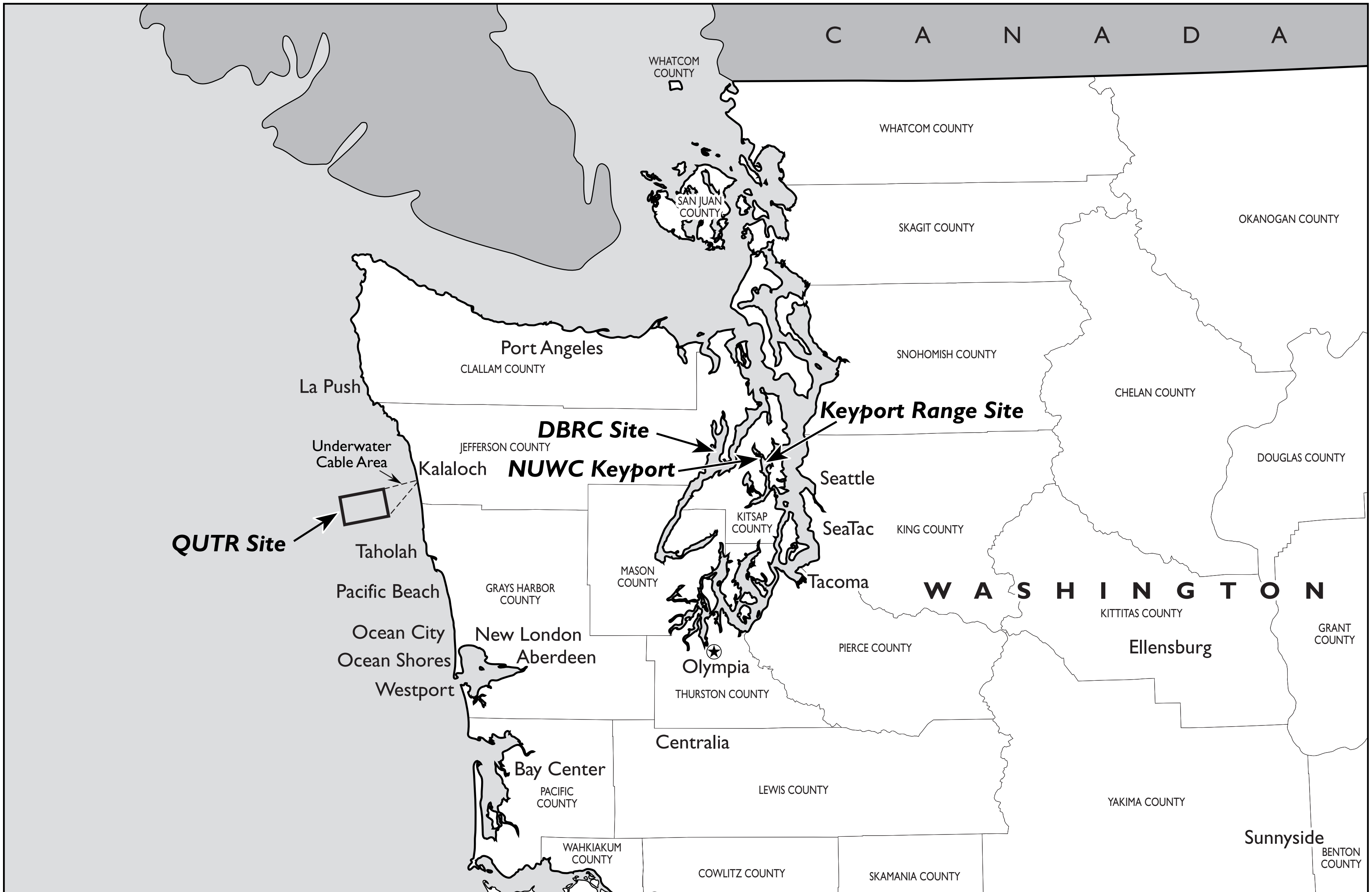
The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to examine the environmental effects of their proposed actions. An Environmental Impact Statement (EIS) is a detailed public document providing an assessment of the potential effects a Federal action might have on the human, natural, or cultural environment. The Department of the Navy (Navy) proposes to extend the operating areas of the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex in Washington State. This Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) addresses potential effects associated with the Proposed Action and alternatives. The NAVSEA NUWC Keyport Range Complex currently comprises the Keyport Range Site, the Dabob Bay Range Complex (DBRC) Site, and the Quinault Underwater Tracking Range (QUTR) Site (Figure 1-1). In addition to extensions of the Keyport Range and QUTR sites, the Proposed Action also includes small increases in the average annual number of tests and days of testing at those ranges. The Proposed Action at the DBRC Site involves extension of the operating area only; no additional operational tempo is proposed for the DBRC Site. The creation of any new designations on standard National Oceanic and Atmospheric Administration (NOAA) navigational charts would occur as a separate action after the Record of Decision (ROD). The Navy is the lead agency for the EIS/OEIS, and the National Marine Fisheries Service (NMFS) is a cooperating agency.

The Navy considers potential environmental impacts in conjunction with other relevant information to plan actions and make decisions. Rather than focusing on specific activities that may occur within a limited part of the NAVSEA NUWC Keyport Range Complex, this EIS/OEIS provides a range-wide, comprehensive evaluation of proposed as well as current NUWC Keyport activities conducted at each of the three range sites.

The Keyport Range Site is located in Kitsap County and includes portions of Liberty Bay and Port Orchard Reach (also known as Port Orchard Narrows). The DBRC Site is located in Hood Canal and Dabob Bay, in Jefferson and Kitsap counties. The QUTR Site is located in the Pacific Ocean off the coast of Jefferson County. The three range sites are geographically distinct. Activities conducted at the various range sites may be related operationally in that certain tests are run interdependently and are used in tandem (e.g., one test may be at the DBRC Site and another run simultaneously at the Keyport Range Site). However, each test is conducted solely at a single range site location, and each site is independently monitored for safety and operational purposes. While one suite of tests may be conducted over various portions of the range complex, each specific activity is planned and executed independently.

1.2 PURPOSE AND NEED

The purpose of the Proposed Action is to enable NUWC Keyport to continue fulfilling its mission of providing test and evaluation services and expertise to support the Navy's evolving manned and unmanned vehicle program activities. NUWC Keyport has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare. Range support requirements for such activities include testing, training, and evaluation of system capabilities such as guidance, control, and sensor accuracy in multiple marine environments (e.g., differing depths, salinity levels, sea states) and in surrogate and simulated war-fighting environments.



Kilometers
0 55.6
0 30
Nautical Miles

Figure 1-1
Regional Location of the NAVSEA NUWC Keyport Range Complex

Technological advancements in the materials, instrumentation, guidance systems, and tactical capabilities of manned and unmanned vehicles continue to evolve in parallel with emerging national security priorities and threat assessments. In response, range requirements and vehicle test protocols must also evolve in order to provide effective program support for such changes.

The infrastructure to support these activities includes a variety of shore-based facilities (outside the scope of this EIS/OEIS) and in-water range sites. To be effective, the range complex must offer the necessary combination of physical characteristics (e.g., sufficient operating area for vehicle maneuverability and monitoring; variations in water depth; shore access; substrate diversity; dynamic sound and buoyancy characteristics) to satisfy the emerging test and evaluation criteria for each type of vehicle. Examples of emerging requirements in undersea vehicle testing include: 1) an increased focus on littoral threat environments such as shorelines, bays, and harbors; 2) a greater ability to differentiate between multiple, widely separated targets of different types (including false targets); 3) deeper water environments up to 4,500 feet (ft) (1,372 meters [m]); 4) increased opportunities for larger, combined exercise test/training scenarios involving Fleet assets; and 5) greater availability of real-world testing in actual surf-zone conditions instead of simulated surf conditions.

The Proposed Action to extend the existing operational boundaries of the NAVSEA NUWC Keyport Range Complex is needed because the existing Range Complex is becoming increasingly incapable of satisfying the existing and evolving operational capabilities and test requirements of next-generation manned and unmanned vehicles. In some cases, test plans have already had to be scaled down to contain test activities within the current range boundaries. The operational endurance and sensor capabilities of such vehicles are expected to continue to expand, and the Navy needs an expanded test range capability to match the projected operational and test requirements. To effectively respond to these changes, the Navy requires a range complex with assets that provide a broader diversity of sea state conditions, bottom type, deeper water, and increased room to maneuver and combine activities. Extending the Range Complex operating areas beyond the current boundaries would enable the Navy to support future vehicle test requirements, including evolving manned and unmanned vehicle program requirements in multiple marine environments.

This EIS/OEIS assesses these requirements for the entire Range Complex in a single NEPA document, which allows the Navy to address upcoming programs collectively, rather than performing separate environmental reviews for future programs on a case-by-case basis. As NUWC Keyport conducts Research, Development, Test, and Evaluation (RDT&E) and other related range complex activities, there is no specific set of scenarios that would describe all possible operational configurations. Therefore, parameters are set for the types of tests, number of tests, days of use, propulsion types, and acoustic sources that may be used on any range site in any combination in order to develop test scenarios. Proposed activities are evaluated within the parameters analyzed in this document. Any proposed activity analyzed within this EIS/OEIS and falling within the set of operational and acoustic parameters would be conducted within the appropriate range site. Any proposed activity that falls outside of these parameters for any reason, whether acoustic, expendable materials (e.g., exhaust, guidance wire, by-products), or other operational issue, would be modified to be within this analysis framework. If the proposed activity cannot be modified to fit within the scope of this EIS/OEIS, the activity would not occur until additional NEPA and EO 12114 analyses are conducted. Commander NUWC Keyport has the primary responsibility for NUWC Keyport activities within the NAVSEA NUWC Keyport Range Complex and is therefore the action proponent.

1.3 BACKGROUND OF THE NAVSEA NUWC KEYPORT RANGE COMPLEX

This section provides an introduction to the NAVSEA NUWC Keyport Range Complex. Topics covered include a description of the location and mission of NUWC Keyport; site-specific descriptions of the Keyport Range Site, DBRC Site, and QUTR Site; an overview of typical activities within the NAVSEA NUWC Keyport Range Complex; and a summary of range operating policies and procedures and public safety. Examples of scenarios characteristic of various types of tests within the existing range sites are presented later in Section 2.3. Definitions for terms often used to describe range activities such as system, platform, test vehicle, and hydrophone are provided in the Glossary following the Table of Contents.

1.3.1 NAVSEA NUWC Keyport

Naval Sea Systems Command (NAVSEA) is responsible for engineering, building, buying, and maintaining the Navy's ships and submarines and associated combat systems. The Naval Undersea Warfare Center (NUWC) is one of two undersea warfare centers under NAVSEA; it provides Fleet readiness support for submarines, surface ships, torpedoes, mines, land attack systems, and Fleet training systems. NUWC Keyport, one of two divisions of NUWC, provides test and evaluation, in-service engineering, maintenance, Fleet readiness, and support for undersea warfare systems, including RDT&E of torpedoes, unmanned vehicles, sensors, targets, countermeasure systems, and acoustic systems.

NUWC Keyport occupies 340 acres (138 hectares [ha]) on the shores of Liberty Bay and Port Orchard Reach, and is located adjacent to the town of Keyport, due west of Seattle (Figure 1-1). The Navy has conducted underwater testing in Puget Sound since 1914, when the Pacific Coast Torpedo Station was established at Keyport. This station has been associated with aspects of virtually all major developments in undersea warfare systems since its operational inception. NUWC Keyport has the mission, organization, facilities, and expertise to support advancements in undersea systems, including the assembly, production acceptance (proofing), testing, and evaluation of these systems as part of their integration into operational Fleet elements. Testing conducted by NUWC Keyport not only provides critical validation of the Navy’s undersea devices and craft but also represents an important Homeland Security component.

1.3.2 Description of the Range Sites

1.3.2.1 Keyport Range Site

The Navy has conducted underwater testing at the Keyport Range Site since 1914. Located adjacent to NUWC Keyport, this range provides approximately 1.5 square nautical miles (nm^2) (5.1 square kilometers [km^2]) of shallow underwater testing, including in-shore shallow water sites and a shallow lagoon to support integrated undersea warfare systems and vehicle maintenance and engineering activities (Figures 1-2 and 1-3). Water depth at the Keyport Range Site is less than 100 ft (30.5 m). Underwater tracking of test activities is accomplished by using temporary or portable range equipment. The range is currently used an average of 6 times per year for vehicle testing and a variety of boat and diver training activities, each lasting 1–30 days. There may be several activities in 1 day. The range site also supports: 1) detection, classification, and localization test objectives and 2) magnetics measurement programs. Explosive warheads are not placed on test units or tested within the Keyport Range Site. The Keyport Range Site is charted as a Restricted Area on NOAA Navigation Chart 18446 (NOAA 2007b). Existing NEPA documentation related to RDT&E activities at the Keyport Range Site includes the *Environmental Assessment (EA) for the Autonomous Underwater Vehicle (AUV) Fest at Keyport Range, WA* and associated Finding of No Significant Impact (FONSI) in 2003 (Navy 2003b).

View of the Northern Portion of the Keyport Range Site (right foreground) and NUWC Keyport (looking north)

View of DBRC Site (looking north)

Figure 1-2
Photos of Keyport Range and DBRC Sites

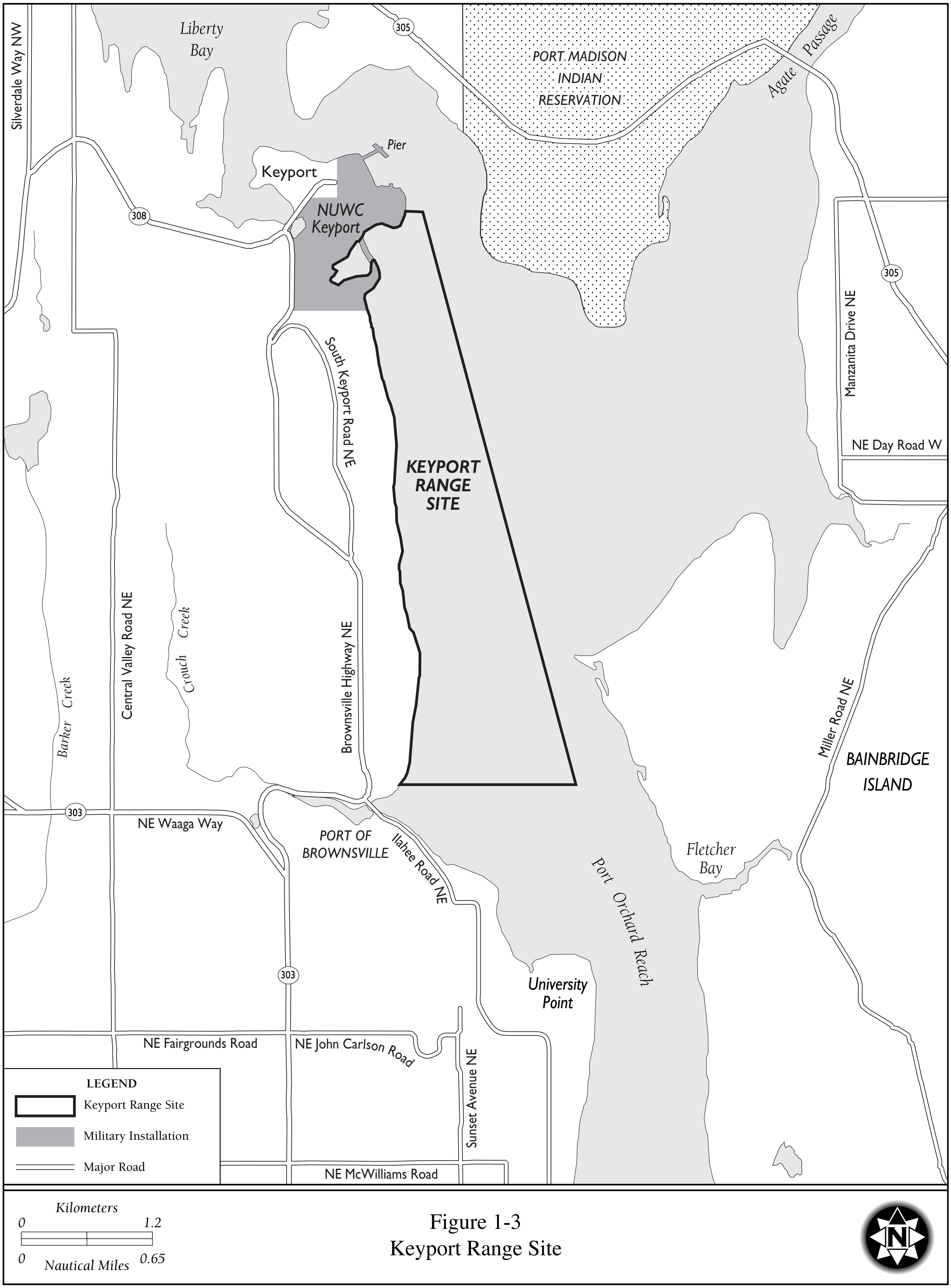


Figure 1-3
Keyport Range Site

1.3.2.2 DBRC Site

The Navy has conducted underwater testing at the DBRC Site since 1956, beginning with a control center at Whitney Point. The control center was subsequently moved to Zelatched Point. Currently, DBRC Site assets include the Dabob Bay Military Operating Area (MOA), the Hood Canal North and South MOAs adjacent to Naval Base Kitsap-Bangor, and the Connecting Waters (Figures 1-2 and 1-4). The DBRC Site is the Navy's premier location within the U.S. for RDT&E of underwater systems such as torpedoes, countermeasures, targets, and ship systems, and is a component of the DoD Major Range Test Facility Base (MRTFB) (Navy 2006c). MRTFB ranges are recognized as critical assets to national defense.

Primary activities at the DBRC Site support proofing of underwater systems, research and development test support, and Fleet training and tactical evaluations involving aircraft, submarines, and surface ships. Tests and evaluations of underwater systems, from the first prototype and pre-production stages up through Fleet activities (inception to deployment), ensure reliability and availability of underwater systems and their Fleet components. As with the Keyport Range Site, there are no explosive warheads tested or placed on test units. The DBRC Site also supports acoustic/magnetic measurement programs. These programs include underwater vehicle/ship noise/magnetic signature recording, radiated sound investigations, and sonar evaluations. In the course of these activities, various combinations of aircraft, submarines, and surface ships are used as launch platforms. Test equipment may also be launched or deployed from shore off a pier or placed in the water by hand.

NUWC Keyport conducts activities in four underwater testing areas at the DBRC Site:

- *Dabob Bay MOA* – a deep-water range in Jefferson County approximately 14.5 nm^2 (49.9 km^2) in size. The acoustic tracking space within the range is approximately 7.3 by 1.3 nm (13.4 by 2.3 km) (9 nm^2 [31 km^2]) with a maximum depth of 600 ft (183 m). The Dabob Bay MOA is the principal range and the only component of the DBRC Site with extensive acoustic monitoring instrumentation installed on the seafloor, allowing for object tracking, communications, passive sensing, and target simulation. Activities within the Dabob Bay MOA are supported by land-based facilities at Zelatched Point. The Zelatched Point area occupies 28 acres (11 ha) of land owned by the Navy overlooking Dabob Bay. The pier at Zelatched Point, which was historically used for float planes and range craft, will be refurbished in the future. This is outside the scope of this EIS/OEIS analysis and additional NEPA documentation will be prepared to address its replacement. There is also a landing pad at Zelatched Point to support helicopter activities.
- *Hood Canal MOAs* – two deep-water operating areas adjacent to Naval Base Kitsap-Bangor in Hood Canal with an average depth of 200 ft (61 m). Hood Canal MOA South is approximately 4.5 nm^2 (15.4 km^2) in size and Hood Canal MOA North is approximately 7.9 nm^2 (27.0 km^2). The Hood Canal MOAs are used for vessel sensor accuracy tests and launch and recovery of test systems where tracking is optional.
- *Connecting Waters* – the portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs (Figure 1-4). The shortest distance between the Dabob Bay MOA and Hood Canal MOA South by water is approximately 3.8 nm (7.0 km) and the total area of the Connecting Waters is approximately 5.8 nm^2 (19.8 km^2). Water depth in the Connecting Waters is typically greater than 300 ft (91 m). The connecting waters are used for sensor accuracy tests and launch and recovery of test systems where tracking is optional.

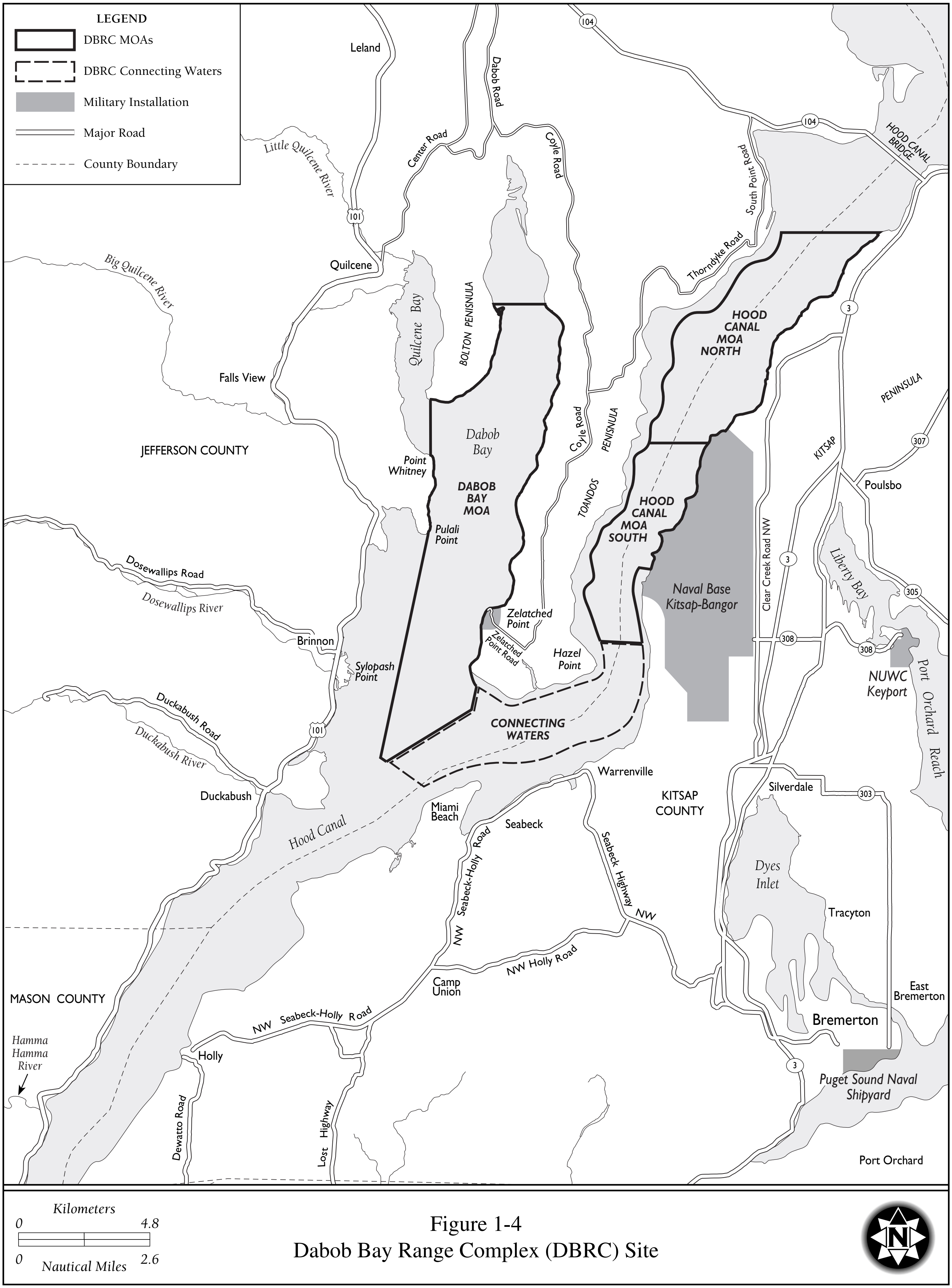


Figure 1-4
Dabob Bay Range Complex (DBRC) Site

The Dabob Bay and Hood Canal MOAs are charted as Naval Operating Areas on NOAA Navigation Chart 18458 (NOAA 2007a). Existing NEPA documentation related to RDT&E activities at the DBRC Site includes an EA and FONSI in 2002 (Navy 2002a). The EA describes the DBRC location and current activities.

1.3.2.3 QUTR Site

The Navy has conducted underwater testing at the QUTR Site since 1981 and maintains a control center at the Kalaloch Ranger Station. As at the other range sites, no explosive warheads are used at the QUTR Site. The QUTR Site is a rectangular-shaped test area of about 48.3 nm^2 (165.5 km^2), located approximately 6.5 nm (12 km) off the Pacific Coast at Kalaloch, Washington (Figure 1-5). Water depth at the QUTR Site is less than 400 ft (122 m). It lies within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS).

The QUTR Site is instrumented to track surface vessels, submarines, and various undersea vehicles. Bottom sensors are permanently mounted on the sea floor for tracking and are maintained and configured by the Navy. The sensors are connected to the shore via cables, which extend under the beach to the bluffs and end at a Navy trailer and communication tower in Kalaloch (National Park Service [NPS] property). In addition, portable range equipment may be set up prior to conducting various activities on the range and removed after it is no longer needed. All communications are sent back to NUWC Keyport for monitoring.

The QUTR Site is part of the Northwest Training Range Complex and it underlies a portion of Warning Area (W)-237A, a component of the larger airspace unit W-237 (inset map on Figure 1-5). This airspace complex comprises the northern portion of the Pacific Northwest Ocean Surface/Subsurface Operating Area (OPAREA), NOAA chart number 18500 (NOAA 2006b). Activities in this airspace are scheduled and coordinated with Naval Air Station (NAS) Whidbey Island and Commander Submarine Force, U.S. Pacific Fleet (COMSUBPAC). Navy activity within W-237A was addressed in the EIS for the 1993 establishment of the OCNMS (NOAA 1993), which included a description of NUWC Keyport equipment, support, general operations, and natural and cultural resources within the range site (NOAA 1993). The EIS evaluated Navy activities in the OCNMS and included activities related to the QUTR instrumented area. Its findings are incorporated into this EIS/OEIS for description of physical parameters and Navy activities but not acoustic analysis. The Navy is currently conducting an EIS/OEIS analysis for the Northwest Training Range Complex operated by U.S. Pacific Fleet. This is a concurrent independent analysis and is included in the Cumulative Impacts section of Chapter 4.

1.3.3 Overview of Typical Tests, Systems, and Activities within All Range Sites of the NAVSEA NUWC Keyport Range Complex

Typical activities conducted by NUWC Keyport on the three existing range sites primarily support undersea warfare RDT&E program requirements, but they also support general equipment test and military personnel training needs, including Fleet activities. For the purposes of this EIS/OEIS, Fleet activities covered in this EIS/OEIS do not include the use of high powered tactical surface ship and submarine hull-mounted sonars. All activities conducted in the NAVSEA NUWC Keyport Range Complex are guided by the *Range Operating Policies and Procedures Manual (ROP)* (NUWC Keyport 2006), the *Range Users Guide* (NUWC Keyport 2004a), and applicable Navy regulations and guidance.

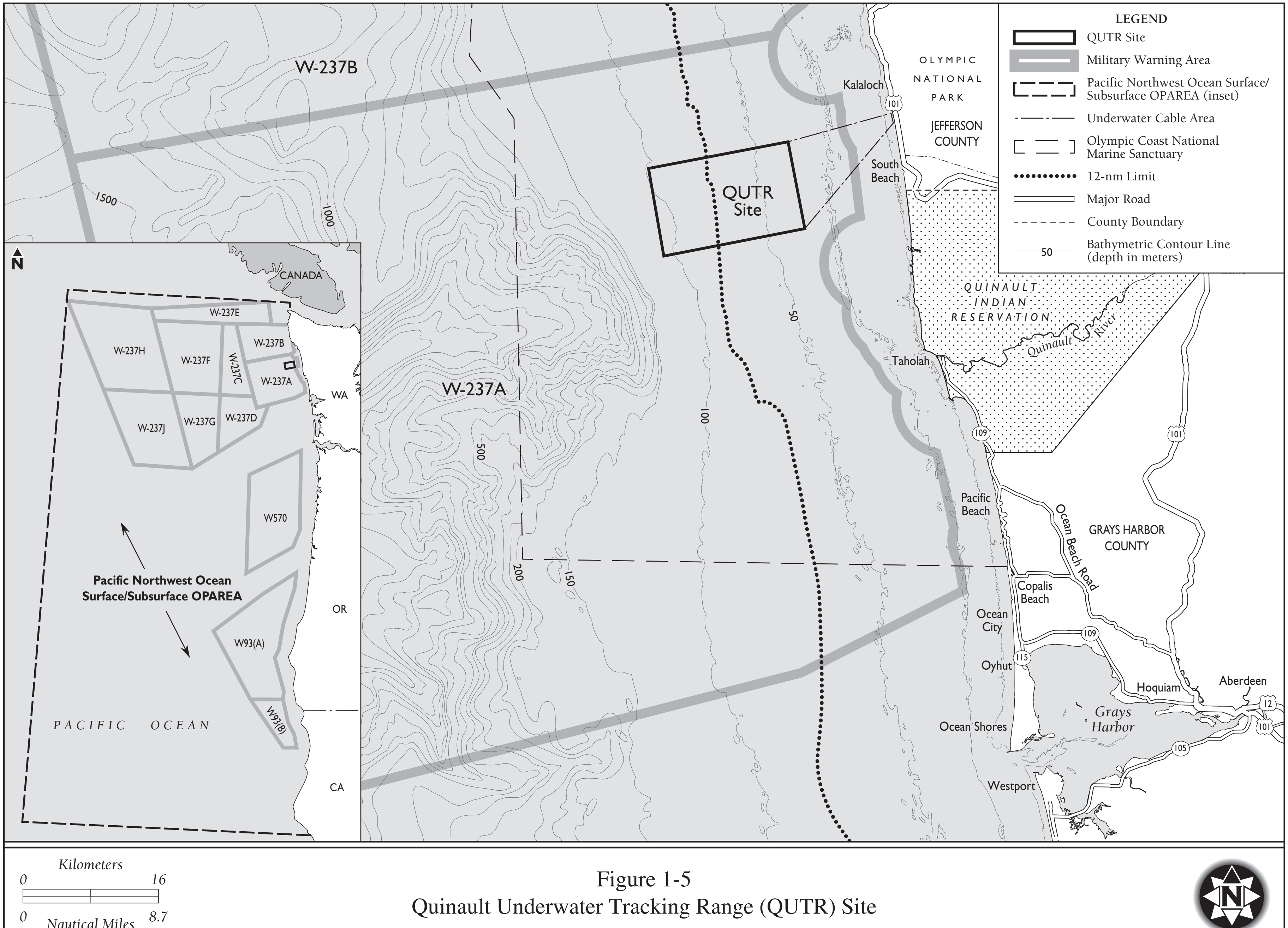


Figure 1-5
Quinault Underwater Tracking Range (QUTR) Site

Test and training activities typically involve a wide variety of platforms, non-explosive exercise weapons, and test-related devices. Submarines, surface ships, and aircraft can be involved in undersea warfare exercises. Historically, the average annual days of use at each range site have been approximately 60 days for the Keyport Range Site, 130 days for the DBRC Site, and 20 days for the QUTR Site. Currently, the average annual range utilization is 55 days for the Keyport Range Site, 200 days for the DBRC Site, and 14 days for the QUTR Site; these current activity levels are used as the baseline conditions in this EIS/OEIS. Changes in national security requirements may affect the number of days per year that range sites are used. Testing activities typically occur during daylight hours on weekdays; however, there are periodic tests that may occur overnight (e.g., for a 72-hour endurance run). Annual use and activities within the NAVSEA NUWC Keyport Range Complex provided in Table 1-1 are based on the current average annual range utilization. As noted in the table, there may be several activities (e.g., tests, launches, and/or "runs") on any given day of use, and some may occur at the same time and in the same location as other activities.

Table 1-1 Annual NAVSEA NUWC Keyport Range Complex Usage and Activities

		*Current Estimated Number of Activities/Year**		
Range Activity	*Platform/Systems Used*	*Keyport Range Site*	*DBRC Site*	*QUTR Site*
Test Vehicle Propulsion	Thermal propulsion systems	0	130	20
	Electric/Chemical propulsion systems	45	140	10
Other Testing Systems and Activities	Submarine testing	0	45	10
	Inert mine detection, classification and localization	5	20	5
	Non-Navy testing	5	5	5
	Acoustic and non-acoustic sensors (e.g., magnetic array, oxygen)	20	10	5
	Countermeasure test	5	50	5
	Impact testing	0	10	5
	Static in-water testing	10	10	5
	Unmanned Undersea Vehicle (UUV) test	45	120	20
Fleet Activities** (excluding RDT&E)	Surface ship activities	1	10	10
	Aircraft activities	0	10	10
	Submarine activities	0	30	30
	Diver activities	45	5	10
Deployment Systems (RDT&E)	Range support vessels:			
	Surface launch craft	35	180	30
	Special purpose barges	25	75	0
	Fleet vessels***	15	20	20
	Aircraft (rotary and fixed-wing)	0	10	20
	Shore and pier	45	30	0

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.

** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

*** Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

An overview of the typical activities conducted within the NAVSEA NUWC Keyport Range Complex, including routinely used systems and procedures, is presented in this section. Simplified graphic representations of various operational components are shown in Figure 1-6. These diagrams portray a variety of different systems that could be used on the range sites. Figure 1-6(a) shows components of a permanently fixed tracking site and Figure 1-6(b) shows the components of a portable tracking site. The current DBRC and QUTR sites are examples of permanently instrumented tracking sites. The Keyport Range site is not permanently instrumented with a fixed tracking range. Portable range tracking can be used to augment an existing permanently instrumented site or provide stand-alone underwater-tracking capability.

Many tests use only one or two systems at a time. For example, a torpedo could be launched from the ocean surface and later recovered from the sea floor. This ability to recover assets from the sea floor is unique to the NAVSEA NUWC Keyport Range Complex because of the specialized recovery equipment and Remotely Operated Vehicle (ROV) expertise developed by NUWC Keyport personnel. Navy-certified hard-hat dive teams can recover to 150 ft (46 m), and ROVs can be used at all depths. ROVs are deployed from NUWC Keyport range craft or commercial craft.

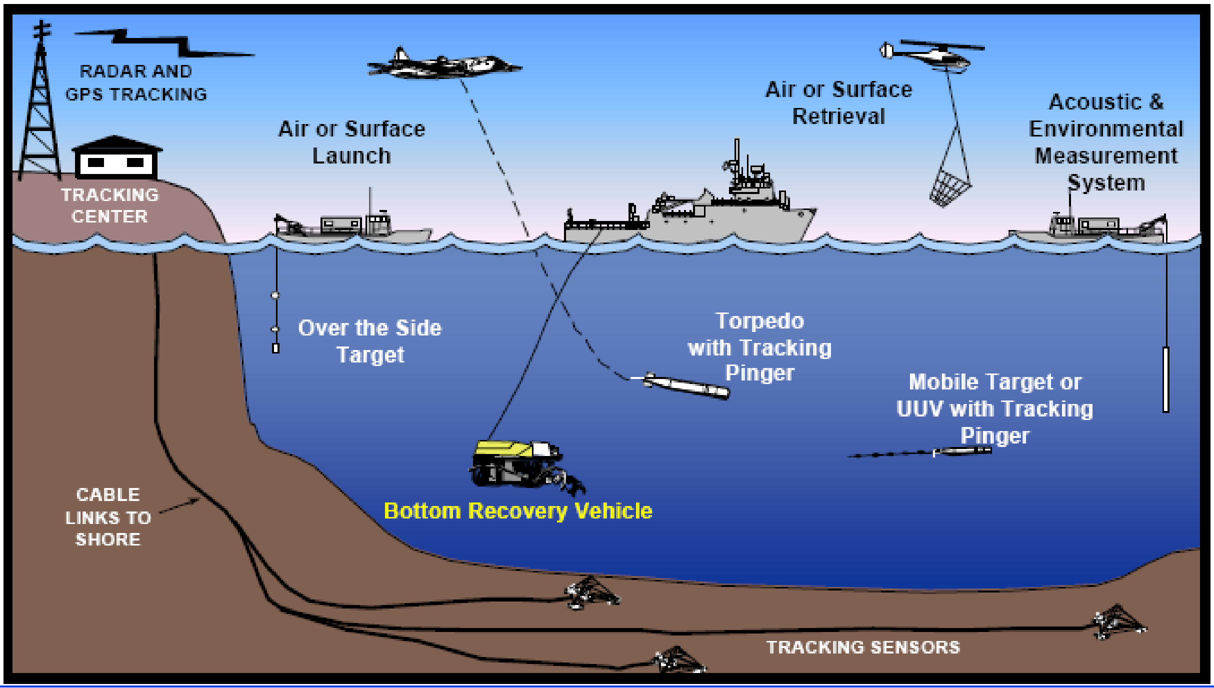
1.3.3.1 Types of Range Activities and Platforms or Systems Used

Test Vehicle Propulsion

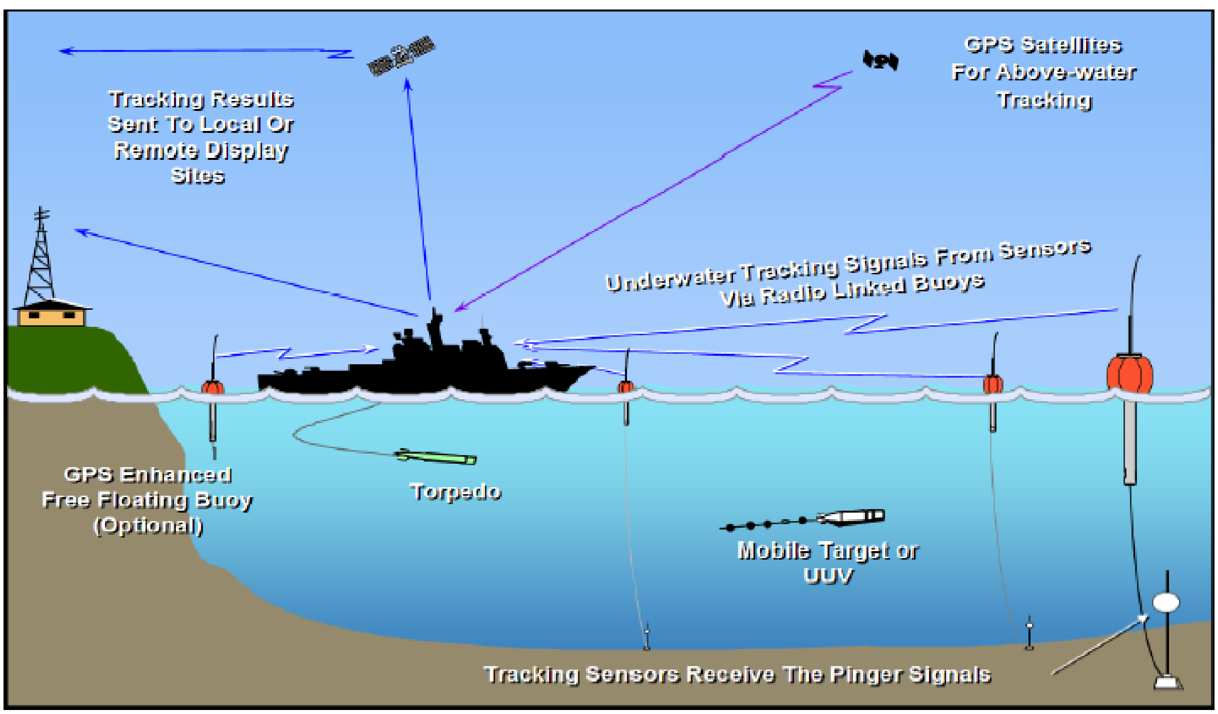
Test vehicles propulsion refers to the type of fuel or energy used to power test vehicles operating at a range site. Test vehicles used at the NAVSEA NUWC Keyport Range Complex sites feature two types of propulsion systems: thermal and electric/chemical.

Thermal propulsion systems, powered by Otto Fuel II, rocket fuel, diesel fuel, and/or jet fuels, are open cycle systems whereby combustion byproducts are exhausted to the water column. There are also closed cycle thermal systems that have no emissions into the environment other than heat. Several torpedoes and Unmanned Undersea Vehicles (UUVs) use thermal engines for high speed and short duration. As shown in Table 1-1, range activities involving thermal propulsion of test vehicles are conducted an average of 130 days per year within the DBRC Site and 20 days per year within the QUTR Site (currently, no activities involving thermal propulsion occur at the Keyport Range Site). Activities utilizing thermal propulsion systems may be scheduled for anywhere from 10 minutes to 24 hours.

Electric propulsion systems are powered by motors using different types of batteries. Battery types include lithium thionyl, lithium ion, lead acid, silver zinc, and nickel hydride. For these closed cycle systems only heat energy is transferred into the environment. Electric propulsion is generally used for mobile targets, UUVs, and other systems that run for relatively long periods. Chemical propulsion systems are usually based on a lithium boiler that is a closed cycle system. Chemical propulsion systems are generally used for high speed and short duration torpedoes and UUVs. As shown in Table 1-1, range activities involving electric or chemical propulsion of test vehicles are conducted an average of 45 days per year at the Keyport Range Site, 140 days per year within the DBRC Site, and 10 days per year within the QUTR Site. Test vehicles utilizing electric/chemical propulsion systems are typically scheduled for 4 hours of use during each activity.



(a). Components of a Typical Permanently Fixed Tracking Site



(b). Components of a Typical Portable Tracking Site

Figure 1-6
Illustrations of Typical Activities within the NAVSEA NUWC Keyport Range Complex

<u>Other Testing Systems and Activities</u>

Submarine Testing. Submarine RDT&E testing includes any Fleet or civilian submarine used in support of testing. It may be small enough to be launched from another submarine or surface craft or it may be as large as an Ohio class submarine. Currently, activities of this type are scheduled an average of 45 days per year within the DBRC Site and 10 days per year within the QUTR Site (no activities involving submarine testing occur at the Keyport Range Site). The typical duration of submarine testing activity is up to 8 hours.

Inert Mine Detection, Classification, and Localization. This type of activity supports RDT&E of inert mine systems and provides training to Navy personnel on how to deploy, detect, and defend against mine systems. For example, UUV mine sensors may be tested to ensure they can detect, classify, and localize inert mines amongst rocky outcrops or inert shapes. These sensors may also be associated with a vessel, or placed before a single inert mine or inert mine field is put in place. The inert mines themselves may be tested to ensure they deploy as required and Fleet operators may be trained in mine field placement. As shown in Table 1-1, range activities involving inert mine detection, classification, or localization are conducted an average of 5 days per year at the Keyport Range Site, 20 days per year within the DBRC Site, and 5 days per year within the QUTR Site. Activities of this type may be anywhere from 4 hours to multiple days in duration.

Non-Navy Testing. These activities may involve a wide variety of non-Navy applications including from private enterprise and universities. Usually the non-Navy customer is doing RDT&E in support of Office of Naval Research or to prepare an item for a Navy or DoD application. RDT&E of non-Navy equipment/software/processes are applied to DoD and usually Navy mission. An example of this would be the test of the American Native Technologies glider. The company hopes to provide this system to the Navy to measure environmental characterization sound velocity profiles measuring salinity and temperature with respect to depth. Non-Navy testing can also involve development of software for use aboard an aircraft carrier or in a Fleet helicopter for managing data from one platform to another. The test would be of the software package on the helicopter for example. As shown in Table 1-1, range activities involving non-Navy testing are conducted an average of 5 days per year at each of the 3 range sites. Activities involving non-Navy testing may be scheduled for anywhere from 10 minutes to multiple days.

Acoustic and Nonacoustic Sensors. Acoustic sensors are any hydrophones on any kind of platform or mounted to crafts or towed at bottom or mid-depth. An example of the application of an acoustic sensor is the bottom moored array at the DBRC Site, which is an array of hydrophones moored to the bottom and suspended in the water column to enable identification of noise from passing torpedoes. The level of noise may change if there is a nick in a propeller or if a mechanism in the vehicle is malfunctioning. These problems can be found by listening with passive acoustics before they become apparent with the vehicle in the shop. An example of a nonacoustic sensor is an oxygen sensor that detects the level of dissolved oxygen in the water with respect to depth. Sensors for Conductivity and Temperature with respect to depth are used frequently to improve tracking with updated sound velocity profiles from raw data. Magnetic sensors are non-acoustic sensors that can be placed on the bottom to detect passing vessels. A sensor may also be put on a UUV as a payload. As shown in Table 1-1, acoustic and non-acoustic sensor tests are conducted an average of 20 days per year at the Keyport Range Site, 10 days per year within the DBRC Site, and 5 days per year within the QUTR Site. Activities involving these systems may be anywhere from 10 minutes to multiple days in duration.

Countermeasure Test. Countermeasures, which may take many different forms and represent a range of tactics, attempt to disrupt an attack intended for a target. Underwater, a countermeasure may emit sound that is louder than the target or in a different location that is similar to the target, causing the attacker to detour away from the target. Additionally, it could be something that looks like a threat or mimics the magnetic characteristics of a target, so that the actual threat or target remains undetected. By design, countermeasures emit active acoustic energy of varying frequencies into the water. Test activities involving countermeasures are currently conducted an average of 5 days per year at the Keyport Range Site, 50 days per year within the DBRC Site, and 5 days per year within the QUTR Site. Activities involving these systems may last anywhere from 8 to 36 hours.

Impact Testing. This type of test evaluates the durability of test vehicles by causing an impact between them or between the test vehicle and some other object. Such tests evaluate the functioning of approach and guidance and control capabilities of test vehicles. Currently, activities of this type are scheduled an average of 10 days per year within the DBRC Site and 5 days per year within the QUTR Site (no impact testing activities occur at the Keyport Range Site). Individual tests of this type typically last about 8 hours.

Static In-Water Testing. Static tests are performed by holding the system under test in place, either hanging over the side of a vessel, mounted on the sea floor, or suspended within the water column. Static in-water testing includes any kind of test in which the system under test doesn't actually move through the water. As shown in Table 1-1, static testing activities are conducted an average of 10 days per year at the Keyport Range Site, 10 days per year within the DBRC Site, and 5 days per year within the QUTR Site. Individual tests of this type may be conducted for as little as 10 minutes to as much as 8 hours.

UUV Testing. UUVs are any unmanned underwater vehicle that swims, floats, or crawls along the sea floor. They include torpedoes and they may carry a payload (e.g., an active acoustic system or a passive acoustic or nonacoustic sensor) that is being tested. As shown in Table 1-1, range activities involving UUVs are conducted an average of 45 days per year at the Keyport Range Site, 120 days per year within the DBRC Site, and 20 days per year within the QUTR Site. UUV tests may be anywhere from 10 minutes to multiple days in duration.

<u>Fleet Activities (Excluding RDT&E)</u>

Fleet activities that occur within the Range Complex may involve the use of ships, aircraft, submarines, or Navy divers. Such activities provide sailors the opportunity to train with actual Naval assets in a controlled range environment. None of the Fleet activities conducted in the NAVSEA NUWC Keyport Range Complex involve the use of hull-mounted active sonars. As shown in Table 1-1, non-RDT&E Fleet activities involving surface ships occur an average of once per year at the Keyport Range Site, and approximately 10 times per year at the DBRC and QUTR Sites. Each occurrence of these activities typically lasts about 8 hours. Surface ships are outfitted with navigation tracking systems so that their location on the instrumented range can be very accurately determined. Surface ships and the range use active acoustics to support navigation (tracking, depth sensors, etc.), detection, classification and localization. Surface ships may launch a lightweight torpedo and active and passive underwater targets while at a range site. There may also be a target simulator with passive acoustics to simulate a target engine noise at depth.

Aircraft activities and submarine activities do not occur at the Keyport Range Site at all, and occur an average of 10 days (aircraft) and 30 days (submarines) per year at the DBRC and QUTR Sites. Training activities involving aircraft typically last from 2 to 4 hours each, while submarine activities often last as much as 8 hours. Aircraft may drop or launch active and passive sonobuoys for detection, location and classification of underwater targets. There may be a target simulator with passive acoustics to simulate a target engine noise at depth. Additionally the aircrew may drop a torpedo and the torpedo acoustics may be activated as part of the training activity. Similarly, submarines are also outfitted with navigation tracking systems so that their location on the instrumented range can be accurately determined. Submarines and the range both also use active acoustics to support navigation (tracking, depth sensors etc.), detection, classification and localization. A submarine may launch a torpedo and active and passive underwater targets, and there may be a target simulator with passive acoustics to simulate a target engine noise at depth.

Fleet training for divers includes the Navy SEAL cold water training and other diver training related to Navy divers supporting range operations. Acoustic systems may be used in diver training. Diver activities occur an average of 45 days per year at the Keyport Range Site, 5 days per year at the DBRC Site, and 10 days per year at the QUTR Site. Each training session involving divers may last from 8 to 36 hours.

Deployment Systems (RDT&E)

Range Support Surface Launch Craft. A variety of small craft are used to deploy, tow, launch, and retrieve test vehicles, systems and platforms in support of testing activities. Such vessels may use standard commercial acoustic navigation (tracking, depth sensors, etc.) systems. No tactical hull-mounted active sonars are used. These craft are utilized an average of 35 days per year at the Keyport Range Site, 180 days at the DBRC Site, and 30 days at the QUTR Site. Typical activities involving such craft may be from 8 hours to 1 week in duration.

Range Support Special Purpose Barges. These are platforms for deploying and monitoring recovery vehicles and operations. They may have self-propulsion or they may be towed into place and moved around by tug boats. They perform many of the same functions as the surface launch craft. As shown in Table 1-1, range support barges are used an average of 25 days per year at the Keyport Range Site and 75 days per year at the DBRC Site, but are not used at the QUTR Site. Activities involving these barges may be anywhere from 8 hours to 2 weeks in duration.

Other RDT&E deployment systems include Fleet vessels, rotary and fixed-wing aircraft, and shore/pier facilities. Table 1-1 provides the average annual level of use of such platforms at each range site. Fleet vessels may include any craft in the Fleet, including small surface and underwater craft used by Navy SEALS and divers. These vessels provide direct support to Fleet training at the range sites, and also take advantage of the Fleet platforms in the area for testing RDT&E systems using the platform and the sailors to ensure the equipment works and the sailors know how to use it before they are deployed. Fleet vessels may provide berthing and personnel support for test managers, scientists, and others. These vessels may also deploy RDT&E systems from an existing system like a towed array and provide locations for launch and retrieval. Fleet vessel use typically ranges from 8 hours to 1 week in duration. Aircraft used in support of RDT&E deployment may include P-3s, float planes, helicopters, and other aircraft both civilian and military. Fixed wing and rotary aircraft are used for surveillance of the range, transporting personnel, and launching of sonobuoys, torpedoes, and sensors. Use of aircraft for such purposes typically ranges from 10 minutes to 2 hours. The pier and shore areas function as stand alone platforms that support range operations, berthing and loading of ships, launch and retrieval of test vehicles, and other uses. Use of such resources is typically 8 hours at any one time.

1.3.3.2 Overview of a Typical Test

NUWC Keyport civilian and military customers conduct tests based on objectives that are appropriate for the development level of their particular system. Some systems are one-of-a-kind undergoing initial in-water guidance and control or propulsion testing. Other newly manufactured systems are being proofed to ensure they meet their performance requirements, including their reliability and operational readiness prior to delivery to the Fleet.

A typical activity involving a test vehicle, such as a UUV, follows a series of steps prior to, during, and after the test. These are described below.

1. Prior to testing, the test vehicle is prepared in a NUWC Keyport shop and loaded onto a truck for transportation to the staging area or loaded onto a range craft for transportation to the range site. Shop checks may include water tightness, guidance and control, subsystem interconnection and reliability.
2. At the staging area, the test vehicle is transferred onto the deployment craft (air, surface, or submarine) or may be prepared for pierside or hand or beach deployment.
3. On the day of testing, the test vehicle is prepared for launch and deployed.
4. On an instrumented range, the underwater test vehicle may be tracked acoustically in 3-dimensions (3-D) during the course of the test. Multiple items are tracked at the same time in air, on the surface, and underwater on an integrated display. After the completion of the test, the test vehicle either floats to the surface or occasionally goes to the bottom. Test vehicles that float to the surface are retrieved by a surface vessel or helicopter. Test vehicles that go to the bottom are recovered with an ROV or by divers.
5. Upon retrieval or recovery, the vehicle is off-loaded from the vessel or lowered onto the staging area if recovered using the helicopter retrieval net. The test vehicle is then taken by truck to a NUWC Keyport shop and prepared for the next activity.
6. Data from the vehicle's internal recorder and the test range are evaluated based on the original test objectives.

1.3.3.3 Weapon Systems Routinely Used and Tested

Torpedoes are the primary undersea warfare weapons used by surface ships, aircraft, and submarines (Figure 1-7). The guidance systems of these weapons may be autonomous or controlled from the launch platform through a variety of 'links' (e.g., electric, fiber optic, acoustic). The autonomous guidance systems use either 'passive' acoustics, detecting the sound energy emitted from the target, or 'active' acoustics, finding the target with sonar and using the received echoes for guidance (definitions in Section 1.3.3.8 *Acoustic Systems Routinely Used*).

All torpedoes, mines, and other weapon systems tested within the range sites of the NAVSEA NUWC Keyport Range Complex are in exercise configuration (i.e., inert); no live warheads are used. The system under test is adjusted for buoyancy by the addition of internal weights. A recording and internal sensor system is often installed in place of the warhead to check for internal noise paths, vibration, temperature, etc. This information is used with external information after the in-water test to evaluate the success of the system under test.

1.3.3.4 Target Systems Routinely Used and Tested

Targets are commonly used at all the range sites to simulate potential threat platforms (i.e., something that simulates a real-world threat such as a hostile submarine) or to stimulate the system under test. New targets are also tested (proofed) on the range sites as well. Targets are often equipped with one or a combination of the following devices: shapes that reflect acoustic energy, acoustic projectors, and/or magnetic sources to trigger magnetic detectors.

Test Barge and Support Craft

Torpedo Launch

Mine Shape Retrieval

Common Underwater Mine Shape

Example of an Autonomous Vehicle

Figure 1-7
Common Equipment and Activities Performed in the
NAVSEA NUWC Keyport Range Complex

Targets come in many forms, including mobile, moored, and over-the-side, which can be expendable or recoverable. A mobile target can be either towed or free-swimming, providing acoustic and maneuvering capability. Mobile targets can be tested on range or used as a test component, depending on the test plan. Some moored targets can be moved up and down in the water column from the sea floor. Some targets used on the range complex are temporary; they are not permanently moored to the ocean floor and can be removed when no longer necessary for test activities. Over-the-side targets can be placed or suspended in the water column from a surface vessel.

1.3.3.5 Autonomous and Non-Autonomous Vehicles Routinely Used and Tested

The autonomous vehicles considered in this EIS/OEIS are systems that may include unmanned undersea vehicles (UUV) and unmanned aerial systems (UAS). Unlike weapon/torpedo launch and retrieval, which is relatively standardized, autonomous vehicle launch and retrieval methods are highly variable because of the differences in autonomous vehicle technology involved and of the variety of autonomous vehicle uses. For increased efficiency, many autonomous vehicles have multiple test objectives or payloads (such as cameras and side-scan or multibeam sonars) onboard so that numerous tests can be run during a single test activity.

Non-autonomous or remotely controlled vehicles are also used and tested. These may be tethered like ROVs or remotely controlled vehicles that have radio links. They may be aerial, surface, or underwater (including bottom) vehicles. Some vehicles may be used to transport personnel (whether inside or outside the vehicle). They may have both manual and autonomous control capabilities. For example, they may be driven to a location and parked, driven to a destination and sent ‘home,’ or they may autonomously navigate their way to a rendezvous spot and be piloted ‘home.’

1.3.3.6 Retrieval and Recovery Capabilities

System retrieval and recovery occurs after the completion of a test (Figure 1-7). *Retrieval* is the collection of the test vehicle from the surface of the water by surface vessel or helicopter. *Recovery* is the collection of the test vehicle when it is lying on the bottom or has become buried in bottom sediments and requires some digging for collection. Approximately 95 percent of the underwater test vehicles contain buoyancy systems that allow the vehicles to float to the surface for retrieval upon test completion. Approximately 5 percent of test vehicles sink to the bottom and are typically recovered by either an ROV or a Submerged Object Recovery Device.

NUWC Keyport personnel regularly apply their expertise in vehicle retrieval and recovery as they collect all major test equipment used anywhere within the NAVSEA NUWC Keyport Range Complex. This includes systems under test for post analysis and test equipment requiring maintenance or upgrade. This capability allows unique systems in early development to be tested and expensive equipment to be returned. Keyport personnel and equipment have also been called upon when private companies are unable either to locate or recover downed aircraft.

1.3.3.7 Expendable Materials

Certain manufactured materials released during the course of testing are expendable and are not recovered due to the low value of the materials and the impracticality of recovery. For example, mine shapes and clump anchors made of concrete and/or steel are left on the bottom because recovery is impractical due to burial in the sediment or depth of deployment. Some of these expendable materials were described and their loss quantified in the previous DBRC EA (Navy 2002a). Additional background on the use and environmental effects of these types of materials is provided in an EA Update prepared for the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) near Nanoose, British Columbia, roughly 100 miles (161 km) north of Puget Sound (ESG 2005). Representative expendable materials used during the range activities listed in Table 1-1 include the following:

- *Test Vehicle Propulsion:* 1/25-inch (1-mm) diameter plastic-coated copper guidance wire (heavyweight torpedoes only; 40 lbs [18 kg]/test event); aluminum doors (10.5 x 10 inches [26.7 x 25.4 cm]); 36-lb (16-kg) lead dropper weights (for buoyancy); flex hoses (heavyweight torpedoes only); stainless steel suspension bands (40 inches [1.02 m] long, 6.4 lbs [3 kg]); fiber optic guidance wire (25 lbs [11 kg]); and small (4 ft [1.2 m] diameter) parachutes.
- *Other Test Systems and Activities:* concrete anchor clumps (some with attached line); sandbag anchors and attached line; small parachutes; torpedo fragments (sizes range from 1 lb [0.5 kg] at DBRC to up to 100 lbs [45 kg] at QUTR); expendable targets (e.g., the Expendable Mobile Anti-Submarine Warfare Training Target [EMATT]) and countermeasures (3 and 6 inch [7.6 and 15.2 cm] diameter and 2 to 6 ft [0.6 to 1.8 m] long); expendable bathymetric thermographs (XBTs) with uncoated copper wire (approximately 1,500 ft [457 m]).
- *Fleet Activities (excluding RDT&E):* XBTs with uncoated copper wire; sonobuoys (QUTR only); expendable targets and countermeasures; marine location markers; flex hoses; stainless steel suspension bands; small parachutes; release wires.
- *Deployment Systems (RDT&E):* XBTs with uncoated copper wire; sonobuoys; expendable targets; countermeasures; marine location markers; flex hoses; stainless steel suspension bands; small parachutes; release wires; nose caps.

1.3.3.8 Acoustic Systems Routinely Used

Weapon systems, targets, and other autonomous vehicles described above may involve a variety of active and passive acoustic systems. Active systems are those that emit acoustic energy or sound into the water. Passive acoustic systems do not generate acoustic energy in the water but are used to listen for sound in the water. NUWC Keyport uses a number of passive acoustic measurement systems including a bottom moored array and various surface deployed arrays. The instrumented portions of the range sites have tracking arrays mounted on the sea floor to detect sound. The permanently deployed tracking arrays provide 3-D tracking capability at the DBRC and QUTR sites. Additionally, 3-D tracking can be accomplished by using portable tracking hardware in a pattern for any location. The data are processed and one of the results is the display of speed and location of each tracked item. Most test vehicles are instrumented with active acoustic sources to track real-time speed, location and recovery or retrieval at the end of activities.

Table 1-2 lists the primary active acoustic sources used within the NAVSEA NUWC Keyport Range Complex and Figure 1-8 shows the frequency bands of these acoustic sources. In this EIS/OEIS, low frequency is defined as below 1 kilohertz (kHz), mid frequency is defined as between 1 kHz and 10 kHz, and high frequency is defined as above 10 kHz.

Table 1-2 Primary Acoustic Sources Routinely Used within the NAVSEA NUWC Keyport Range Complex

Active Acoustic Sources	*Frequency* (kHz)*	*Maximum Source Level (dB re 1 µPa @ 1 m)*
Sonars		
General range tracking (at Keyport Range Site)	10 - 100	195
General range tracking (at DBRC and QUTR Sites)	10 - 100	203
UUV tracking	10 - 100	195
Torpedoes/test vehicles	10 - 100	233
Range targets and special tests (at Keyport Range Site)	5 - 100	195
Range targets and special tests (at DBRC and QUTR Sites)	5 - 100	238
Special sonars (e.g., UUV payload)	100 – 2,500	235
Fleet aircraft—active sonobuoys and helo-dipping sonars	2 - 20	225
Side-scan	100 - 700	235
Other Acoustic Sources		
Acoustic modems	10 - 300	210
Target simulator	0.1 - 10	170
Aid to navigation (range equipment)	70 - 80	210
Sub-bottom profiler	2 - 7	210
	35 - 45	220
Engine noise (surface vessels, submarines, torpedoes, UUVs)	0.05 – 10	170

*Refer to Figure 1-8 for frequency bands routinely used in the NAVSEA NUWC Keyport Range Complex.

- *General range tracking* on the instrumented ranges and portable range sites have active output in relatively widefrequency bands. Operating frequencies are 10 to 100 kHz. At the Keyport Range Site the sound pressure level (SPL) of the source (source level) is a maximum of 195 decibels reference 1 micro Pascal at 1 meter (dB re 1 µPa @ 1 m). At the DBRC and QUTR sites, the source level for general range tracking is a maximum of 203 dB re 1 µPa @ 1 m. Average annual use is approximately 505 hours.
- *UUV tracking* systems operate at frequencies of 10 to 100 kHz with maximum source levels of 195 dB re 1 µPa @ 1 m at all range sites. Average annual use is included under the hours for general range tracking.
- *Torpedo/test vehicle sonars* are used for several purposes including detection, classification, and location and vary in frequency from 10 to 100 kHz. The maximum source level of a torpedo/test vehicle sonar is 233 dB re 1 µPa @ 1 m. Average annual use is approximately 21 hours.
- *Range targets and special test systems* are within the 5 to 100 kHz frequency range at the Keyport Range Site with a maximum source level of 195 dB re 1 µPa @ 1 m. At the DBRC and QUTR sites, the maximum source level is 238 dB re 1 µPa @ 1 m. Average annual use is approximately 9 hours.
- *Special sonars* can be carried as a payload on a UUV, suspended from a range craft, or set on or above the sea floor. These can vary widely from 100 kHz to a very high frequency of 2,500 kHz for very short range detection and classification. The maximum source level of these acoustic sources is 235 dB re 1 µPa @ 1 m. Average annual use is approximately 487 hours.
- *Sonobuoys and helicopter dipping sonars* are deployed from Fleet aircraft and operate at frequencies of 2 to 20 kHz with maximum source levels of 225 dB re 1 µPa @ 1 m. Dipping sonars are active or passive devices that are lowered on cable by helicopters or surface vessels to detect or maintain contact with underwater targets. Average annual use is included under the hours for special sonars.

- *Side-scan sonar* is used for mapping, detection, classification, and localization of items on the sea floor such as cabling, shipwrecks, and mine shapes. It is high frequency typically 100 to 700 kHz using multiple frequencies at one time with a very directional focus. The maximum source level is 235 dB re 1 µPa @ 1 m. Side-scan and multibeam sonar systems are towed or mounted on a test vehicle or ship. Average annual use is approximately 166 hours.

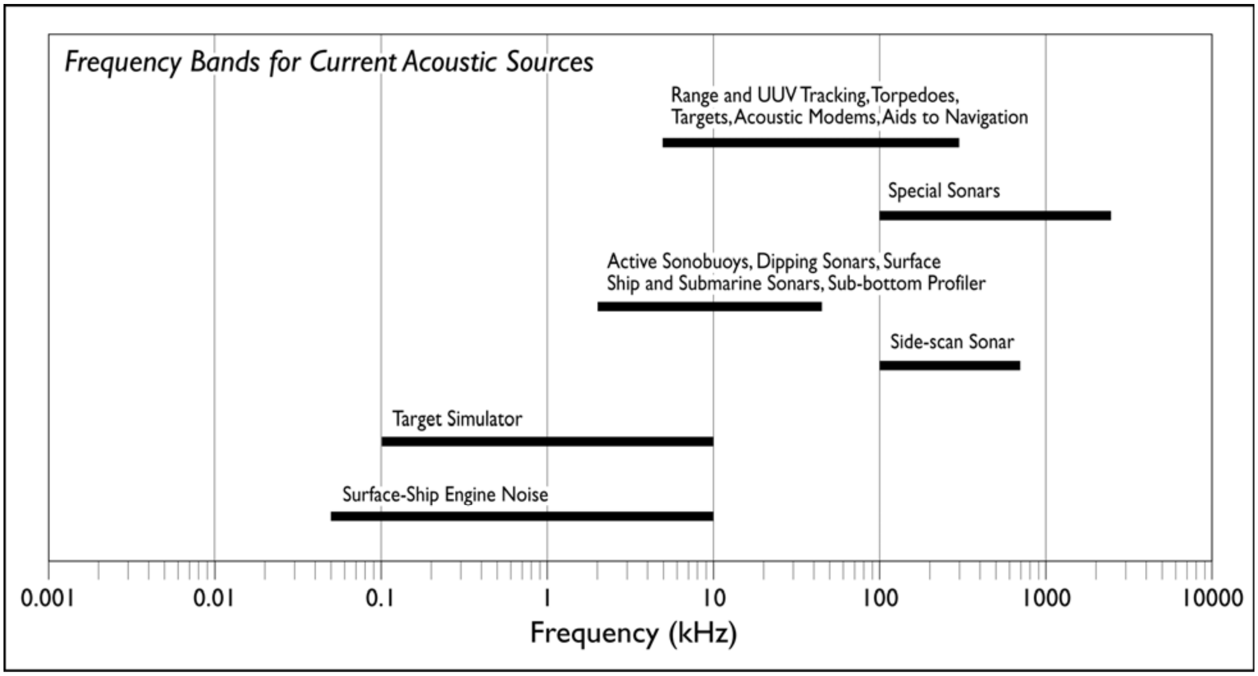


Figure 1-8 Frequency Bands of Acoustic Sources Routinely Used in the NAVSEA NUWC Keyport Range Complex

Other acoustic sources may include acoustic modems, targets, aids to navigation, subbottom profilers, and engine noise.

- An *acoustic modem* is a communication device that transmits an acoustically encoded signal from a source to a receiver. Acoustic modems emit a few pulses from 10 to 300 kHz at source levels less than 210 dB re 1 µPa @ 1 m. Average annual use is approximately 166 hours.
- *Target simulators* operate at frequencies of 100 Hertz (Hz) (0.1 kHz) to 10 kHz at source levels of less than 170 dB re 1 µPa @ 1 m. Average annual use is approximately 24 hours.
- *Aids to navigation* transmit location data from ship to shore and back to ship so the crew can have real-time detailed location information. This is typical of the range equipment used in support of testing. New aids to navigation can also be deployed and tested using 70 to 80 kHz at source levels less than 210 dB re 1 µPa @ 1 m. Average annual use is included under the hours for general tracking.
- *Subbottom profilers* are often commercial off-the-shelf sonars used to determine characteristics of the sea bottom and subbottom such as mud above bedrock or other rocky substrate. These operate at 2 to 7 kHz at source levels less than 210 dB re 1 µPa @ 1 m, and 35 to 45 kHz at less than 220 dB re 1 µPa @ 1 m. Average annual use is approximately 192 hours.
- There are many sources of *engine noise* including but not limited to surface vessels, submarines, torpedoes, and other UUVs. The acoustic energy generally ranges from 50 Hz to 10 kHz at

source levels less than 170 dB re 1 µPa @ 1 m. Targets, both mobile and stationary, may simulate engine noise at these same frequencies.

A variety of surface vessels operate active acoustic depth sensors (fathometers) within the range sites, including Navy, private, and commercial vessels. In some cases, one or more frequencies are projected underwater. Bottom type, depth contours, and objects (e.g., cables, sunken ships) can be located using this equipment. The depth sensors used by NUWC Keyport are the same fathometers used by commercial and recreational vessels for navigational safety. Because these instruments are widely used and are not found to adversely impact the human or natural environment, they are not analyzed further in this EIS/OEIS. Table 1-3 describes, for each of the range activities and systems from Table 1-1, the typical duration of use of each type of system or platform and the primary acoustic sources used. Not all acoustic sources are continuously active throughout the duration of each range activity. For example, a general range tracking source is active less than five percent of the time throughout an activity.

1.3.3.9 Non-Acoustic Sensors

The non-acoustic sensors include magnetic, oceanographic, and lasers to monitor characteristics of systems under test.

Magnetic – there are two types: 1) magnetic sensors and 2) magnetic sources. Magnetic sensors are passive and do not have a magnetic field associated with them. The sensors are bottom mounted, over the side (stationary or towed) or can be integrated into a UUV. They are used to sense the magnetic field of an object such as a surface vessel, a submarine, or a buried target. Magnetic sources are used to represent magnetic targets or are energized items such as power cables for energy generators (e.g. tidal). Magnetic sources generate electromagnetic fields (EMF). Evaluation of EMF (Navy 2008a) has shown that sources (e.g. Organic Airborne and Surface Influence Sweep (OASIS)) used are typically below 23 gauss (G) and are considered relatively minute strength. For the purpose of this EIS/OEIS, only magnetic sources equal to or less than 23 G are being evaluated – sources above this level would require consideration under separate environmental documentation.

Oceanographic sensors – have been used historically to determine marine characteristics such as conductivity, temperature, and pressure of water to determine sound velocity in water. This provides information about how sound will travel through the water. These sensors can be deployed over the side from a surface craft, suspended in water, or carried on a UUV.

Laser imaging detection and ranging (LIDAR), also known as light detection and ranging, is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship or submerged object. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, underwater LIDAR uses light in the blue-green part of the spectrum as it attenuates the least. Common civilian uses of LIDAR in the ocean include seabed mapping and fish detection. All safety issues associated with the use of lasers are evaluated for all applicable test activities within the range sites according to Navy and Federal regulations. This bounds the intensity of LIDAR used pursuant to this EIS to those systems that meet human safety standards. Other more intense systems would require consideration under separate environmental documentation.

Table 1-3 Systems and Acoustic Sources Used for Various Range Activities

Range Activity	*Platform/Systems Used*	*Typical Duration*	*Primary Acoustic Source Used*
Test Vehicle Propulsion	Thermal propulsion systems	0.16 – 24 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
	Electric/Chemical propulsion systems	4 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
Other Testing Systems and Activities	Submarine testing	8 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
	Non-Navy testing	0.16 hour – multiple days	Torpedo; Tracking; Aid to Navigation
	Acoustic and non-acoustic sensors (e.g., magnetic array, oxygen)	0.16 hour – multiple days	Aid to Navigation
	Countermeasure test	8 – 36 hours	Countermeasures: Variable Frequencies
	Impact testing	8 hours	Torpedo; Countermeasures; Tracking; Aid to Navigation
	Static in-water testing	0.16 – 8 hours	May have no active acoustics
	Unmanned Undersea Vehicle (UUV) test	0.16 hour – multiple days	Torpedo; UUV Tracking; Aid to Navigation; Engine Noise
Fleet Activities* (excluding RDT&E)	Surface ship activities	8 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
	Aircraft activities	2 – 4 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
	Submarine activities	8 hours	Torpedo; Tracking; Aid to Navigation; Engine Noise
	Diver activities	8 – 36 hours	Tracking; Aid to Navigation
Deployment Systems (RDT&E)	Range support vessels:		
	Surface launch craft	8 hours – 1 week	Torpedo; Tracking; Aid to Navigation; Sub-bottom profiler; Engine Noise; UUV Tracking
	Special purpose barges	8 hours – 2 weeks	Torpedo; Tracking; Aid to Navigation; Sub-bottom profiler; Engine Noise; UUV Tracking
	Fleet vessels	8 hours – 1 week	Torpedo; Tracking; Aid to Navigation; Engine Noise; UUV Tracking
	Aircraft (rotary and fixed-wing)	0.16 – 2 hours	Torpedo; UUV Tracking; General Tracking; Helo-dipping Sonar; Engine Noise; Active Sonobuoys; Aid to Navigation
	Shore and pier	8 hours – permanent facility	Engine Noise

* Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

1.3.4 Range Operating Policies and Procedures (ROP) and Public Safety

All range activities within the NAVSEA NUWC Keyport Range Complex are conducted in compliance with the *ROP* (NUWC Keyport 2006) and the *Range Users Guide* (NUWC Keyport 2004a) to protect the health and safety of the public and Navy personnel, as well as the marine environment. These documents address issues such as safety, development of approved run plans, responsibilities of range operation personnel, deficiency reporting, all facets of range activities, and establishing 'exclusion zones' to ensure that there are no marine mammals within a certain area prior to the commencement of each in-water exercise. None of the tests involve explosive warheads, and every effort is made to ensure public safety.

NUWC Keyport operates in cooperation with local maritime activities, Tribal fishing, commercial and recreational fisheries, and public recreation. NUWC Keyport activities rarely require complete restricted access from operating areas, and active acoustic activities are postponed if pinnipeds or cetaceans are observed within established exclusion zones, which are 100 yards (91 m) for pinnipeds and 1,000 yards (914 m) for cetaceans. All operators are trained by NOAA personnel in marine mammal identification. Moreover, on-range passive listening devices can detect vocalizing marine mammals not seen on the surface. Procedures for real-time reporting of marine mammals are in place and are orchestrated by the Range Officer at all range sites. Both the Keyport Range Site and the DBRC Site have shore-to-shore surveillance capability because of the proximity of land on both sides. This provides the Navy a unique opportunity to implement marine mammal surveillance procedures. This policy is implemented for all current range activities and would continue to be implemented as appropriate at all range sites as part of any of the proposed alternatives, including the No-Action Alternative. The ROP is discussed in more detail in Chapter 2, Section 2.3.4. It is a "living" document, as operating policies and procedures are updated as necessary over the course of time and operational experience.

1.3.4.1 Range Site Public Safety Procedures

The Navy implements a variety of procedures to ensure the safety of the general public, marine mammals, fish, and the human environment during testing activities at all range sites. NUWC Keyport conducts a thorough environmental and safety review for all test systems before the tests are conducted on any of the range sites. Prior to going into the water most systems go through land-based shop testing and many have been tested in smaller fresh water areas or tanks. Shop testing can be quite rigorous and may include, but not be limited to, pressure integrity, leak resistance, and guidance and control logic. After an initial review, modifications can be made, as needed, to minimize the amount of expended material and the potential impacts to public safety and the natural environment. Other procedures to ensure public safety include communicating test activities at the DBRC Site to Tribes, regulators, and the public.

Navy personnel on guard boats may be used to communicate with non-military vessels unaware of the test restrictions or to provide other information (e.g., having non-military vessels shut off their engines for a short time to eliminate acoustical interference during noise-sensitive testing or, less commonly, having them remain outside the testing area for a period of time until the activity is completed). Other communication procedures for advising non-military vessels of test restrictions are described below.

For the majority of testing activities at the Keyport Range, DBRC, and QUTR sites, the procedures outlined above are sufficient to notify the public of activities and ensure public safety. Halting marine traffic is typically not required as a safety measure, as test units run at sufficient depth and have no live warheads that would present a risk to surface vessels. In cases where certain testing and equipment retrieval activities involve navigational hazards, the Navy coordinates with the U.S. Coast Guard to issue a Notice to Mariners (NOTMAR). Marine radio channels 12 or 16 are monitored by all range craft and range control during range activities in accordance with safety afloat regulations. This also helps to minimize conflicts with Tribal, commercial, and private vessels. During any potentially hazardous surface or aviation activity at the QUTR Site or in W-237A, public safety is assured by coordinating with NAS Whidbey Island Air Operations Range Schedules and issuing Notices to Airmen in accordance with Federal Aviation Administration (FAA) procedures.

When necessary, NOTMARs identify locations of planned Navy activities and alert the public to the need to avoid those locations. Prior to the use of active sonar, Navy observers ensure that there are no non-Navy divers or swimmers in the water within a safe standoff distance. The safe standoff distances are based on the most current version of Appendix 1A (Safe Distances from Transmitting Sonar) of the U.S. Navy Diving Manual (Navy 2008c), and vary with sonar and diver characteristics.

The DBRC instrumented site is the only range site where unique fixed warning lights are used. There are no warning lights used at the Keyport Range or QUTR sites. The Navy maintains yellow, white, and red warning lights at Sylopash, Pulali, Whitney, and Zelatched points, and the southeast edge of Bolton Peninsula, all within sight of the Dabob Bay MOA. The lights warn non-military craft of the status of Navy activities within the MOA. The descriptions of the lights are posted at local boat ramps and marinas on NUWC Keyport Form 5720/3 (Rev 6-93), and are clearly indicated on standard NOAA charts (e.g., NOAA Nautical Chart No. 18458). Yellow or alternating white and yellow lights indicate to non-military vessels that: 1) they should proceed with caution; 2) range activities are in progress, but no noise-sensitive acoustic measurement tests are in progress; or 3) vessels should be prepared to shut down engines when lights change to red. Red or alternating white and red lights indicate: 1) range activities involving critical measurements are in progress; 2) engines should be stopped until red beacons have been shut off, indicating the test is completed; and 3) advice of Navy personnel on guard boats should be followed when in or near the range site. Typically, boat passage is permitted between tests when the yellow beacons are operating.

1.3.4.2 After-Action Reporting

Following the completion of each test, NUWC Keyport personnel evaluate the performance of the test and compile information into a weekly report for the NUWC Keyport Commanding Officer. The report summarizes items relating to equipment, software, procedures, and safety.

1.4 ENVIRONMENTAL REVIEW PROCESS

This section presents an overview of the EIS/OEIS process and timeline, which is summarized in Table 1-4.

1.4.1 Notice of Intent (NOI)

Official notification of the Navy proposal began with the publication of the NOI on September 11, 2003, in the *Federal Register*. A copy of the NOI is presented in Appendix A. Press releases were sent to several newspapers in the Washington State area announcing the NOI publication. Following this, letters outlining the Navy proposal and announcing scoping meetings were sent to federal, state, and local agencies; Native American Indian Tribes and Nations; elected officials; and various interest groups.

Table 1-4 EIS/OEIS Process

Item	*Date(s)*
Notice of Intent Published	September 2003
Public Scoping	September 2003 – January 2004
Preparation of Draft EIS/OEIS	January 2004 – August 2008
Notice of Availability of Draft EIS/OEIS	September 2008
Public Comment Period 45 Days	September 2008 – October 2008
Public Hearings	October 2008
Preparation of Final EIS/OEIS	November 2008 – April 2010
Notice of Availability of Final EIS/OEIS	May 2010
Wait Period 30 Days	May/June 2010
Record of Decision	June 2010

1.4.2 Public Scoping Process

Public review, comment, and participation are critical components of the EIS/OEIS process. Input gathered from meetings and comments is an essential tool for thoroughly addressing issues in the EIS/OEIS. The scoping period began September 11, 2003, with the publication of the NOI, and was originally scheduled to end on December 5, 2003. In response to public request, the Navy extended the scoping period to January 9, 2004. Scoping meetings were held in four counties adjacent to the current and proposed sites that could potentially be affected by the Proposed Action or alternatives: Keyport, Kitsap County (November 17, 2003); Belfair, Mason County (November 18, 2003); Quilcene, Jefferson County (November 19, 2003); and Hoquiam, Grays Harbor County (November 20, 2003). Advertisements describing the Proposed Action and alternatives were placed in nine local newspapers one week before the scoping meetings. A copy of the advertisement is presented in Appendix A. The advertisements provided the times, dates, and locations of the scoping meetings. As part of the public outreach effort, flyers were also posted in local marinas, grocery stores, and post offices. Public comment was solicited in the advertisements, flyers, and the scoping meetings.

The scoping meetings were designed in an "open house" format to create a comfortable atmosphere for attendees and to facilitate dialogue with Navy personnel. Displays were presented to enhance public understanding of the NEPA process, the need for the Proposed Action, how the alternatives were designed and selected, and the public's role in shaping the proposal.

The Navy provided the public with several venues for providing comments during the scoping process and at the meetings. Attendees could submit written comments, complete a comment form provided by the Navy, or dictate their comments to a Navy representative for computer entry. The public could also submit comments by mail and e-mail during the entire scoping period (September 11, 2003 – January 9, 2004). The attendees were informed of the public website established for the EIS/OEIS. One central location was provided to the public for all scoping comments. Comments received during the scoping period helped refine the Navy proposal and are reflected in the Proposed Action and Alternatives discussion in Chapter 2.

A total of 124 individuals attended the four scoping meetings and 49 (including some individuals representing various groups) commented on the Proposed Action. In general, the attendees provided positive feedback regarding the scoping process. The main concerns expressed included access to marine areas and shorelines, economic impacts, safety of marine mammals, use of sonar as a result of Navy activities, and request for clarification/notification of restrictions.

Letters from Native American Indian Tribes and Nations were received, and several agencies and organizations also provided comments on the Navy's proposal. The letters included requests for the following: clarification of the Proposed Action; further cooperation with the Navy, local agencies, and government; an extension of the comment period and an increase in the number of public meetings; development of additional alternatives for analysis; and re-evaluation of the thresholds for underwater sound and sound impacts in general. Comments from these entities included: suggestions for issues to consider in the EIS/OEIS; economic concerns; and questions about the influence public comments would have on the Navy's decision to proceed with the Proposed Action. Input from the public obtained during the scoping process was used to further refine the alternatives that are carried forward for analysis in this EIS/OEIS.

Of significance was a change from the original proposed surf-zone alternative for the QUTR Site. Initially there was only one alternative surf-zone location for the QUTR site at Sea Lion Rock and the Quinault Nation Reservation. Native American Indian Tribes and Nations, the public, and regulators provided feedback about the proposed surf-zone locations during the scoping period. This included seeking potential surf-zone locations outside the OCNMS and also away from Sea Lion Rock and the Quinault Indian Reservation. The Navy subsequently used this input to refine the surf-zone alternatives, resulting in the three QUTR Site surf-zone alternatives under consideration in this EIS/OEIS. Chapter 2 provides a description of these three locations.

1.4.3 Government-to-Government Consultations

NUWC Keyport conducted Government-to-Government consultations between November 5 and December 1, 2003. The purpose was to present the Proposed Action and alternatives of the EIS/OEIS and to initiate consultations. The following Native American Indian Tribes and Nations were involved in these consultations: Hoh Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Port Gamble S'Kallam Tribe, Quileute Tribe, Quinault Nation, Skokomish Tribe, and Suquamish Tribe (listed in alphabetical order). The Makah Tribe was sent a letter discussing the proposed project; however, no meeting was requested by the tribe. The Point No Point Treaty Council was also included in the discussions. Some of the main concerns of the Native American Indian Tribes and Nations included potential for restricted access to beach areas and usual and accustomed fishing (e.g., shellfish) grounds, potential damage to fishing gear, and effects on salmon returning to the streams.

1.4.4 Regulatory Agency Briefings

The Navy provided briefings between November 5 and December 1, 2003 to the following regulatory agencies: U.S. Fish and Wildlife Service (USFWS), NOAA (OCNMS, Marine Mammal Lab, National Marine Fisheries Service [NMFS] Northwest Fisheries Science Center, and Office of Protected Resources), NPS (Olympic National Park), Washington Department of Natural Resources (WDNR), Northwest Region of the Washington Department of Ecology (WDOE), and Region 6 of the Washington Department of Fish and Wildlife (WDFW). The parties to these meetings raised a variety of issues and concerns. In brief, some of the main concerns included restricted access to beach areas and Tribal usual and accustomed fishing grounds; impacts to marine mammals; impacts to geoduck harvesting; impacts to shore habitats; expended materials in the water; sediment disturbance; use of sonar; surf-zone location; possible impacts to cultural resources; and the need for monitoring.

1.4.5 Draft EIS/OEIS

The Draft EIS/OEIS for the NAVSEA NUWC Keyport Range Complex Extension was made available for public review beginning in September 2008, with the public comment period occurring from September 12, 2008 through October 27, 2008. The Draft EIS/OEIS was prepared in compliance with NEPA of 1969 (42 U.S. Code [USC] § 4321, as amended); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] §§ 1500-1508, 1 July 1986); Department of the Navy Procedures for Implementing NEPA (Chief of Naval Operations Instruction [OPNAVINST] – 5090.1); and Executive Order (EO) 12114, which directs federal agencies to assess the impacts of their activities beyond the 12-nm (22-km) limit of U.S. Territorial Waters.

A Notice of Availability for the Draft EIS/OEIS was announced in the *Federal Register*, local newspapers, and on the EIS/OEIS website. This notice indicated locations (e.g., public libraries) where the Draft EIS/OEIS could be reviewed, the duration of the public review and comment period, the address where comments could be sent, and the time and location of the public hearings.

Once the public comment period commenced, the Navy also:

- Overnight expressed hard copies and CDs of the Draft EIS/OEIS to 11 Tribes/Nations, commissions, and treaty councils;
- Mailed hard copies and CDs of the EIS/OEIS to 10 federal agency offices and 11 local repositories (i.e., libraries);
- Mailed CDs to 18 federal, state and local elected officials, 5 Washington state agencies, 5 local agencies and organizations, and 6 interest groups;
- Mailed a CD to each of 56 individuals who had requested a copy of the Draft EIS/OEIS through the scoping process;
- Mailed "Notice of Availability" postcards to all other entities (77 total) indicating when the Draft EIS/OEIS was issued, where copies may be obtained and reviewed, the duration of the comment period, where comments may be sent, and the location, date and time of the Draft EIS/OEIS public hearings;
- Placed the Draft EIS/OEIS on the project website;
- Conducted 4 public hearings each with an "open house" poster session staffed by Navy subject matter experts, a formal briefing by the Navy, and the opportunity to provide oral and/or written comments;
- Distributed a "fact sheet" brochure at the public hearings that included information on providing comments and a comment sheet to help facilitate public input and feedback;

- Provided a CD to any individual requesting a copy of the DEIS/OEIS at the public hearings; and
- Conducted briefings to support the Government-to-Government consultation process and legislative coordination efforts.

The public hearings were held in four different communities during October 2008: Keyport on October 1; Belfair on October 2; Pacific Beach on October 6; and Quilcene on October 7. These public hearings provided an opportunity for interested parties to comment on the content of the Draft EIS/OEIS and form the basis for making subsequent changes to the Final EIS/OEIS.

Seven displays were presented at the public hearings to inform interested parties about the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. These displays were designed to: 1) enhance public understanding of the NEPA process, 2) present the Purpose and Need and the Proposed Action and Alternatives, and 3) illustrate acoustic and non-acoustic effects on marine life and the environment.

After the open-house forum and the Navy's formal presentation were completed, the meeting facilitator reviewed the public hearing guidelines for the audience and called on individuals who indicated on the registration cards their desire to speak at the meeting. Public officials were provided the first opportunity to speak. The general public was then called upon in the order in which they submitted their cards. A court reporter recorded the formal presentation and verbal testimony verbatim. All hearings provided ample time for everyone who had registered to speak, as well as the opportunity to speak more than once.

In addition to seeking verbal comments, the Navy provided several other venues for the public to express their concerns. Public hearing attendees could submit written comments they brought with them, complete a comment sheet provided by the Navy, send a letter at their convenience, or comment on the website provided in the fact sheet packet. Attendees chose to submit letters at their convenience; four (4) comments were received at the hearing meetings.

A total of 58 individuals attended the four meetings, distributed as follows:

- Keyport – 33 attendees
- Belfair – 2 attendees
- Pacific Beach – 6 attendees
- Quilcene – 17 attendees

Seven individuals provided verbal comments and four individuals provided written comments. Issues raised during the meetings included restrictions and conflicts with recreational activities (e.g., boating and diving) and commercial fishing, socioeconomic impacts, the Draft EIS/OEIS public outreach process, public health and safety, timing and duration of range test activities, and effects on proposed expansion plans of local marinas.

In total, the Navy received 235 written comments on the Draft EIS/OEIS, including: 39 comments from 5 Tribes and Nations; 16 comments from 5 federal agencies; 7 comments from 3 state and local agencies; 115 comments from 2 organizations (Natural Resources Defense Council and Olympic Coast National Marine Sanctuary Advisory Council), and 58 comments from 18 individuals who attended the public hearings. In general, the primary issues raised in written comments pertain to the following general categories: marine mammals, effects of sonar use, fish and fisheries, benthic species and habitats, and water and sediment quality. The Navy's responses to all comments received on the Draft EIS/OEIS are provided in Appendix G.

1.4.6 Final EIS/OEIS

Following the close of the comment period, written and oral comments on the Draft EIS/OEIS were reviewed and responses to comments were developed. This Final EIS/OEIS is then prepared, incorporating responses to comments and any additional evaluation that was warranted. The Final EIS/OEIS is circulated in the same manner as the Draft EIS/OEIS.

1.4.7 Record of Decision (ROD)

The ROD reflects the Navy's final decision on the Proposed Action, the rationale behind that decision, and any commitments to monitoring and mitigation. A ROD will be issued by the Navy following the issuance of the Final EIS and a 30-day wait period. The Notice of Availability for the ROD will be published in the *Federal Register,* distributed to agencies and interested parties, posted on the NAVSEA NUWC Keyport EIS/OEIS website, and also announced in local newspapers.

1.5 SCOPE AND CONTENT OF THE EIS/OEIS

The Navy considers potential environmental impacts in conjunction with other relevant information to plan actions and make decisions. Rather than focusing on specific activities that may occur within a limited part of the NAVSEA NUWC Keyport Range Complex, this EIS/OEIS provides a range-wide, comprehensive evaluation of proposed as well as on-going NUWC Keyport activities conducted at any or all of the three range sites.

The analysis encompasses all typical activities that are scheduled and managed by NUWC Keyport, which may include undersea warfare RDT&E program activities, general equipment testing, and military personnel training (including Fleet activities not involving the use of surface ship and submarine hull-mounted sonars). Activities that are not scheduled by NUWC Keyport, or those activities whose RDT&E protocols are not controlled or managed by NUWC Keyport, are not included within the Proposed Action. This would include all other government, commercial, and private activities. These activities would be under either Tribal, private, commercial, or government authority, outside NUWC Keyport authority. Activities outside the scope that are actually planned in the reasonably foreseeable future are addressed as appropriate in the cumulative impacts analysis (Section 4.1). Navy activities not under the cognizance of NUWC Keyport account for less than 15 percent of all Navy activities at the Keyport Range and DBRC sites. Within the QUTR Site, NUWC Keyport works with NAS Whidbey Island and Commander Submarine Force, U.S. Pacific Fleet (COMSUBPAC) to schedule and coordinate NUWC Keyport activities. Navy activities in W-237 have been previously addressed in the OCNMS EIS (NOAA 1993). Other military activities (e.g., airspace use of W-237A) constitute a larger portion of all activities in the QUTR Site; these training activities are being analyzed by the Navy in the Northwest Training Range Complex EIS/OEIS and are described in further detail in Section 4.1, *Cumulative Impacts*. Activities controlled by NUWC Keyport constitute less than 1 percent of Navy activities conducted in W-237A. If separate test and training proposals are identified in the future, such proposals would be the subject of additional NEPA documentation as appropriate.

1.6 DOCUMENTS INCORPORATED BY REFERENCE

Material relevant to an EIS/OEIS may be incorporated by reference in accordance with CEQ regulations (40 CFR 1502.21), with the intent of reducing the document's size. A number of documents provide important information directly related to the preparation of this EIS/OEIS. The applicable content of these documents is incorporated by reference due to their relevance to the Proposed Action and evaluation of impacts addressed in this EIS/OEIS. The documents include:

a) EA for Autonomous Underwater Vehicle (AUV) Fest Keyport Range, Washington (Navy 2003b).
b) EA for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas (Navy 2002a).
c) Final EIS/Management Plan for the OCNMS (NOAA 1993).
d) 15 CFR 922.152, Chapter IX, Subpart O - Olympic Coast National Marine Sanctuary. This regulation describes the OCNMS, the military activity exemptions for current activities by NUWC Keyport in the QUTR Site, and Navy activities within the OCNMS.

These previously prepared NEPA documents specifically address each range site and are summarized below.

<u>Keyport Range Site:</u>

- The AUV Fest EA resulted in a FONSI in 2003 (Navy 2003b). This EA analyzed the impacts associated with conducting AUV operations within the proposed extended area specifically for UUV testing. This EIS/OEIS incorporates by reference most of the analysis associated with that EA. It includes the description of the existing operational procedures and tempo for the Keyport Range Site. Activities associated with Fleet cold water training and the Acoustic Test Facility (ATF) have been added for the purposes of analysis in this EIS/OEIS. The ATF is used to calibrate transducers used on the NAVSEA NUWC Keyport Range Complex. However, the amplitudes transmitted into the water at the ATF are at reduced levels and do not exceed those that are emitted on the ranges. Hence, the analysis covering acoustic sources on the range covers those at the ATF.

<u>DBRC Site:</u>

- A comprehensive EA was prepared covering ongoing and future activities within the DBRC Site, including a study of sediment and water quality. The EA resulted in a FONSI in 2002 (Navy 2002a). It described the current DBRC location and the current operational tempo within the DBRC Site. In this EIS/OEIS, the proposed extension is based on the same tempo and types of activities. This EIS/OEIS analyzes the added effect of extending the operating area (no additional permanent instrumentation would be on the sea bottom).

<u>QUTR Site:</u>

- The QUTR Site and special use airspace W-237A were addressed in the NOAA EIS for the OCNMS (NOAA 1993). The NOAA EIS resulted in a management plan and the establishment of the OCNMS in 1993-1994. The EIS generically described Navy activities in the proposed OCNMS. This included activities specific to the QUTR Site instrumented area and Navy activities in W-237A. This EIS/OEIS addresses those same activities, suggests alternatives for surf-zone activities proposed by NUWC Keyport, and looks outside of the OCNMS boundary in its analysis.

These NEPA documents are incorporated by reference in this EIS/OEIS. The Marine Mammal Protection Act (MMPA) analysis contained in these previous NEPA documents for the three range sites was conducted qualitatively. Since the completion of those previous NEPA documents, new acoustic modeling procedures and impact assessment methodologies have been developed. Therefore, the acoustic impact assessment for this EIS/OEIS is quantitative and based upon current Navy acoustic threshold criteria for marine mammals (Navy 2006b, 2007a), acoustic sources proposed for use within the three range sites, and marine mammal densities within each range site from current scientific literature. The acoustic modeling and marine mammal impact assessment are discussed in more detail in Section 3.5.2 and Appendix C.

1.7 Relevant Environmental Documents Being Prepared Concurrently with this EIS/OEIS

The following documents are in progress at this time and are relevant to Navy training and RDT&E in the NAVSEA NUWC Keyport Range Complex.

Northwest Training Range Complex (NWTRC) EIS/OEIS. The NWTRC consists of numerous individual training areas in the Pacific Northwest. The range complex extends westward in the Pacific Ocean to 250 nautical miles (nm) (463 kilometers [km]) beyond the coast of Washington, Oregon, and Northern California and eastward to Idaho. This EIS/OEIS examines the potential environmental effects of the Navy's proposal for future range management operations and activities. A No Action and two action alternatives are analyzed in the EIS/OEIS. Additional information is provided at: http://www.nwtrangecomplexeis.com/default.aspx.

Trident Support Facilities Explosives Handling Wharf EIS. The Navy is proposing to construct and operate a second explosives handling wharf adjacent to, but separate from, the existing wharf at Naval Base Kitsap Bangor. The purpose of constructing and operating a second explosives handling wharf is to support current and future Trident Fleet Ballistic Missile program requirements. The second explosives handling wharf is needed to ensure the Navy has facilities required to offload/load missiles and perform required operations and upgrades necessary to maintain the Trident program. A No Action and two action alternatives are analyzed in the EIS. Additional information is provided at http://ehw.nbkeis.com.

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CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Navy's Proposed Action and alternatives for the NAVSEA NUWC Keyport Range Complex extension. It is divided into four major subsections: Section 2.1 *Overview of Alternatives Selection Criteria*; Section 2.2 *No-Action Alternative*; Section 2.3 *Proposed Action and Alternatives* (including an overview description of the Proposed Action, the action alternatives for each of the three range sites, and Standard Range Operating Policies and Procedures); and Section 2.4 *Alternatives Considered but Eliminated from Detailed Consideration*.

Chapter 2 uses "example scenarios" to augment the descriptions provided in Section 1.3.3 of typical RDT&E activities conducted at the three range sites. Example scenarios are also used to describe the types of RDT&E activities that may occur within the proposed range extension at each site. The example scenarios are not intended to bound the types of activities at each of the range sites. Other activities would be conducted within each of the range sites. The potential Range Complex activities cannot all be described through limited scenarios, so the parameters of various propulsion, acoustic, and mechanical systems are analyzed individually. Other types of potential systems to be tested at each of the range sites would be evaluated against the current analysis to determine if they fit within the parameters established in this EIS/OEIS.

2.1 OVERVIEW OF ALTERNATIVES SELECTION CRITERIA

CEQ regulations (40 CFR 1502.14) and Navy Procedures (32 CFR 775) provide guidance on the consideration of alternatives in an EIS/OEIS and promote the objective evaluation of all reasonable alternatives. Reasonable alternatives must meet the stated objectives and purpose and need for the Proposed Action. As discussed in Section 1.2, the purpose of and need for the action are based on range requirements necessary to support continued testing, training, and evaluation of evolving manned and unmanned vehicle technologies and capabilities in multiple marine environments. Such range requirements have been defined by NAVSEA to include a broader diversity of sea state conditions, bottom type, water depth, and increased range capacity to maneuver vehicles and combine test activities. These requirements were used to develop the following alternatives selection criteria, which were in turn used to identify the range of reasonable action alternatives that would achieve the defined objectives:

- Proximity to NUWC Keyport facilities and existing NAVSEA/NUWC Keyport Range Complex sites;
- Variable water depths from shore to 4,500 ft (1,372 m) depth for a variety of test platforms;
- Surf-zone access to simulate hostile littoral threat areas;
- Multiple salinity and bathymetry types to simulate in-situ physical and operational environments of selected threat areas of the world;
- Locations where simulations can be provided to test collision avoidance in a safe manner;
- Various range sizes suitable to test search capabilities;
- Environment with approach and transit of several miles for launch platform standoff and endurance testing;
- Ability to conduct multiple test scenarios on an individual system within a variety of specialized environments located in close geographic proximity; and
- Realistic navigational hazards, interference, and shipping traffic.

With the exception of the No-Action Alternative (as described below), only alternatives that would satisfy these criteria were considered reasonable and were carried forward for detailed evaluation in this EIS/OEIS (Section 2.3). Alternatives that were considered but eliminated from detailed consideration based on these criteria are described in Section 2.4.

2.2 NO-ACTION ALTERNATIVE – CONTINUE CURRENT RANGE SITE ACTIVITIES

Under the No-Action Alternative, current activities would continue to be conducted on all three range sites and would continue to fit within the existing range dimensions currently established for the NAVSEA NUWC Keyport Range Complex. While implementation of the No-Action Alternative would not satisfy the purpose and need for the action, it is carried forward for further analysis as required under CEQ regulations.

Annual activities broken out by activity type are shown in Table 2-1. Currently, NUWC Keyport schedules the Keyport Range Site to be used an average of 55 days/year, the DBRC Site an average of 200 days/year, and the QUTR Site an average of 14 days/year of offshore use and minimally for surf-zone activities.

Table 2-1 Current NAVSEA NUWC Keyport Range Complex Activities (No-Action Alternative)

Range Activity	*Platform/Systems Used*	*Current Estimated Number of Activities/Year** *Keyport Range Site*	*DBRC Site*	*QUTR Site*
Test Vehicle Propulsion	Thermal propulsion systems	0	130	20
	Electric/Chemical propulsion systems	45	140	10
Other Testing Systems and Activities	Submarine testing	0	45	10
	Inert mine detection, classification and localization	5	20	5
	Non-Navy testing	5	5	5
	Acoustic & non-acoustic sensors (e.g., magnetic array, oxygen)	20	10	5
	Countermeasure test	5	50	5
	Impact testing	0	10	5
	Static in-water testing	10	10	5
	UUV test	45	120	20
Fleet Activities** (excluding RDT&E)	Surface ship activities	1	10	10
	Aircraft activities	0	10	10
	Submarine activities	0	30	30
	Diver activities	45	5	10
Deployment Systems (RDT&E)	Range support vessels:			
	Surface launch craft	35	180	30
	Special purpose barges	25	75	0
	Fleet vessels***	15	20	20
	Aircraft (rotary and fixed wing)	0	10	20
	Shore and pier	45	30	0

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.

** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

2.2.1 Current Keyport Range Site Activities

Table 2-1 lists the varied test and evaluation activities that currently occur at the Keyport Range Site in a typical year. Figure 2-1 illustrates an example scenario within the existing range site. The scenario consists of a combined shallow-water target field evaluation and personnel training using a UUV within existing range boundaries. A portable tracking system may be deployed in each test area for tracking the UUV. In this example scenario, the tracking system operates at a frequency of 75 kHz and a source level of less than 195 dB re 1 μPa @ 1 m. The primary objective is to demonstrate operational capabilities by conducting tests on a shallow-water target field. Secondary objectives are to test the UUV launch method and provide training opportunities for Navy personnel. The UUV is deployed from the NUWC Keyport Pier using a pier-side crane, and retrieval occurs using a small boat, divers, and pier-side crane; target shapes are positioned prior to, and recovered subsequent to, the test activity. The estimated time for the test, including set up and retrieval, is 3 to 6 hours. The combination of the following characteristics provides a unique testing environment at the Keyport Range Site: shallow depth (shore to 90 ft [27 m]), varying topography, shore-to-shore surveillance, shore facilities, and realistic navigational hazards (e.g., boat traffic).

2.2.2 Current DBRC Site Activities

Table 2-1 lists the current annual activities conducted at the DBRC Site. An example scenario within the existing range site is shown in Figure 2-2. The primary objective under this example scenario is a 72-hour endurance mission to evaluate the UUV's navigational accuracy. Secondary objectives include obtaining the UUV radiated noise signature and demonstrating performance of UUV onboard sensors, including the side-scan sonar and the Acoustic Doppler Current Profiler. A passive acoustic sensor is used to obtain a radiated-noise signature of the UUV.

The tracking sonar is active prior to and after the test run to locate the sensor accurately for post-test run analysis. A hydrophone is used to measure surrounding (ambient) noise prior to the test runs and after the test runs for comparison to vehicle-radiated noise that is acquired during the run. During this example scenario, active sonars (side-scan sonar, acoustic Doppler current profiler, and tracking sonars) emit at source levels of 203-233 dB re 1 μPa @ 1 m and at frequencies of 10 to 700 kHz. The total estimated operational test time is approximately 80 hours, including UUV launch and retrieval.

The combination of the following characteristics provides a unique testing environment at the DBRC Site. These characteristics include moderately deep water, permanent bottom-mounted instrumentation for Fleet submarine safety and navigation, shore-to-shore surveillance, and capability for barge access (retrieval/moorage). The bottom of the DBRC Site is unique compared to the other two range sites in that it has steep side walls with depths up to 600 ft (183 m).

2.2.3 Current QUTR Site Activities

Activities currently conducted at the QUTR Site are listed in Table 2-1; Figure 2-3 illustrates an example scenario for current activities within the QUTR Site. The primary objective of this example scenario is to test and evaluate shallow water acoustic sonar technology in a reverberant environment, with a diesel-electric submarine simulating a potential threat target. The example scenario consists of ranging a test vehicle with a diesel-electric submarine operating at periscope depth as described in the following sentences. The test vehicle (a torpedo in this case) is launched from the launch craft.

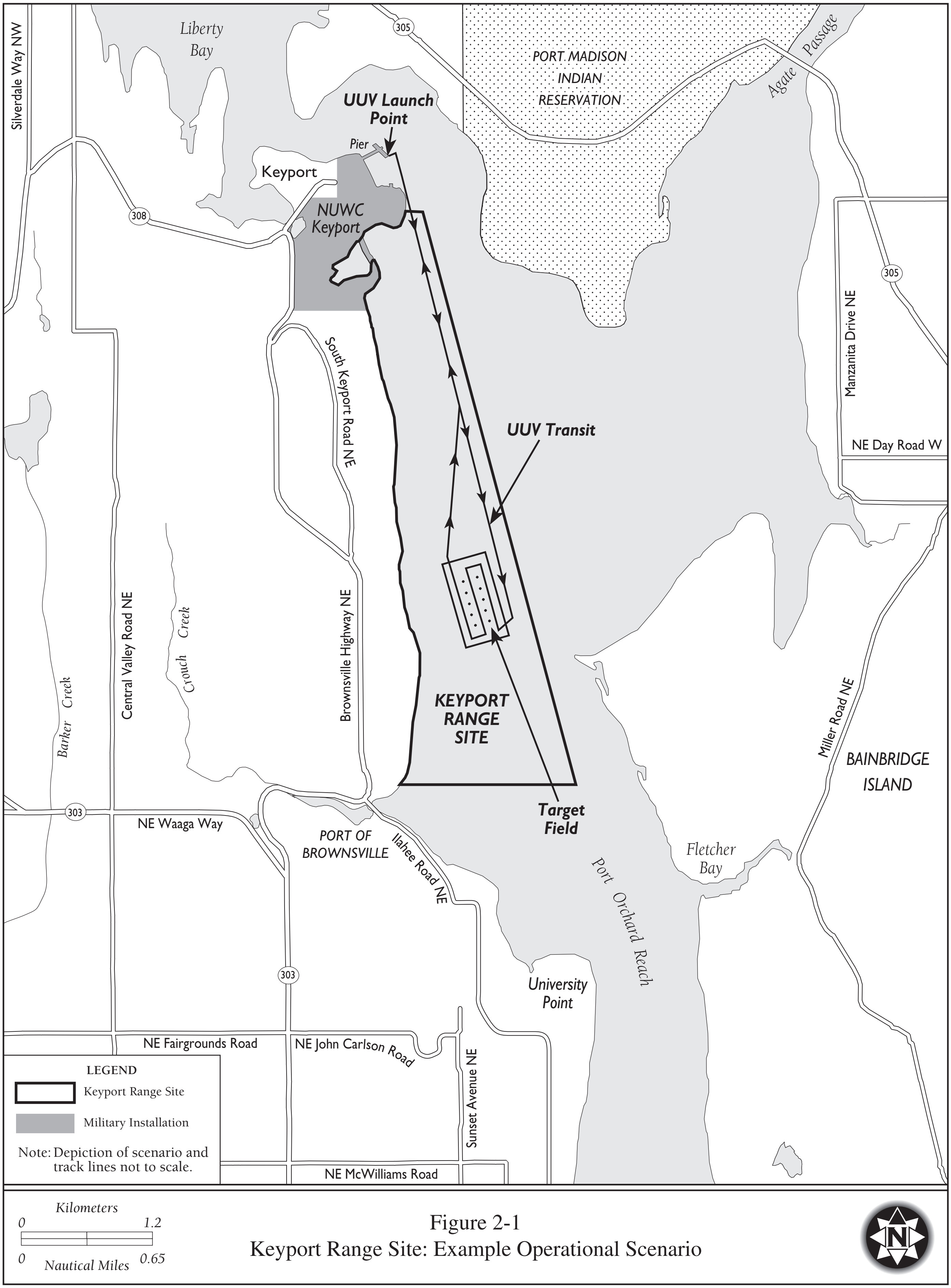


Figure 2-1
Keyport Range Site: Example Operational Scenario

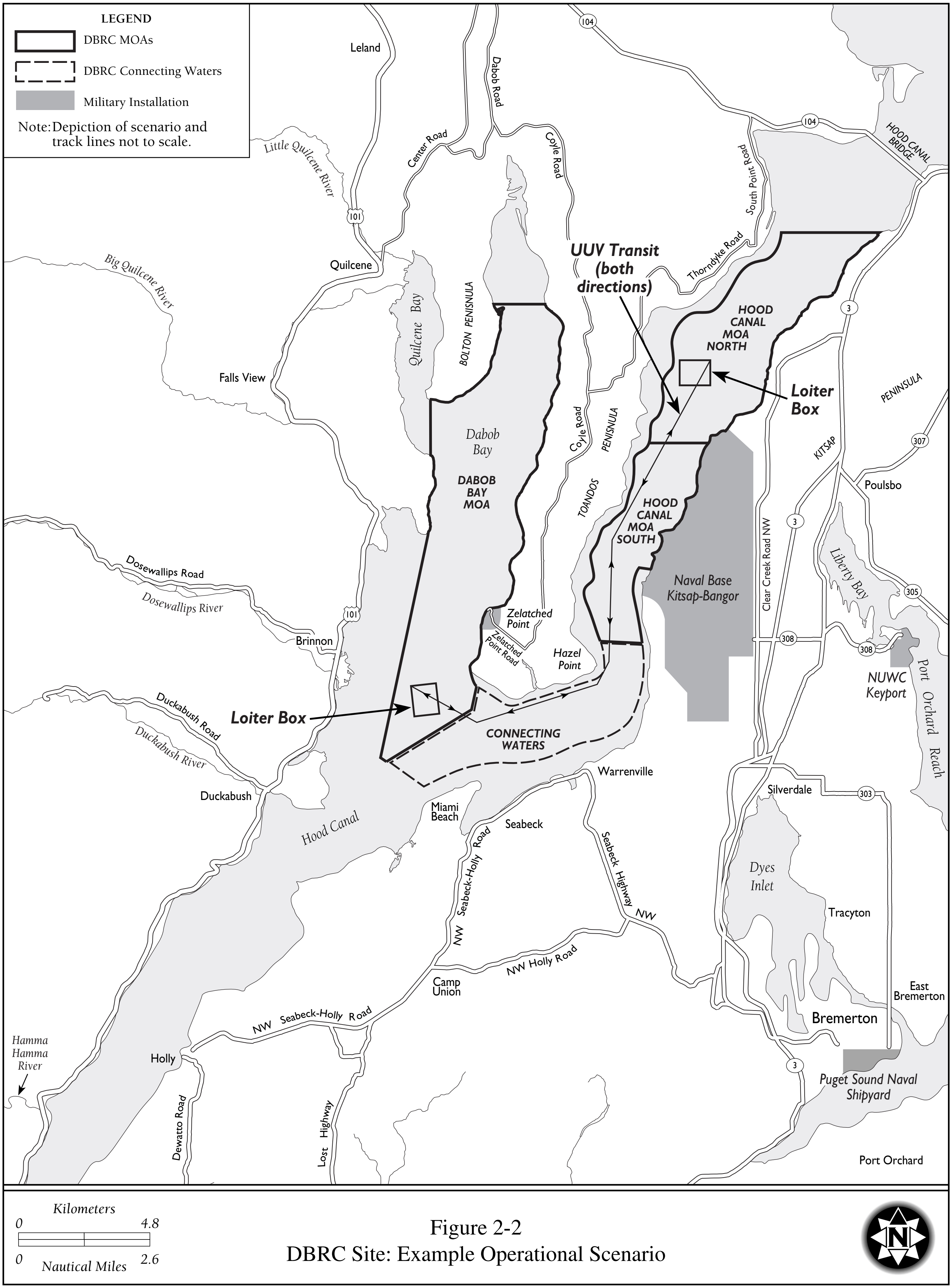


Figure 2-2
DBRC Site: Example Operational Scenario

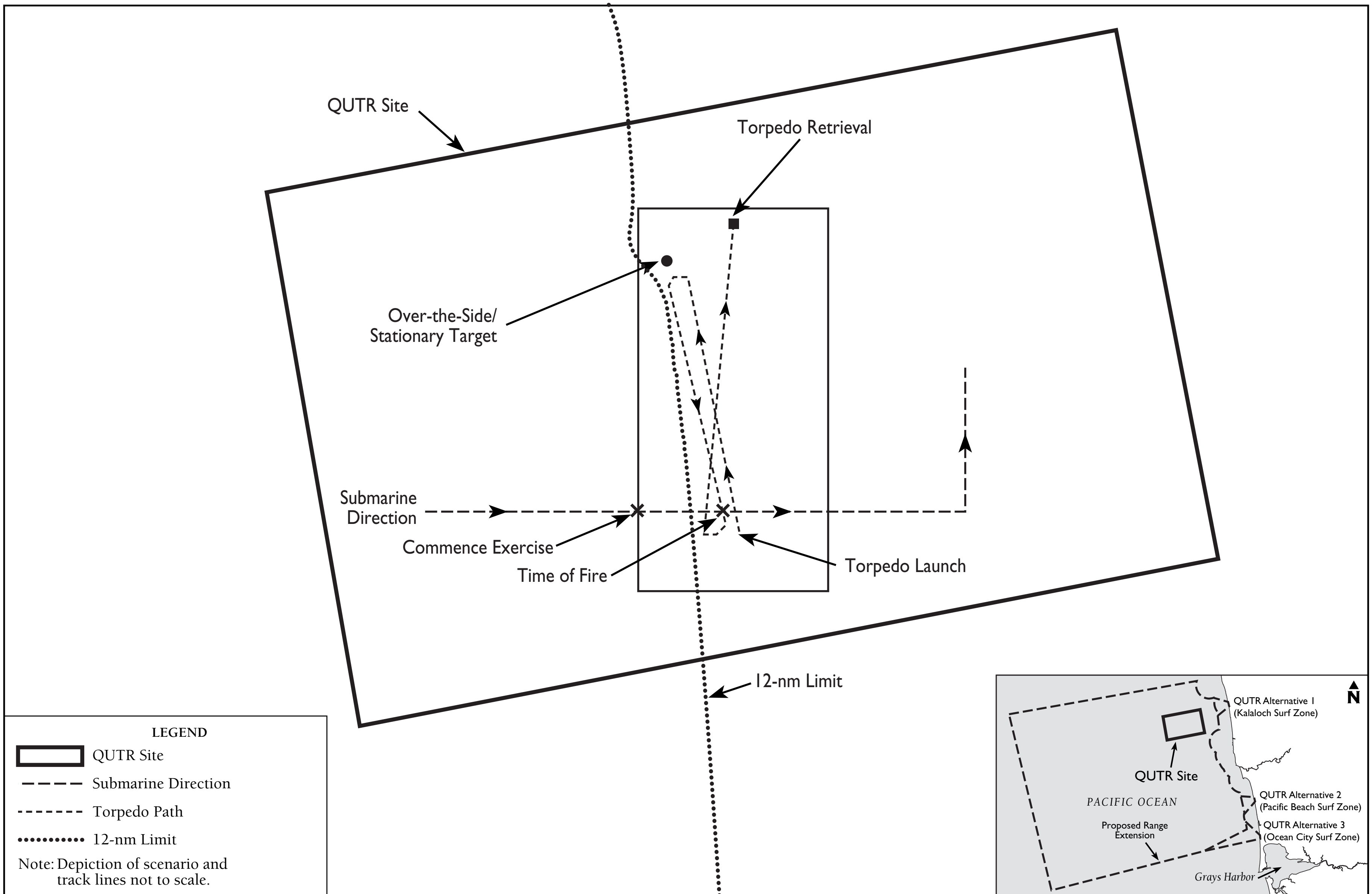


Figure 2-3
QUTR Site: Example Operational Scenario

To support this example scenario, the existing QUTR Site underwater-tracking equipment requires recalibration for high accuracy tracking capability. Portable tracking range assets would be deployed to supplement the underwater-tracking equipment. An additional range craft deploys the Over-the-Side/Stationary Target (schematic representation in Figure 1-6a). The submarine enters the range area at the commencement of the range exercise. The exercise torpedo is launched and makes its attack on the submarine and the over-the-side stationary target. Vehicle retrieval is accomplished through use of a retrieval craft. The estimated test time is 10 hours for the exercise and 2 to 10 days for range gear set up and removal.

In addition to tracking provided at the range, the range craft are equipped with global positioning system (GPS) tracking. The range craft transit to the range site for range activities. The test vehicle and associated support hardware are prepared in a NUWC Keyport shop and transported to KB Docks at Naval Base Kitsap-Bangor via truck for load-out onto the launch craft. During this test, active acoustic sources are at levels up to 226 dB re 1 µPa @ 1 m and at frequencies between 12 and 45 kHz. Upon completion of the test, all craft return to KB Docks for equipment offload. Current shore activities include maintenance and surveillance of: 1) cabling from Kalaloch; and 2) bottom-mounted instrumentation.

The combination of the following characteristics provides a unique testing environment at the QUTR Site. These characteristics include the proximity to Navy Fleet assets such as air operations, a large operational area for maneuvering multiple Fleet assets, and an open ocean environment. The bottom within the permanently mounted tracking range is hard sand bottom with mild slope and relatively shallow water (150-300 ft [46 – 91 m]). The hard sand bottom and shallow depths provide a very reverberant acoustic setting where multiple bounces can be used to test torpedo detection, classification and localization capability.

2.3 PROPOSED ACTION AND ALTERNATIVES

2.3.1 Proposed Action

The Navy proposes to extend the NAVSEA NUWC Keyport Range Complex in Washington State. The Proposed Action would provide additional operating space outside the existing operational areas to support existing and evolving range activities by NUWC Keyport. The scope of the Proposed Action includes only those activities scheduled and coordinated by NUWC Keyport. Other military operations currently occur within these areas (e.g., W-237A is used for a variety of military training activities outside of NUWC Keyport control). These other Navy training activities at the QUTR Site are being evaluated in the Northwest Training Range Complex EIS/OEIS and will be considered under cumulative impacts (Chapter 4) in this EIS/OEIS.

2.3.2 Action Alternatives

As the three range sites within the NAVSEA NUWC Keyport Range Complex are geographically distinct, the set of alternatives for one range site is independent of the set of alternatives for another range site. Therefore, action alternatives are presented for each range site separately. For each range site, one or more action alternatives have been identified in addition to the No-Action Alternative and are summarized below. When viewed collectively (i.e., for all three range sites in the NAVSEA NUWC Keyport Range Complex), all of the identified action alternatives satisfy the defined selection criteria described in Section 2.1.

- *Keyport Range Site*: Keyport Range Alternative 1 (Preferred Alternative) – extend range boundaries to the north, east and south, increasing the size of the range from 1.5 nm^2 to 3.2 nm^2 (5.1 km^2 to 11.0 km^2). The average annual days of use of the Keyport Range Site under this alternative would increase from the current 55 days to 60 days (Table 2-2).
- *DBRC Site*: DBRC Alternative 1 – extend the southern boundary of this range by approximately 10 nm (19 km), thereby increasing the total operating area from approximately 32.7 nm^2 (112.1 km^2) to approximately 44.0 nm^2 (150.8 km^2). DBRC Alternative 2 (Preferred Alternative) – extend the southern boundary by approximately 10 nm (19 km) and the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge (Highway 104). DBRC Alternative 2 would increase the operating area at the DBRC Site from approximately 32.7 nm^2 (112.1 km^2) to approximately 45.7 nm^2 (156.7 km^2). The same numbers and types of activities would occur under each DBRC Site alternative and there would be no increase in average annual days of use above current levels (Table 2-2).
- *QUTR Site*: QUTR Alternative 1 – extend the range boundaries to coincide with the overlying special use airspace of W-237A plus locate an 8.4 nm^2 (28.8 km^2) surf zone at Kalaloch. The total range area under QUTR Alternative 1 would increase from approximately 48.3 nm^2 (165.5 km^2) to approximately 1,840.4 nm^2 (6,312.4 km^2). QUTR Alternative 2 (Preferred Alternative) – extend the range boundaries the same as Alternative 1 but locate a 7.8 nm^2 (26.6 km^2) surf zone at Pacific Beach instead of at Kalaloch. The total range area under QUTR Alternative 2 would be 1,839.8 nm^2 (6,310.2 km^2). QUTR Alternative 3 – extend the range boundaries the same as Alternative 1 but locate a 22.6 nm^2 (77.6 km^2) surf zone at Ocean City instead of at Kalaloch. The total range area under QUTR Alternative 3 would be 1,854.6 nm^2 (6,361.2 km^2). The same numbers and types of activities would occur under each QUTR Site alternative. The average annual number of days of use for offshore activities would increase under each QUTR Site action alternative from 14 days/year to 16 days/year in the offshore area. The average annual days of use for surf-zone activities would increase from 0 days/year to 30 days/year (Table 2-2).

Table 2-2 Current and Proposed Average Annual Days of Use by Range Site

	Keyport Range Site	*DBRC Site*	*QUTR Site – Offshore*	*QUTR Site – Surf Zone*
Current	55	200	14	0
Proposed	60	200	16	30

Each range site of the NAVSEA NUWC Keyport Range Complex encompasses a wide variety of test and training activities coordinated by NUWC Keyport. In order to comprehensively depict the variety of activities that would occur under the Proposed Action, representative example scenarios were developed to characterize the types of activities that would be conducted at each range site, although other activities would also occur as described in Section 1.3.3. Under the Proposed Action, specific components such as launch, retrieval, and recovery methods and propulsion systems are evaluated and the example scenarios indicate how these activities would occur on the three range sites.

The amount of expendable materials used is expected to increase with the increased number of activities that produce expendables. At the Keyport Range Site, the number of expendable materials used is expected to increase by approximately 10 for a total of 76 items expended annually. At the DBRC Site, the number of expendable materials used is expected to increase by approximately 84 for a total of 364 items expended annually. At the QUTR Site, the number of expendable materials used is expected to increase by approximately 222 for a total of 617 items expended annually. Tables 2-3, 2-4, and 2-5 list the current and proposed number of expendables used at the range sites.

Table 2-3 Current and Proposed Numbers of Expendables Used at the Keyport Range

Type of Expendable	*Current #*	*Proposed #*
Copper guidance wire (40 lbs)	3	3
Fiber optic guidance wire	2	2
Aluminum door	0	8
Lead dropper	0	0
Flex hose	0	2
Stainless steel suspension band	0	0
Small parachute (4ft diameter)	0	0
Countermeasure	1	1
Anchor clump (concrete)	10	10
Anchor line (e.g., rope)	20	20
Sandbag anchor with attached line (e.g., nylon line)	30	30
Total	**66**	**76**

Notes: Refer to Section 1.3.3.7 for a description of expendable materials.

Table 2-4 Current and Proposed Numbers of Expendables Used at the DBRC Range Site

Type of Expendable	*Current #*	*Proposed #*
Copper guidance wire (40 lbs)	80	80
Fiber optic guidance wire	10	20
Aluminum door	112	112
Lead dropper	4	4
Flex hose	6	6
Stainless steel suspension band	0	8
Small parachute (4ft diameter)	0	4
Expendable target (e.g., EMATT)	0	8
Countermeasure	2	10
XBT with un-coated copper wire	4	6
Anchor clump (concrete)	10	10
Anchor line (e.g., rope)	20	30
Torpedo fragment (1 lb)	12	24
Sandbag anchor with attached line (e.g., nylon line)	20	30
Nose cap	0	8
Release wire	0	4
Total	**280**	**364**

Note: Refer to Section 1.3.3.7 for a description of expendable materials.

Table 2-5 Current and Proposed Numbers of Expendables Used at the QUTR Range Site

Type of Expendable	*Current #*	*Proposed #*	
		Offshore	*Surf Zone*
Copper guidance wire (40 lbs)	8	12	0
Fiber optic guidance wire	2	3	1
Aluminum door	40	56	0
Lead dropper	4	4	0
Flex hose	6	8	0
Stainless steel suspension band	24	34	0
Small parachute (4ft diameter)	12	17	0
Expendable target (e.g., EMATT)	2	4	6
Countermeasure	40	56	0
XBT with uncoated copper wire	5	5	0
Anchor clump (concrete)	5	15	15
Anchor line (e.g., rope)	5	15	15
Torpedo fragment (100 lbs)	0	20	0
Sandbag anchor with attached line (e.g., nylon line)	10	30	15
Sonobuoy	200	200	0
Marine location marker	20	60	0
Nose cap	0	6	0
Release wire	12	20	0
Total	**395**	**565**	**52**

Note: Refer to Section 1.3.3.7 for a description of expendable materials.

Table 2-6 summarizes the proposed operational tempo and the key activities associated with the NAVSEA NUWC Keyport Range Complex proposal, and provides an estimate of the types of range activities that occur in a given year. In addition, the table lists the different types of platforms and/or systems that would be employed.

Propulsion systems, sensors, transmitters, data transfer technology, and deployment and retrieval methods do not remain the same over the years; as newer systems evolve, older systems will be retired. At that time, appropriate NEPA analysis will be undertaken if warranted. The following discussion focuses on the Proposed Action as it relates to each of the three range sites.

Table 2-6 Proposed Annual NAVSEA NUWC Keyport Range Complex Activities

Range Activity	*Platform/System Used*	*Proposed Number of Activities/Year** *Keyport Range Site*	*DBRC Site*	*QUTR Site*
Test Vehicle Propulsion	Thermal propulsion systems	5	130	30
	Electric/Chemical propulsion systems	55	140	30
Other Testing Systems and Activities	Submarine testing	0	45	15
	Inert mine detection, classification and localization	5	20	10
	Non-Navy testing	5	5	5
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	20	10	5
	Countermeasure test	5	50	5
	Impact testing	0	10	5
	Static in-water testing	10	10	6
	UUV test	45	120	40
	Unmanned Aerial System (UAS) test	0	2	2
Fleet Activities** (excluding RDT&E)	Surface Ship activities	1	10	10
	Aircraft activities	0	10	10
	Submarine activities	0	30	30
	Diver activities	45	5	15
Deployment Systems (RDT&E)	Range support vessels:			
	Surface launch craft	35	180	30
	Special purpose barges	25	75	0
	Fleet vessels***	15	20	20
	Aircraft (rotary and fixed wing)	0	10	20
	Shore and pier	45	30	30

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.
** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.
*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

2.3.2.1 Description of Keyport Range Site Alternative and Example Scenario

The proposed Keyport Range Site extension would increase the size of the range from approximately 1.5 nm^2 to 3.2 nm^2 (5.1 km^2 to 11.0 km^2), thereby providing more operational space for NUWC Keyport activities. Only one alternative (Keyport Range Alternative 1, the Preferred Alternative) was identified for this range extension. The range would be extended to the northeast and east, and to the south in Port Orchard Reach near University Point (Figure 2-4a). This would extend the available operating area to include more east-west and north-south maneuvering room, and also incorporate the pier associated with NUWC Keyport. The creation of any new designation on standard NOAA navigational charts would occur as a separate action after the ROD.

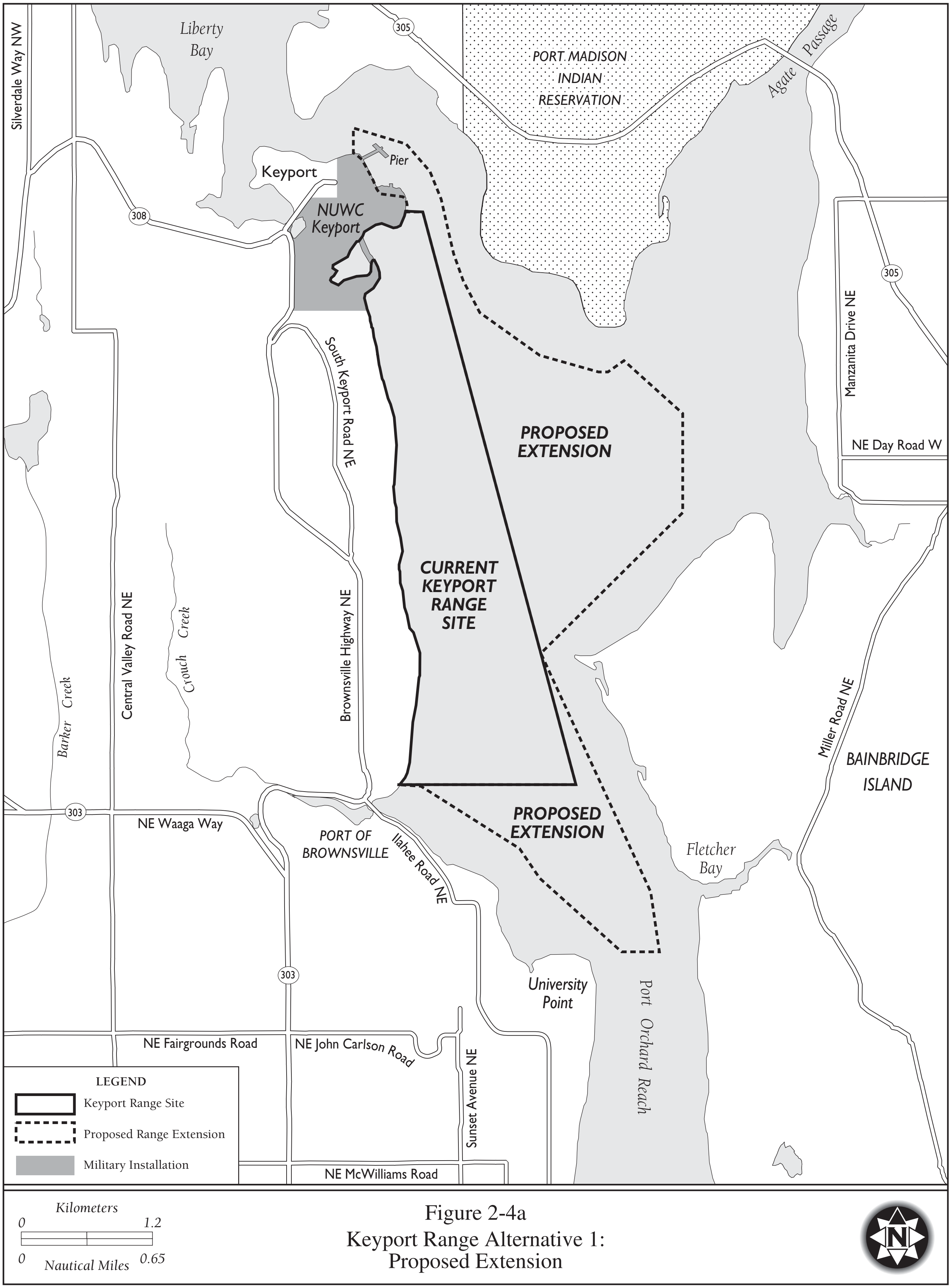


Figure 2-4a
Keyport Range Alternative 1:
Proposed Extension

Figure 2-4b shows a proposed example scenario at the Keyport Range Site associated with the NAVSEA NUWC Keyport Range Complex extension. This example test scenario consists of a series of three events with a UUV operating within the extended Keyport Range Site boundaries. A tracking system may be deployed in each test area for tracking the UUV. The tracking system operates at a frequency of 75 kHz and a source level of less than 195 dB re 1 µPa @ 1 m. This example activity would verify the UUV's capability to perform the following functions:

- *Conduct general bottom target-shape detection*. The UUV's capability to detect bottom target shapes with side-scan sonar would be tested by running north-south lines in a sliding-box pattern survey, at a speed of 4 knots (7 km per hour) and an altitude (i.e., above the sea floor) of 33 ft (10 m). The location is labeled Test Area 3 in Figure 2-4b.
- *Conduct close inspection and bottom target shape detection*. The UUV's capability to detect bottom target shapes in 100 ft (31 m) of water with side-scan sonar would be verified by running north-south lines in a sliding box, at a speed of 4 knots (7 km per hour [kph]) and an altitude of 16 ft (5 m). The location is labeled as Test Area 2 in Figure 2-4b.
- *Obtain UUV's electromagnetic and passive acoustic signature*. Electric, magnetic, and acoustic sensor measurements of the UUV would be obtained by having the UUV make several passes over a transportable electric and magnetic field measurement system installed at the range site. The north-south passes are at least 0.25 nm (0.46 km) in length and at altitudes above the bottom of 16, 33, and 50 ft (5, 10, and 15 m).

The estimated operational time for each of the above events is between 3 and 4 hours for a total of approximately 12 hours, including UUV launch and retrieval. All targets in the proposed range extension areas would be temporary; they would not be permanently mounted on the bay bottom and could be removed when they were no longer necessary for testing activities, which could be up to 2 years. Table 2-7 provides a comparison of current and proposed activities at the Keyport Range Site. Thermal propulsion systems are not currently used in the Keyport Range Site; under the Proposed Action, thermal propulsion test vehicles would be used about 5 times per year, and electrical/chemical propulsion test vehicle use would increase from 45 (currently) to 55 times per year. In addition, the average number of days on which activities would occur at the Keyport Range Site would increase to 60 from the current average of 55 days per year (Table 2-2). The previously discussed scenario provides the reader with an example of how the proposed Keyport Range Site extension would be used. It is not intended to bound the types of activities. Other scenarios would also be conducted within the Keyport Range Site, such as diver/special forces cold water training and transducer calibration for range equipment at the ATF. Potential RDT&E and other NUWC Keyport managed activities cannot all be described by limiting scenarios so the parameters of various propulsion, acoustic, and mechanical systems are reviewed individually. Other types of potential systems to be tested at the Keyport Range Site would be evaluated against the current analysis to determine if they fit within the parameters established in this EIS/OEIS.

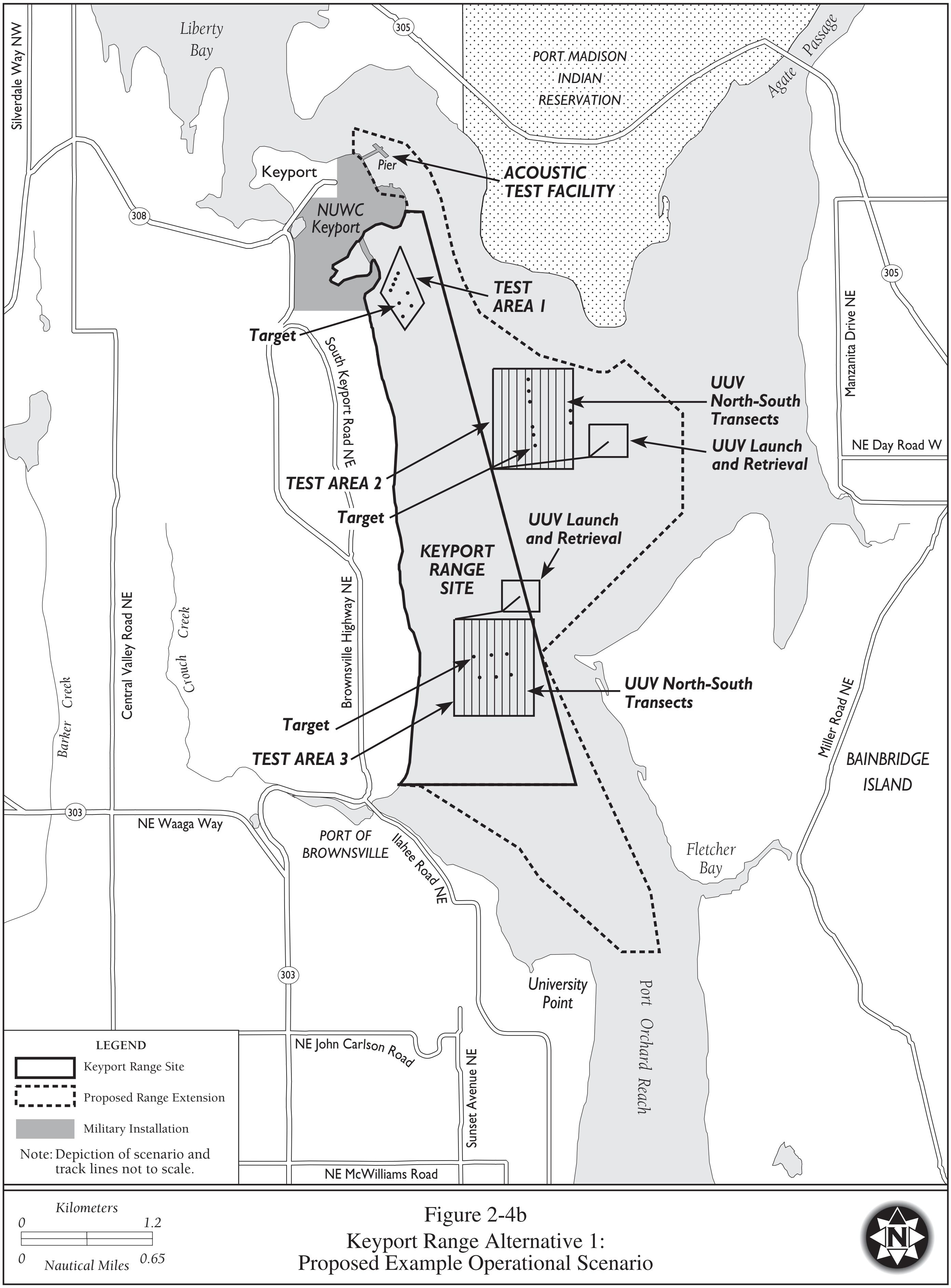


Figure 2-4b
Keyport Range Alternative 1:
Proposed Example Operational Scenario

Table 2-7 Current and Proposed Average Annual Activities at Keyport Range Site*

Range Activity	*Platform/System Used*	*Current*	*Proposed*
Test Vehicle Propulsion	Thermal propulsion systems	0	5
	Electric/Chemical propulsion systems	45	55
Other Testing Systems and Activities	Submarine testing	0	0
	Inert mine detection, classification and localization	5	5
	Non-Navy testing	5	5
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	20	20
	Countermeasure test	5	5
	Impact testing	0	0
	Static in-water testing	10	10
	UUV test	45	45
	UAS test	0	0
Fleet Activities** (excluding RDT&E)	Surface Ship activities	1	1
	Aircraft activities	0	0
	Submarine activities	0	0
	Diver activities	45	45
Deployment Systems (RDT&E)	Range support vessels:		
	Surface launch craft	35	35
	Special purpose barges	25	25
	Fleet vessels***	15	15
	Aircraft (rotary and fixed wing)	0	0
	Shore and pier	45	45

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.

** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

2.3.2.2 Description of DBRC Site Alternatives and Example Scenario

Under this proposal, Alternative 1 would extend the southern boundary of the DBRC Site approximately 10 nm (19 km) to the Hamma Hamma River (Figure 2-5a). Alternative 2 (the Preferred Alternative) would extend the southern boundary to the Hamma Hamma River plus extend the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge (Highway 104) (Figure 2-5a). Both of these alternatives would increase the size of the current operating area (in the case of the Preferred Alternative from approximately 32.7 nm^2 [112.1 km^2] to approximately 45.7 nm^2 [156.7 km^2]) and would afford a straight run of approximately 27.5 nm (50.9 km). The creation of any new designation on standard NOAA navigational charts would occur as a separate action after the ROD. Table 2-8 summarizes the number and types of current and proposed activities for the DBRC Site. With the exception of Unmanned Aerial System (UAS) tests, the number of proposed activities would be the same under either alternative and would remain the same as the current level of use within the DBRC Site. However, the proposed range extensions would allow the opportunity to test systems in areas where freshwater comes from large rivers (e.g., Duckabush River, Hamma Hamma River) to form freshwater layers, changing the dynamics of underwater sound and buoyancy. The proposed range extensions would also allow for a longer vehicle track with the areas connected throughout the DBRC Site.

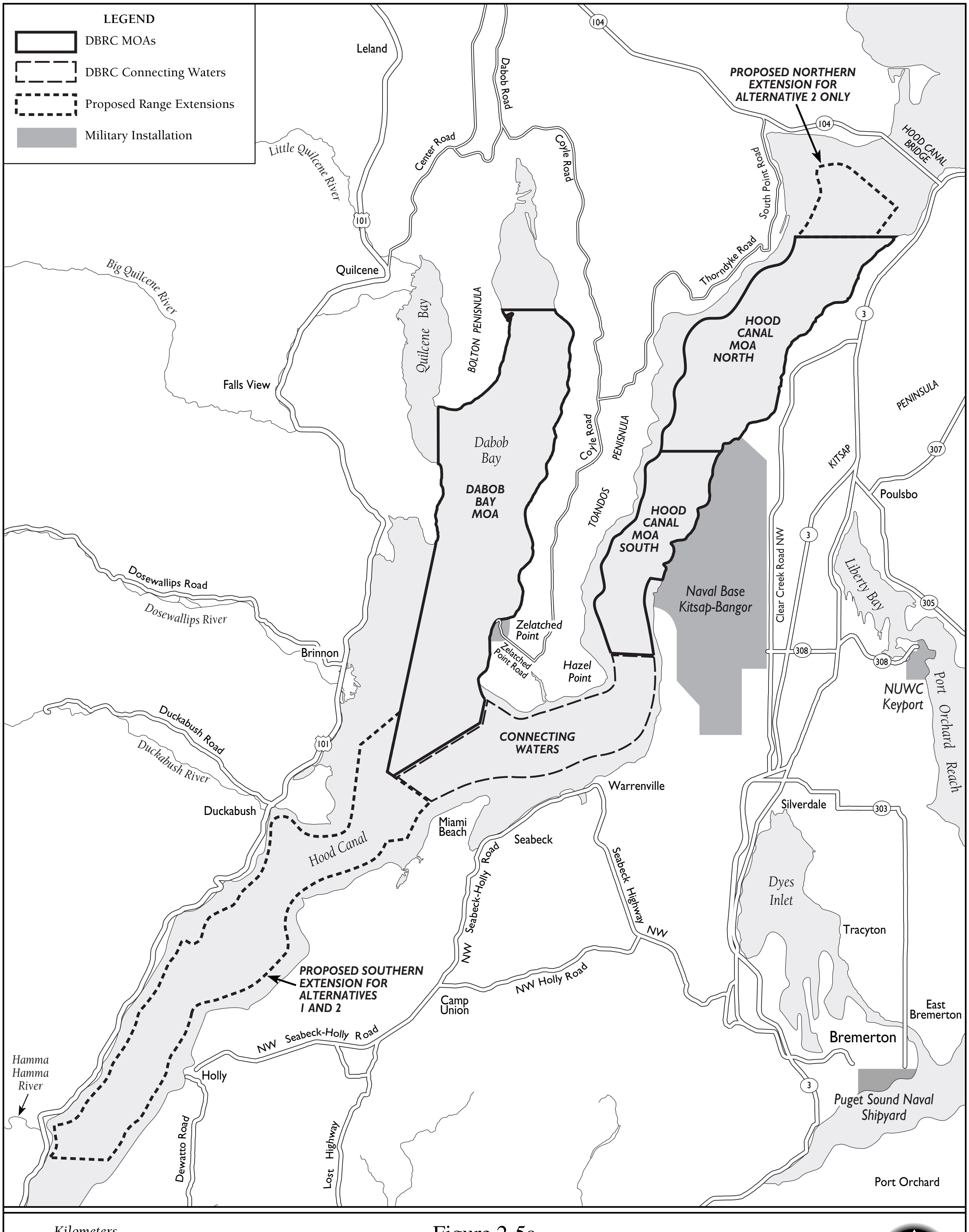


Figure 2-5a
Proposed DBRC Site Extensions:
Alternative 1 and Alternative 2

Table 2-8 Current and Proposed Average Annual Activities at DBRC Site*

Range Activity	*Platform/System Used*	*Current*	*Proposed*
Test Vehicle Propulsion	Thermal propulsion systems	130	130
	Electric/Chemical propulsion systems	140	140
Other Testing Systems and Activities	Submarine testing	45	45
	Inert mine detection, classification and localization	20	20
	Non-Navy testing	5	5
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	10	10
	Countermeasure test	50	50
	Impact testing	10	10
	Static in-water testing	10	10
	UUV test	120	120
	UAS test	0	2
Fleet Activities** (excluding RDT&E)	Surface Ship activities	10	10
	Aircraft activities	10	10
	Submarine activities	30	30
	Diver activities	5	5
Deployment Systems (RDT&E)	Range support vessels:		
	Surface launch craft	180	180
	Special purpose barges	75	75
	Fleet vessels***	20	20
	Aircraft (rotary and fixed wing)	10	10
	Shore and pier	30	30

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.

** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

Under either of the two alternatives, annual activities within the DBRC Site would only increase with the addition of UASs. No other changes in the type of activities would occur nor in the number of average days per year used, currently at 200.

Under the Proposed Action alternatives, a variety of UASs would potentially be tested at the DBRC Site. UASs are remotely piloted or self-piloted (i.e., preprogrammed flight pattern) aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. They can carry cameras, sensors, communications equipment, or other payloads. UASs can vary in size up to approximately 10 ft (3 m) in length, with gross vehicle weights of a couple hundred pounds. Propulsion types can range from traditional turbofans, turboprops, and piston engine-driven propellers, to electric motor-driven propellers powered by rechargeable batteries (lead-acid, nickel-cadmium, lithium ion), photovoltaic cells, and/or hydrogen fuel cells. At the DBRC Site, UAS testing could support one or more of the following mission areas: intelligence, surveillance, and reconnaissance; antisurface ship warfare and antisubmarine warfare (ASW); mine warfare; communications relay; and derivations of these themes. Since the DBRC Site is not overlain by restricted airspace or a Warning Area, and currently the FAA does not permit UAS operations outside of such designated areas without a Certificate of Authorization (COA), the Navy would apply for a COA in specific places within the DBRC Site for specific test events. Pursuant to FAA policy on UAS operations within the National Airspace System (Interim Operations Approval Guidance [IOAG] 08-01), a COA is required for UAS operations affecting areas of the National Airspace System other than active Restricted, Prohibited, or Warning Areas. FAA's policy regarding operations in the

National Airspace System for UAS in the "experimental category" is provided in FAA Order 8130.34. In general, the Navy conducts RDT&E of UAS in accordance with all FAA regulations (Title 14 Code of Federal Regulations) and Navy UAS operating rules and regulations.

Prior to testing at a range site, a UAS would be ground checked to ensure proper system operations. Takeoff procedures would vary by UAS, using the helopad at Zelatched Point or a portable launcher from a surface vessel. Personnel would use computers to remotely operate the UAS from a command post on a surface ship or located within an existing building at Zelatched Point.

Depending on the UAS being tested, individual flights within the DBRC Site could extend just a few nautical miles or tens of nautical miles. Maximum altitudes for flights would be approximately 3,000 ft (915 m) above mean sea level. Maximum velocities attained would be approximately 50 knots (93 kph). Use of UASs would occur only in accordance with Federal Aviation Administration regulations. The types of UAS tests conducted could include demonstration of aircraft flight worthiness and endurance, surveillance activities using onboard cameras and other sensors, and over-the-horizon targeting. Approximately two flights per year would occur within the DBRC Site and would last up to 2 hours each. At the completion of each flight test, the vehicle would land in a small clearing, the helopad at Zelatched Point, or using retrieval nets from a surface craft.

Figure 2-5b shows a proposed example scenario, the goal of which is to conduct a bottom-mapping survey of the existing and proposed extension boundaries of the DBRC Site using a UUV. The primary operational objective in this scenario would be to obtain an accurate topographical map of the DBRC Site seabed and proposed extensions that are correlated to global coordinates. Secondary operational objectives would include obtaining a radiated noise signature of the UUV and directly comparing the noise between two on-board signature tracking systems.

The total estimated operational test time for this example scenario would be 45 hours, including UUV launch and retrieval. As part of the scenario, a "shadow" track would be used to follow the UUV. A transponder would be mounted on the UUV and a transducer would be mounted on the launch and retrieval vessel that would communicate with the transponder on the UUV to determine its position relative to the launch and retrieval craft; the craft would then "shadow" the UUV as it made its run. During this test, active sonars (including tracking sonars) would emit at source levels of 168–223 dB re 1 μPa @ 1 m and at frequencies of 2 kHz–300 kHz.

2.3.2.3 Description of QUTR Site Alternatives and Example Scenario

The existing QUTR Site covers an area of approximately 48.3 nm^2 (165.5 km^2), beginning approximately 7.5 mi (12.1 km) off the Pacific Coast from Kalaloch. The Site underlies a portion of special use airspace W-237A. QUTR Site Alternative 1 would extend the NUWC Keyport activities to coincide with the entirety of the established W-237A; additionally, the surf zone would be located at Kalaloch. QUTR Site Alternative 2 (the Preferred Alternative) would extend the range activities the same as Alternative 1, but the surf zone would be located at Pacific Beach. QUTR Site Alternative 3 would be the same as Alternative 1, but the new surf zone would be located at Ocean City (Figure 2-6a). The creation of any new designation on standard NOAA navigational charts would occur as a separate action after the ROD. The number of activities within the extended QUTR Site (under any of the alternatives) would increase for vehicle propulsion tests and submarine, inert mine, static in-water, and UUV testing, while UAS and shore deployment system testing would be new to the range. The shore has only been used minimally in the past to maintain cabling. It has also been used by agreement with the Quinault Nation for pre/post-range preparations. Diver Fleet activities would increase by 5/year (Table 2-9).

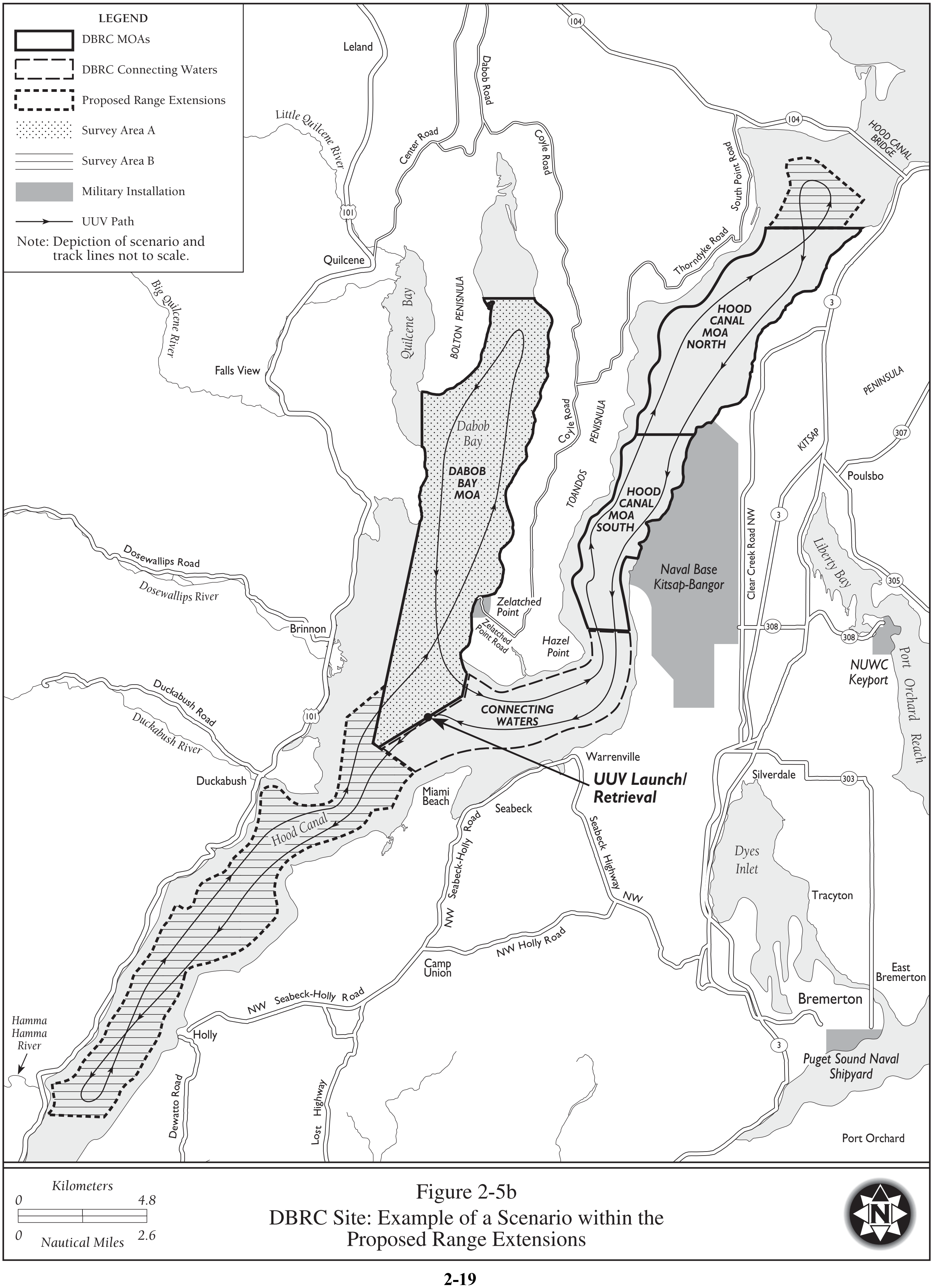


Figure 2-5b
DBRC Site: Example of a Scenario within the Proposed Range Extensions

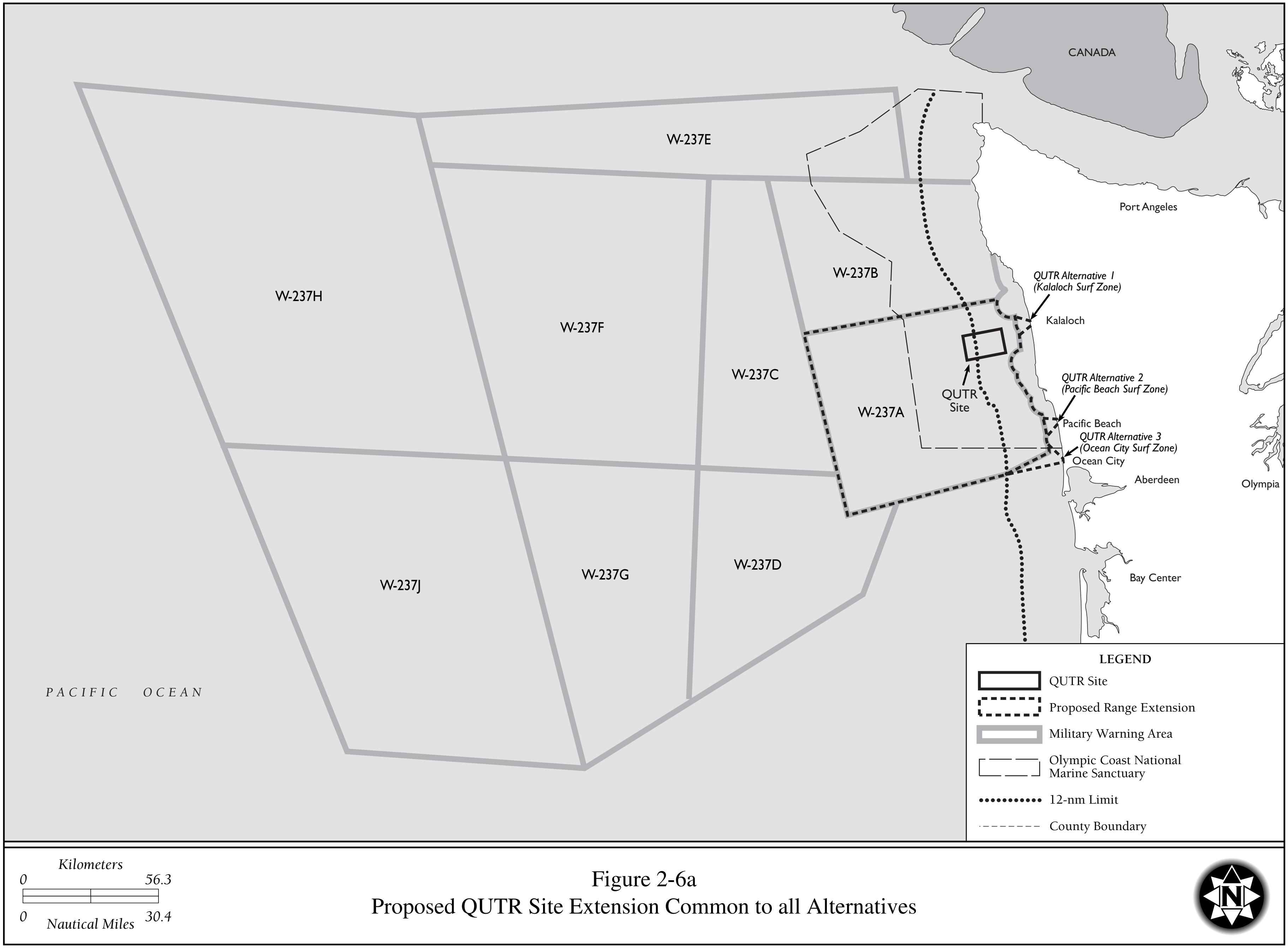


Figure 2-6a
Proposed QUTR Site Extension Common to all Alternatives

Table 2-9 Current and Proposed Average Annual Activities at QUTR Site*

Range Activity	*Platform/System Used*	*Current Activities/ year*	*Proposed Activities/ year*	*Offshore*	*Surf Zone*
Test Vehicle Propulsion	Thermal propulsion systems	20	30	X	
	Electric/Chemical propulsion systems	10	30	X	X
Other Testing Systems and Activities	Submarine testing	10	15	X	
	Inert mine detection, classification and localization	5	10	X	X
	Non-Navy testing	5	5	X	X
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	5	5	X	X
	Countermeasure test	5	5	X	
	Impact testing	5	5	X	
	Static in-water testing	5	6	X	X
	UUV test	20	40	X	X
	UAS test	0	2	X	X
Fleet Activities** (excluding RDT&E)	Surface Ship activities	10	10	X	
	Aircraft activities	10	10	X	
	Submarine activities	30	30	X	
	Diver activities	10	15	X	X
Deployment Systems (RDT&E)	Range support vessels:				
	Surface launch craft	20	20	X	
	Special purpose barges	20	20	X	
	Fleet vessels***	20	20	X	X
	Aircraft (rotary and fixed wing)	20	20	X	X
	Shore and pier	0	30	X	X

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.

** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.

*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

The proposed range extension would not result in additional permanent bottom deployed instrumentation. All bottom deployed equipment is temporary and would be recovered. Temporary deployment is defined for this analysis as less than 2 years, which includes planning, funding, and availability to retrieve/recover. Extending the operating area would provide a more varied range of bottom topography than the existing permanently instrumented range site. The current instrumented site is a gently sloping, hard, reverberant sand bottom with up to approximately 300 ft (91 m) of depth. The proposed extension offers multiple types of substrate with mud, rocks, and canyons as deep as 6,000 ft (1,829 m). This would enable deeper runs and variations in bottom type and acoustic characteristics. Sensors could also be used in multiple environments from shallow to deep simulating other coastlines with surf, cross currents, and distant shipping noise. This proposed extension would also allow for combined test and training activities with larger area for maneuverability of Fleet platforms and for longer vehicle tracks.

As with the DBRC Site, a variety of UASs may be tested at the QUTR Site under any of the action alternatives. UAS testing at the QUTR Site could support one or more of the following mission areas: intelligence, surveillance, and reconnaissance; antisurface ship warfare and ASW; mine warfare; communications relay; and derivations of these themes.

Prior to testing at the range site, a UAS would be ground-checked to ensure proper system operations. Takeoff procedures could utilize a portable launcher from a surface vessel. Personnel would remotely operate the UAS from a command post on a surface ship or shore.

Depending on the UAS being tested, individual flights within the QUTR Site could extend just a few nautical miles or many tens of nautical miles. Maximum altitudes for flights would be approximately 3,000 ft (914 m) above mean sea level. Maximum velocities attained would be approximately 50 knots (93 kph). Use of UASs would only occur in accordance with FAA regulations and coordination with NAS Whidbey Island. For any activities involving UASs within 3 nm of the coast (and therefore outside W-237A), NUWC Keyport would apply for a COA from FAA for specific test events. The COA would be required for UAS operations in the airspace between the launch point and the eastern boundary of W-237A (3 nm offshore); for UAS operations conducted within W-237A, no COA is necessary and use of the airspace would be scheduled with the NAS Whidbey Island range scheduling office. As noted previously for DBRC, the Navy conducts RDT&E of UAS in accordance with all FAA (Title 14 Code of Federal Regulations) and Navy UAS operating rules and regulations. The types of tests conducted could include demonstration of aircraft flight worthiness and endurance, surveillance activities using onboard cameras and other sensors, and over-the-horizon targeting. Approximately two flights per year would occur within the QUTR Site and would last up to 2 hours each. At the completion of each flight test, vehicle landing would occur using retrieval nets from a surface craft.

Figure 2-6b shows an example scenario for proposed range activities extending from the deep area of the proposed QUTR Site extension in to the shallow portion of the range. This example scenario consists of ranging a UUV in the southwest corner of W-237A in water up to 6,000 ft (1,829 m) deep. A portable range system would be set up prior to the torpedo run to provide 3-D underwater tracking. A NUWC Keyport range craft or other surface vessel often serves as the control center while activities take place at the QUTR Site. The UUV would be launched from and retrieved by a Navy Fleet destroyer. Inert mine shapes would be temporarily planted as targets (Figure 2-6b shows these deployed at 6 nm [11.1 km] from shore). An additional vessel would deploy an over-the-side active acoustic target transponder. The portable tracking range components would be deployed and retrieved from the launch craft. The launch craft would serve as the control center for the portable tracking range and also as the overall range activities control center. In addition to the tracking noted above, the range craft and portable tracking range components could be equipped with GPS tracking capabilities. The estimated test time would be 8 hours for the test and 2 to 10 days for set up and removal of the range gear.

During this test, active sonars would operate at levels from 168 to 215 dB re 1 μPa @ 1 m and at frequencies between 12 and 75 kHz. The primary objective of this test would be to evaluate the endurance, navigational, and search capabilities of a UUV. A passive acoustic system would be deployed to record acoustic events to compare with data from the active acoustic system.

The proposed extension would also include a surf-zone corridor from the shoreline to the boundary of W-237A. The surf-zone component would extend north to south 5 nm (9 km) along the eastern boundary of W-237A, extend approximately 3 nm (6 km) to shore along the mean lower low water line, and encompass 1 mi (2 km) of shoreline. Surf-zone activities would be conducted from an area on the shoreline and seaward. There are three surf-zone alternatives under consideration that are discussed later in this section. Figures 2-6c and 2-6d show the proposed QUTR Site extension within W-237A and the three surf-zone alternatives.

Figure 2-6e portrays an example scenario for proposed surf-zone activities; this scenario could be conducted within any of the surf-zone alternative locations. Other options for activities in QUTR Site include, but are not limited to, shallow water bathymetry sensing, subbottom profiling, UUV surveillance, or UAS testing as appropriate. Fleet platform participation is optional and contributes to realistic Fleet training. This is a robust example of a complicated activity with coordinated shore and sea support.

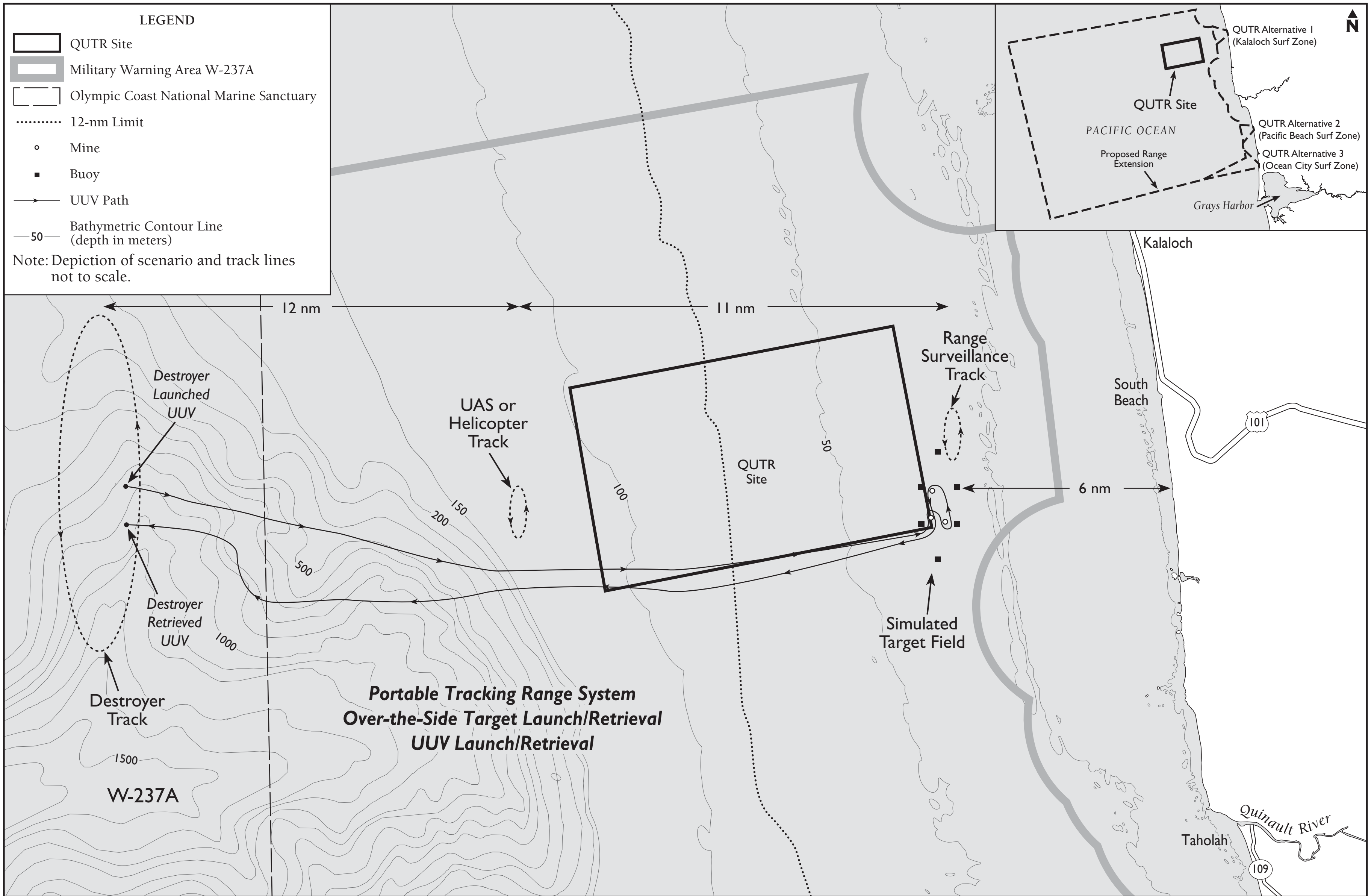


Figure 2-6b
QUTR Site: Example Deepwater Scenario within the Proposed Extension

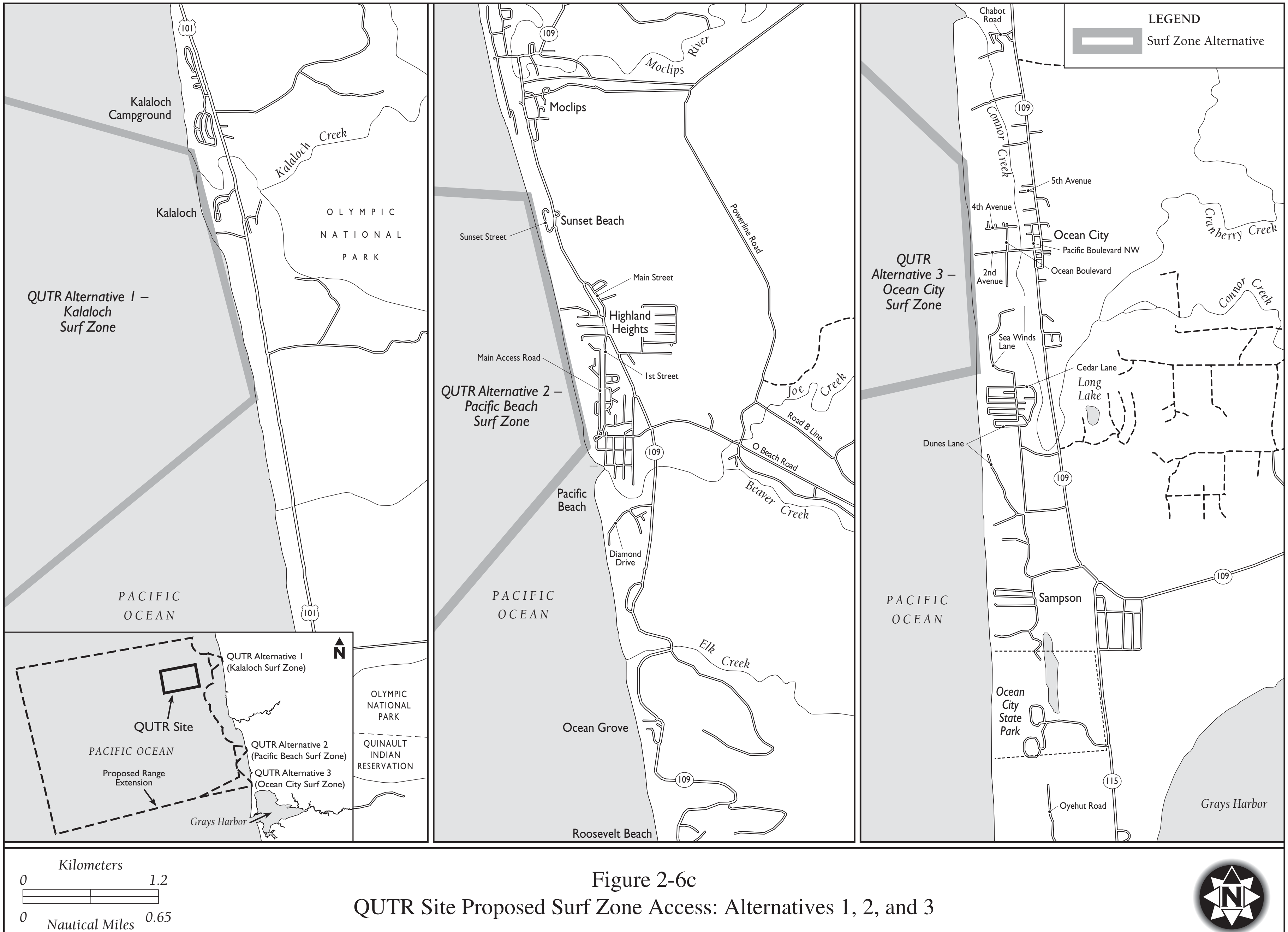


Figure 2-6c
QUTR Site Proposed Surf Zone Access: Alternatives 1, 2, and 3

looking south

looking west

looking north

(a) Representative Views of the Beach at Kalaloch

looking south

looking east

looking north

(b) Representative Views of the Beach at Pacific Beach

looking south

looking east

looking north

(c) Representative Views of the Beach at Ocean City

Figure 2-6d
Photos of Surf Zone Alternative Locations

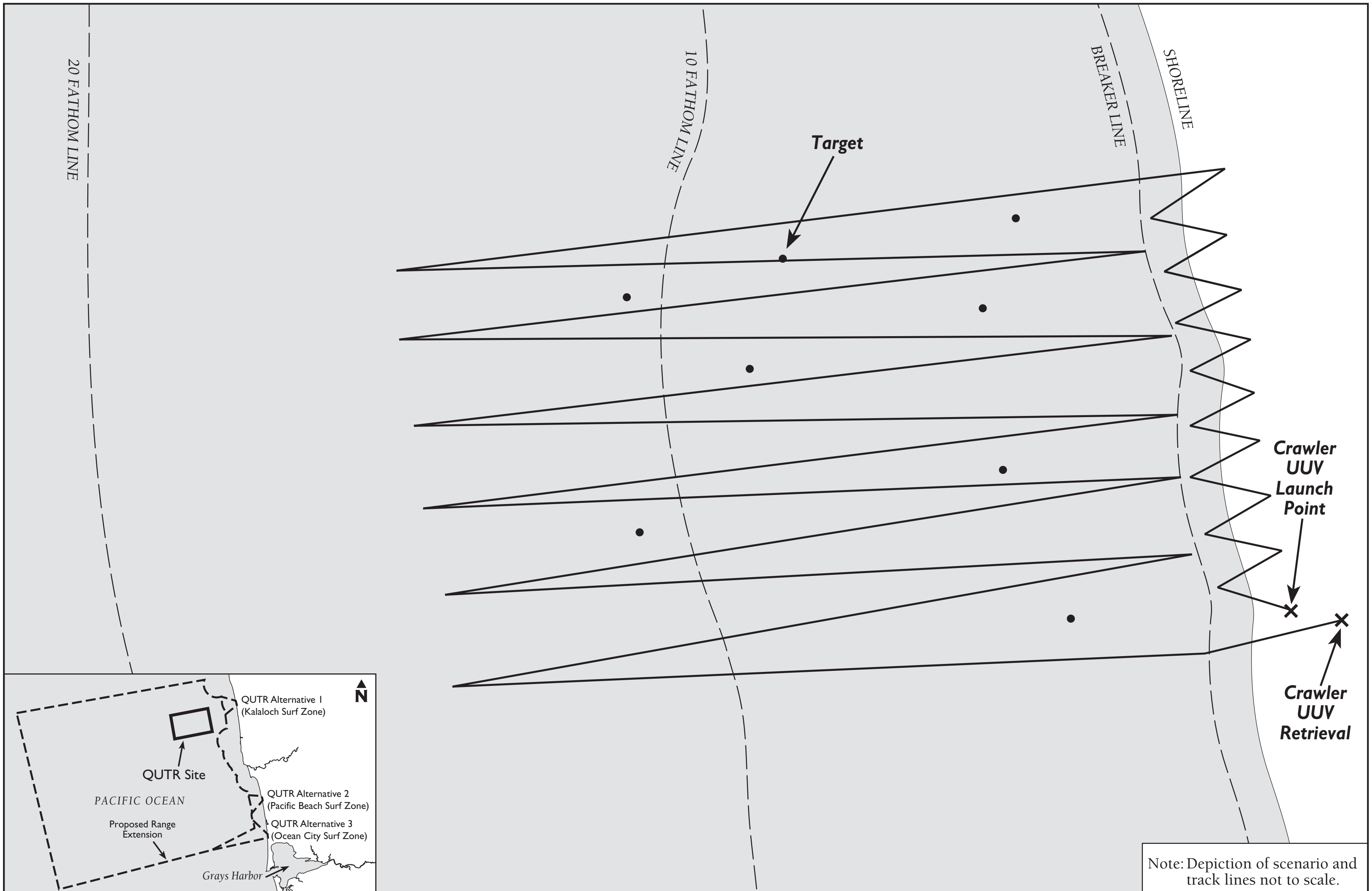


Figure 2-6e
QUTR Site: Example Surf Zone Scenario within the Proposed Extension

This example scenario consists of testing a bottom-crawling robotic vehicle in the surf-zone area in water depths from 0 to 100 ft (0 to 31 m). The representative crawler would carry a payload of several acoustic emitters, including communication/navigation equipment and sonars. Generally, one sonar unit and one communication/navigation aid system would be used on a crawler at any time. The surf-zone area would be planted with temporary target fields to test the crawler sensors. A small boat and divers would potentially be used as a backup for launch and retrieval of the crawler vehicle. Vehicle command and control would occur via a radio frequency (RF) modem mounted in a float connected to the crawler using a tether. RF and video data would then be transmitted by additional RF modems and a RF video transmitter mounted in the float.

A temporary beach station, consisting of various electronics paired with the electronics on the float, would typically be located close to the waterline. A small 1-kilowatt gasoline generator could be used as the power source for the command and control equipment. A secondary containment would be used for the gas generator gasoline container. The estimated operational test time would be 8 hours with 3 days for preparation and gear retrieval. During the test time, the public would be kept clear from a small portion of the beach to ensure the safety of the public and security of equipment.

Several target shapes would be deployed in the surf-zone test area in water greater than 10 ft (3 m) deep; additional targets would be placed in depths of less than 10 ft (3 m). The target shapes, crawler vehicle, and associated support hardware described above may be transported via roadways from NUWC Keyport to the surf-zone test area, deployed from the truck, and recovered during low tide. Test activities could begin at high tide (10 ft [3 m]); tidal shift allows target shapes to be deployed on the beach and meet required depths for test operation. At the conclusion of the test, all equipment would be returned to the NUWC Keyport shop. If a small boat were used, it would be transported by trailer to the coast from NUWC Keyport and launched near the surf-zone test area.

<u>QUTR Alternative 1 (Kalaloch Surf Zone Access Area)</u>

Under this alternative, the extension of QUTR Site boundaries (to the full extent of W-237A) and associated activities, as described above and in Section 2.2.3, would occur. The surf zone would be located at Kalaloch. The shoreline associated with the Kalaloch alternative is part of the Olympic National Park near Kalaloch and the offshore area is within the OCNMS. The proposed surf-zone area begins just south of the Kalaloch campground at the high water mark and extends 1 mi (2 km) south along the shoreline. Beach access would likely occur from either the Kalaloch campground or from one of the existing beach trails. However, vehicles cannot be driven down to the beach from these access points because of the bluff leading down to the beach, so equipment delivered by land would need to be lowered to and raised from the beach at these locations. Equipment could also be brought in from sea by surface vessels (e.g., Helicopter, Zodiac, landing craft).

<u>QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)</u>

Under this alternative, the extension of QUTR Site boundaries (to the full extent of W-237A) and associated activities, as described above and in Section 2.2.3, would occur. The surf zone would be located at Pacific Beach. The Pacific Beach surf-zone alternative comes to shore within the OCNMS. A Navy Morale, Welfare, and Recreation (MWR) facility is on a high bluff above the shoreline near State Highway 109. The Pacific Beach Navy regional facility also includes buildings, a fenced area separate from the more public area, and a helicopter landing pad. These would be used for basing equipment and personnel for shore activities. There are two beach access roads: Annelyde Gap Road (also referred to as Homer Street) leading down from the bluffs 0.5 mi (0.8 km) to the north of the southern boundary, and Moclips Gap (also referred to as Pacific Street) approximately 1 mi (2 km) north of the northern boundary. The rules for this location as promulgated by the State of Washington prohibit non-governmental motor vehicles from the southern boundary to Annelyde Gap Road from April 15 through the day following Labor Day each year, except during recreational razor-clam season (Washington State Legislature 1988). The beach north of Annelyde Gap Road is open for driving year-round. Starting from the northern portion of the shoreline, single-family homes are situated close to and fronting the high tide area. The beach is designated state highway property. The intertidal zone is managed by the Washington State Parks and Recreation Commission. Based on these assets, this is the preferred alternative.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Under this alternative, the extension of QUTR Site boundaries to the full extent of W-237A and associated activities as described above and in Section 2.2.3, would occur. The surf zone would be located at Ocean City. The Ocean City surf-zone alternative comes to shore near State Highway 109, south of the boundary of the OCNMS. There are several beach access roads to the shore area including the Ocean City State Park Access Road, 0.5 mi (0.8 km) to the north of the southern boundary; Chance A La Mer Beach Road, approximately 2.7 mi (4.3 km) south of Ocean City Beach Road; and Benner Gap Road, approximately 3 mi (5 km) north of Ocean City Beach Road. The rules for this location as promulgated by the State of Washington prohibit non-governmental motor vehicles from Ocean City Beach Road north from April 15 through the day following Labor Day each year, except during recreational razor clam season (Washington State Legislature 1988). The beach south of Ocean City Beach Road is open for driving all year. This area has low dunes and no obvious bluff. Homes are not located on the waterfront, but there are residences inland from the beach. The Quinault Beach Resort and Casino is visible to the south but not within this proposed surf-zone alternative. The beach is designated state highway property. The intertidal zone is managed by the Washington State Parks and Recreation Commission.

2.3.3 Representative Acoustic Sources

Table 2-10 lists representative acoustic sources and the associated frequency, source level, and total number of hours of proposed use per year for all three sites. Section 1.3.3.8 describes these sources in more detail. The majority of the hours of use would come from UUV testing and the use of subbottom profilers. Range targets and test vehicles represent a much smaller portion of the total hours of use of acoustic sources.

Table 2-10 Representative Acoustic Sources for Marine Mammal Acoustic Effects Analysis

Acoustic Source	*Frequency (kHz)*	*Source Level (dB re 1 µPa @ 1 m)*	*Hours of Use per Year*
Subbottom Profiler	4.5	207	192
UUV 1	15	205	166
UUV Acoustic Modem	10	186	166
UUV 2	150	220	166
Range Target	5	233	9
Test Vehicle 1	20	233	7
Test Vehicle 2	25	230	7
Test Vehicle 3	30	233	7

The eight acoustic sources listed in Table 2-10 are a subset of the types of acoustic sources that would be used on the NAVSEA NUWC Keyport Range Complex and have been identified as representative of proposed range activities for purposes of modeling acoustic impacts (i.e., test vehicles listed in table 2-10 are theoretical in nature and representative of upper boundaries of actual vehicles for modeling purposes only). Associated hours listed in table 2-10 are cumulative in nature within the designated parameters. To ensure that any new range systems can be evaluated when applying this EIS/OEIS analysis, a set of parameters was established based on frequencies and output levels to ensure there was a range of types of acoustic sources to consider. These EIS/OEIS results will be used to determine which systems can be tested by NUWC Keyport on the NAVSEA NUWC Keyport Range Complex sites without further NEPA analysis. For a more detailed discussion of system parameters and the acoustic modeling procedures and assumptions, refer to Section 3.5. The NUWC Keyport mission to test active acoustic systems is limited to those acoustic sources described in this EIS/OEIS. Further, NUWC Keyport proactively monitors and subsequently limits acoustic devices and sensors that have operational capacities outside the acoustic ranges specified herein.

2.3.4 Range Operating Policies and Procedures

Operating policies and procedures, as described in NUWC Keyport Report 1509, *Range Operating Policies and Procedures Manual (ROP)*, are followed for all NUWC Keyport range activities. NUWC Keyport would continue to implement the ROP policies and procedures within the NAVSEA NUWC Keyport Range Complex with implementation of any of the proposed range-site alternatives, including the No-Action Alternative. The ROP is followed to protect the health and safety of the public and Navy personnel and equipment as well as to protect the marine environment. The policies and procedures address issues such as safety, development of approved run plans, range operation personnel responsibility, deficiency reporting, all facets of range activities, and the establishment of 'exclusion zones' to ensure that there are no marine mammals within a prescribed area prior to the commencement of each in-water exercise within the NAVSEA NUWC Keyport Range Complex. All range operators are trained by NOAA in marine mammal identification, and active acoustic activities are suspended or delayed if whales, dolphins, or porpoises (cetaceans) are observed within range areas. Table 2-11 provides a summary of selected ROP sections and other range procedures. The ROP contains additional sections; only the sections that specifically apply to this analysis are covered here.

The ROP sections shown in Table 2-11 apply to current NUWC Keyport activities at the Keyport Range Site, DBRC Site, and QUTR Site, and they would also apply to proposed activities within the current and proposed range site boundaries. The policies and procedures outlined in the ROP are continually being updated as new environmental and health and safety information becomes available. In addition, the ROP may be revised in the future to reflect any conservation or mitigation measures that arise from ongoing agency consultations (e.g., NMFS) and permitting process regarding this EIS/OEIS. With respect to UAS operations, NUWC Keyport is updating the ROP to comply with current FAA policies and procedures relevant to UAS activity in the National Airspace System, including implementing a review process for experimental UAS operations in the Range Complex in accordance with FAA Order 8130.34.

Table 2-11 NAVSEA NUWC Keyport Range Complex ROP Sections and General Flight Rules

ROP	*ROP Implementation*
ROP 10-1 (Revision E, June 2004)	• Establishes policies and procedures to be followed in the event of an OTTO Fuel II spill within the NAVSEA NUWC Keyport Range Complex or aboard a NUWC Keyport craft during the loading/off-loading, retrieval/recovery, or stowage of test units containing OTTO Fuel II; and the handling of OTTO Fuel II waste material or reclaimable liquids by range or craft personnel.
ROP 10-4 *Safety/Environmental Requirements and Operational Restrictions for Test Units* (Revision E, June 2004)	• Establishes safety/environmental requirements and operational restrictions for all test units (this includes but is not limited to, torpedoes, mobile ASW targets, inert mines, UUVs, and research and developmental vehicles) to be tested within the NAVSEA NUWC Keyport Range Complex or used in support of range activities.

Table 2-11 NAVSEA NUWC Keyport Range Complex ROP Sections and General Flight Rules (Continued)

ROP	*ROP Implementation*
ROP 6-4 *Range Operations and Marine Mammals* (Revision E, June 2004)	• Ensures that NAVSEA NUWC Keyport Range Complex personnel from NUWC Keyport are in compliance with OPNAVINST 5090.1C, *Navy Environmental and Natural Resources Program Manual*; MMPA; and Endangered Species Act (ESA). In particular, the following marine mammal protection measures are implemented per ROP 6-4: 1. Range activities shall be conducted in such a way as to ensure marine mammals are not harassed or harmed by human-caused events. 2. Marine mammal observers are on board ship during range activities. All range personnel shall be trained in marine mammal recognition. Marine mammal observer training is normally conducted by qualified organizations such as NOAA/National Marine Mammal Lab (NMML) on an as needed basis. 3. Vessels on a range use safety lookouts during all hours of range activities. Lookout duties include looking for any and all objects in the water, including marine mammals. These lookouts are not necessarily looking only for marine mammals. They have other duties while aboard. All sightings are reported to the Range Officer in charge of overseeing the activity. 4. Visual surveillance shall be accomplished just prior to all in-water exercises. This surveillance shall ensure that no marine mammals are visible within the boundaries of the area within which the test unit is expected to be operating. Surveillance shall include, as a minimum, monitoring from all participating surface craft and, where available, adjacent shore sites. 5. The Navy shall postpone activities until cetaceans (whales, dolphins, and porpoises) leave the project area. When cetaceans have been sighted in an area, all range participants increase vigilance and take reasonable and practicable actions to avoid collisions and activities that may result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (e.g., safety, weather). 6. In accordance with the MMPA and ESA, which address marine mammal protection, an "exclusion zone" shall be established and surveillance will be conducted to ensure that there are no marine mammals within this exclusion zone prior to the commencement of each in-water exercise. For cetaceans (whales, dolphins, and porpoises), the exclusion zone must be at least as large as the entire area within which the test unit may operate, and must extend at least 1,000 yards (914.4 m) from the intended track of the test unit. For pinnipeds, the exclusion zone extends out 100 yards (91 m) from the intended track of the test unit. 7. The minimum marine mammal exclusion zones defined above are sufficient to mitigate the effects of the acoustic energy transmitted by the test units, range tracking equipment, and the range target simulators currently in operation on U.S. ranges as of this writing. The exclusion zones specified in ROP 6-4 meet the requirements of Navy (2002a, 2003b) and NOAA (1993) and thereby ensure that active acoustic emissions from the acoustic sources currently in use do not constitute marine mammal harassment. 8. The NMFS recommendation that vessels not approach within 100 yards (91 m) of marine mammals shall be followed to the extent practicable considering human and vessel safety priorities. All Navy vessels and aircraft, including helicopters, are expected to comply with this directive. This includes marine mammals "hauled-out" on islands, rocks, and other areas such as buoys. 9. In the event of a collision between a Navy vessel and a marine mammal, NUWC Keyport activities will notify the Navy chain of Command, which would result in notification to NMFS. 10. Procedures for reporting marine mammal sightings on the NAVSEA NUWC Keyport Range Complex shall be promulgated, and sightings shall be entered into the Range Operating System and forwarded to NOAA/NMML Platforms of Opportunity Program.
Flight Rules for Wildlife (per Navy 2001a, 2002a)	General flight rules for terrestrial and marine wildlife include: • Flights over land must be at least 1,000 ft (305 m) above the level of the land; • Flights over water must be at least 500 ft (152 m) above the level of the sea; and • Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 ft (305 m) above sea level. • A 656-ft (200-m) lateral no-fly area around bald eagle nests for all aircraft (Navy 2001a, 2002a).

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED CONSIDERATION

As introduced in Section 2.1, selection criteria were established based on the purpose and need for the Proposed Action to help determine the set of reasonable alternatives that would be carried forward for detailed consideration in this EIS/OEIS. Navy ranges in other locations were considered unreasonable as they would not satisfy the criterion for proximity to NUWC Keyport and its existing assets, nor would they support the mission of NUWC Keyport to provide test and evaluation services in a wide range of environments that represent real war-fighting conditions for emerging manned and unmanned vehicle program activities.

For the Keyport Range Site and DBRC Site, larger range extensions were initially considered to further enhance proposed activities. However, the sizes and locations of these potential range extensions were considered to be above and beyond the basic purpose and need of the Proposed Action. Therefore, these range extension alternatives were not carried forward for analysis.

For the QUTR Site, three additional surf-zone alternatives were initially considered: Sea Lion Rock, South Beach, and Copalis Beach (Figure 2-7). The location at Sea Lion Rock was initially considered in lieu of the Kalaloch alternative, but was eliminated from consideration due to concerns from the Quinault Nation, regulators, and the public. In a scoping response letter dated December 1, 2003, the Quinault Nation formally requested "…that you [Navy] move any proposed shore landing area off its Reservation lands and preferably outside of its U&A [Usual and Accustomed] area." Although NUWC Keyport had been allowed by the Quinault Nation to use the Reservation land for activities in the 1990s, the Quinault Nation land is private property and each proposed use would have to be negotiated on a Government-to-Government basis with the Quinault Nation. In light of this, the Navy respects the current wishes of the Quinault Nation and is looking at surf-zone alternatives off reservation land.

The South Beach and Copalis Beach locations were eliminated from consideration due to the availability of more suitable locations nearby (Pacific Beach and Ocean City, respectively), which provide access to the beach from the road, and ideal proximity to W-237A. The South Beach location does not provide ready access to the beach from the road for equipment and is not near existing facilities. The Copalis Beach location, when fanned out to join W-237A, would still be within OCNMS. Therefore, Copalis Beach did not meet the request from the OCNMS to analyze an alternative outside the sanctuary.

Alternative configurations of the proposed QUTR Site extension were also considered but eliminated from further consideration in the EIS/OEIS. The primary criteria that led to the proposed QUTR Site extension area (in addition to the need for a surf zone area) was the need for variable water depths up to 4,500 feet. Bathymetry charts indicate that such depths occur well to the west of the existing QUTR Site. Configurations of the QUTR Site extension that were smaller than the one proposed would not reach these deeper areas and therefore would not satisfy this criterion. Since current and proposed NUWC Keyport activities are consistent with those already conducted in the existing Pacific Northwest Ocean Surface/Subsurface Operating Area (OPAREA), extension of the QUTR Site to correspond to the much larger OPAREA was also considered; however, such a large increase in the size of the QUTR Site would be above and beyond the purpose and need for the action. The existing boundary of the W-237A Warning Area represented a close approximation of the area required to minimally satisfy the water depth and other criteria, so this boundary was selected as the proposed QUTR extension area. The correlation with the W-237A boundary made sense in order to avoid having multiple boundary lines in the same general area for distinct but related military activity areas.

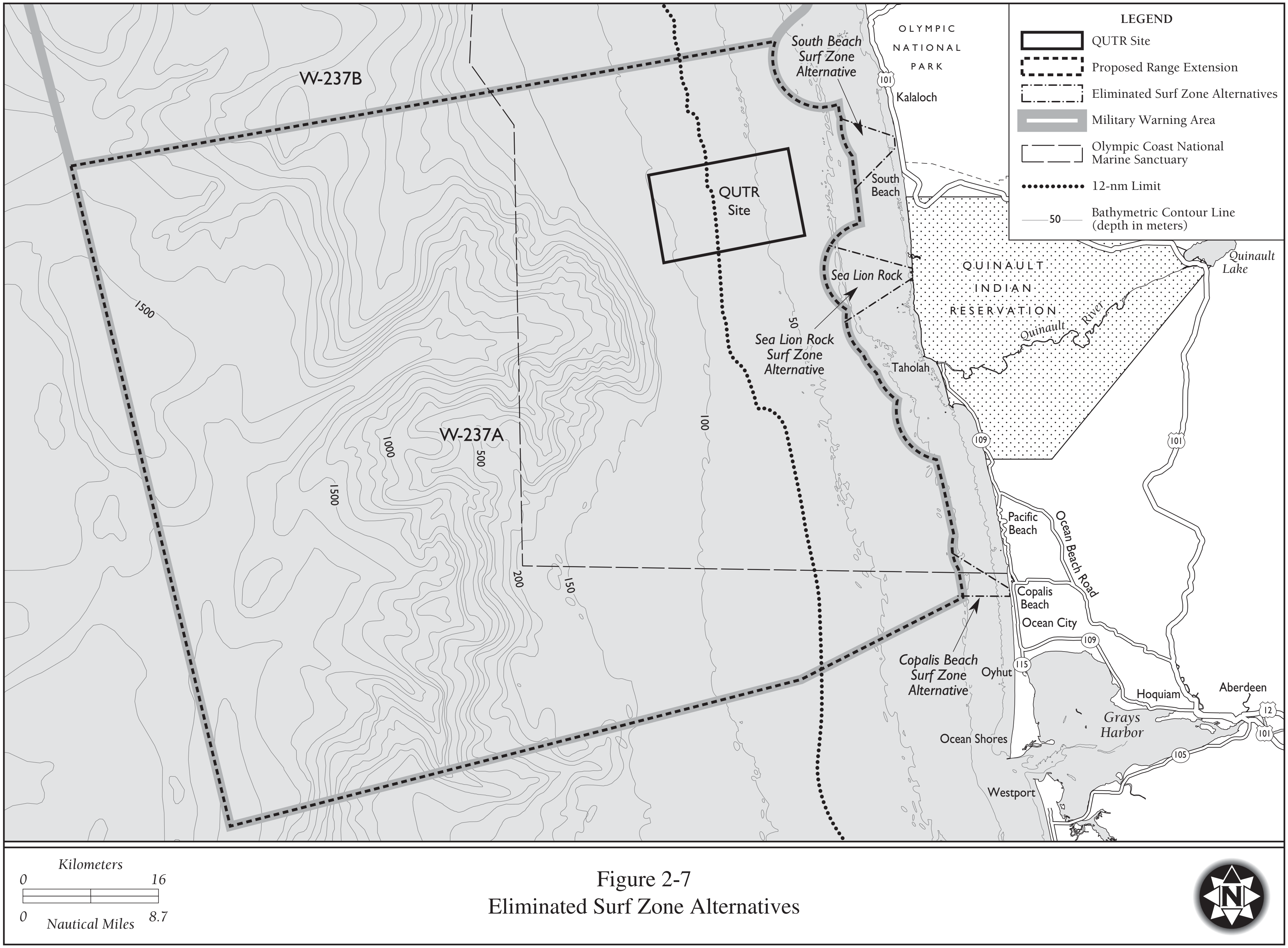


Figure 2-7
Eliminated Surf Zone Alternatives

CHAPTER 3
AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES

This chapter includes a description of existing environmental conditions at the Keyport Range Site, DBRC Site, QUTR Site, and their associated proposed extension areas. Also presented are the potential environmental consequences associated with implementation of the Proposed Action and alternatives, as well as any necessary mitigation measures to reduce, minimize, and/or avoid impacts to an acceptable level. Cumulative impacts (40 CFR 1508.7) are addressed in Chapter 4. Other NEPA considerations, including possible conflicts between the Proposed Action and the objectives of federal, regional, state, and local land use plans, policies and controls, and irreversible or irretrievable commitment of resources, are also provided in Chapter 4.

NEPA and EO 12114

This EIS/OEIS was prepared in accordance with NEPA and EO 12114. Impacts within U.S. Territory are analyzed using the procedures set out in NEPA and associated implementing regulations. Under customary international law, U.S. Territory generally extends out into the ocean for a distance of 3 nm (6 km) from the coastline. By Presidential Proclamation 5928, issued December 27, 1988, the U.S. extended its exercise of sovereignty and jurisdiction under international law to 12 nm (22 km), but the Proclamation expressly provides that it does not extend or otherwise alter existing federal law or any associated jurisdiction, rights, legal interests, or obligations. The Proclamation thus did not alter existing legal obligations under NEPA. As a matter of policy, however, the Navy has elected to apply NEPA to the 12 nm (22 km) limit established by the Proclamation.

The Keyport Range and DBRC sites are both located in inland waters of Washington State, completely within the 3-nm (6-km) state waters limit. All actions or affected resources at the Keyport Range and DBRC sites occur inside Territorial Waters, therefore potential impacts at these range sites are subject to analysis under NEPA.

Approximately half of the existing instrumented QUTR Site is outside Territorial Waters, and much of the proposed QUTR Site range extension lies outside Territorial Waters (Figure 2-6a). Potential impacts in the portions of the proposed QUTR Site that are outside Territorial Waters, often referred to as the global commons, are analyzed using the procedures set out in EO 12114 and associated implementing regulations.

Though both EO 12114 and NEPA apply to the impact analysis for QUTR, a separate analysis for EO 12114 impacts is not presented in this EIS/OEIS for the following reasons: it is not possible to distinguish the level and location of proposed NUWC Keyport activities within and outside Territorial Waters, non-military activities such as usual and accustomed fishing occur within and outside territorial waters, the OCNMS occurs within and outside territorial waters, and marine resources do not recognize the 12-nm (22-km) boundary (e.g., marine fish, marine mammals move freely within the marine environment). For cultural resources, one known shipwreck is outside the Territorial Waters limit. However, its specific location is unknown, and no effects to this specific resource were identified. Aside from that exception, affected resources analyzed in Chapter 3 are either relatively consistent between Territorial and non-Territorial Waters, or the resources regularly move freely inside and outside the 12-nm (22-km) limit; consequently, no resource-specific distinction between Territorial and non-Territorial

Waters can be made. In addition, NMFS does not consider Territorial Waters for their determinations with regards to MMPA. Therefore, potential impacts under EO 12114 and NEPA are addressed collectively in this EIS/OEIS.

Biological Resource Considerations

For the terrestrial and marine biological resources analyses presented in this EIS/OEIS, an "action area" was defined for each range site that includes the existing range site plus the proposed range extension area: existing Keyport Range Site and proposed range extension (Keyport action area); existing DBRC Site and proposed northern and southern extension areas (DBRC action area); and existing QUTR Site, proposed range extension, and surf zone access areas (QUTR action area). The biological resources sections in this chapter also use common names of species only; the scientific names of species are provided in Appendix F.

Consultation with USFWS or NMFS (depending on which agency has jurisdiction over the species being considered) is required under section 7 of the ESA for federal actions that may affect a listed species or designated critical habitat. No consultation or further action is required in cases where the lead federal agency determines that the action would have no effect. The determination as to "may affect" is based on the presence of the species or designated critical habitat within the action area, and the circumstances of the action which indicate the likelihood of an effect. This Final EIS/OEIS incorporates the conculsions resulting from consultations with both agencies, including the nature of any effects to listed species and critical habitat as well as any required terms and conditions.

The Biological Evaluation (BE) was the initial step in ESA section 7 consultation with the USFWS and/or NMFS. The Navy, in accordance with ESA, prepared a Threatened and Endangered Species BE to assess the effects of the Preferred Alternative for each range site on ESA-listed species and designated critical habitat. The Navy consulted with USFWS and NMFS (through meetings, dialogue, and information exchange) on the nature of the action and its potential effects. Species that were proposed for listing and have subsequently been listed by NMFS during review of the BE were also considered.

Based on "may affect" determinations, the Navy consulted with USFWS or NMFS as required on the following listed species and critical habitat: Puget Sound Chinook Salmon Evolutionary Significant Unit (ESU), Hood Canal Summer-Run Chum Salmon ESU and critical habitat, Coastal-Puget Sound Bull Trout Distinct Population Segment (DPS) and critical habitat, Puget Sound Steelhead Trout DPS and critical habitat, southern DPS of Pacific eulachon, Georgia Basin/Puget Sound bocaccio, Georgia Basin/Puget Sound canary rockfish, Georgia Basin/Puget Sound yelloweye rockfish, green sturgeon southern DPS and critical habitat, leatherback sea turtle, marbled murrelet, humpback whale, blue whale, fin whale, sei whale, North Pacific right whale, sperm whale, Southern Resident killer whale and critical habitat, and Steller sea lion.

The agencies subsequently provided their determinations regarding the nature of any effects on each listed species or critical habitat. For each species not likely to be adversely affected, informal consultation occurred as required and concluded with the agency's concurrence. For each species likely to be adversely affected, i.e., subject to take or adverse effect on critical habitat, formal consultation with the agency occurred as required, culminating in the agency's issuance of a Biological Opinion (BO) containing the necessary and sufficient terms and conditions under which the action can proceed. These terms and conditions are incorporated into Chapter 5 of this document.

The section 7 consultations were based on the agencies' review of the preferred alternative, which for the Proposed Action comprises Keyport Alternative 1, DBRC Alternative 2, and QUTR Alternative 2.

Although the terms and conditions of the BO are written for the preferred alternative, equivalent terms and conditions would be required for the other alternatives considered in this document, based on the similarity of effects to those of the preferred alternative.

To support MMPA compliance and consultation regarding potential impacts to marine mammals, the Navy has applied to NMFS for a Letter of Authorization (LOA) for its proposed activities within the NAVSEA NUWC Keyport Range Complex analyzed under this EIS/OEIS. Refer to Section 3.5 for further discussion of the LOA process and MMPA compliance requirements.

3.1 TERRESTRIAL WILDLIFE

This section describes the existing condition of terrestrial wildlife and seabirds that might be affected by the proposed range extensions and associated Navy activities that would occur within each range site. The "action area" for each range site includes the existing range site and the proposed range extension: existing Keyport Range Site and proposed range extension (Keyport action area); existing DBRC Site and proposed northern and southern extension areas (DBRC action area); and existing QUTR Site, proposed range extension, and surf zone access areas (QUTR action area). Since all activities under the Proposed Action and alternatives would occur within either the offshore (i.e., underwater or on the water's surface) or nearshore (i.e., beach, intertidal) marine environment, the following discussion of terrestrial biological resources focuses on those wildlife species that use the marine and nearshore environment for feeding, resting, or breeding.

3.1.1 Regulatory Framework

Terrestrial wildlife species are under the jurisdiction of the Department of Interior's USFWS, as provided under several key statutes. The ESA was discussed previously in the Introduction to Chapter 3. Under the ESA, the two terrestrial species within the action areas for which USFWS has jurisdiction are the marbeled murrelet and the snowy plover. The Navy submitted a BE and consulted with USFWS on the action's effects on these species.

The **Migratory Bird Treaty Act (MBTA)** of 1918 is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. The complete list of bird species protected by the MBTA appears in Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13). Section 704(a) of the MBTA prescribes regulations to exempt the Armed Forces for the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense or the Secretary of the military department concerned. Congress determined that allowing incidental take of migratory birds as a result of military readiness activities is consistent with the MBTA and the treaties. The Armed Forces must give appropriate consideration to the protection of migratory birds when planning and executing military readiness activities, but not at the expense of diminishing the effectiveness of such activities. Military readiness activities are exempt from the take prohibitions of the MBTA provided they do not result in a significant adverse effect on the population of a migratory bird species.

According to the 2003 National Defense Authorization Act, military readiness activities include all training and operations of the Armed Forces that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. It includes activities carried out by contractors, when such contractors are performing a military readiness activity in association with the Armed Forces, including training troops on the operation of a new weapons system or testing the interoperability of new equipment with existing weapons systems. By this definition, the current and proposed RDT&E and other test and training activities scheduled and coordinated by NUWC Keyport within the NAVSEA NUWC Keyport Range Complex qualify as military readiness activities, and are therefore exempt from the MBTA take prohibitions.

Virtually all of the bird species encountered at the Keyport Range sites are covered by the MBTA, including seabirds, shorebirds, wading birds (e.g., herons, egrets), and ESA-listed species such as snowy plover and marbled murrelet. No designated or proposed critical habitat for ESA terrestrial species occurs within the vicinity of the Keyport, DBRC, and QUTR action areas. In accordance with section 7 of the ESA, a BE has been prepared to assess the impacts of the Preferred Alternative on ESA-listed species.

The **Bald and Golden Eagle Protection Act** (16 USC 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Bald eagles (but not golden eagles), are present in the action areas.

3.1.2 Keyport Range Site

3.1.2.1 Existing Conditions

Migratory Birds

Migratory birds that occur within the marine or nearshore environment of the Keyport action area comprise numerous species of seabirds and waterfowl including harlequin duck, surf scoter, pigeon guillemot, common merganser, pied-billed grebe, western grebe, Barrow's and common goldeneye, bufflehead, American wigeon, ruddy duck, double-crested cormorant, glaucous-winged gull, ring-billed gull, and great blue heron (WDFW 2004b; USGS 2009). Although most of these species do not breed within the vicinity, they forage, rest, or overwinter in the waters of Liberty Bay, Port Orchard Reach, and Puget Sound in general. Other bird species that are known to nest in the vicinity and forage within the waters of Port Orchard Reach include belted kingfisher and osprey. These species forage on marine flora, invertebrates, and fish primarily nearshore and within the upper water column at depths of 1-33 ft (0.3-10 m) (WDFW 2004b). All of these species are migratory birds protected under the MBTA.

Bald Eagles

The bald eagle was first protected under the federal Bald and Golden Eagle Protection Act of 1940 ("Eagle Act") and was listed as threatened in the lower 48 states in 1978 under ESA. Bald eagle populations have since recovered and USFWS delisted the species in July 2007 (USFWS 2007a). Bald eagles are still protected under the Eagle Act and the MBTA. Recovery of the bald eagle has been especially dramatic in Washington State, where the number of occupied nests increased from 105 in 1980 to 840 in 2005. Bald eagle nesting territories are now found along much of the shorelines of Puget Sound. Washington State also supports the largest wintering population of bald eagles in the continental U.S. (Stinson et al. 2007).

Nesting, foraging, and perching habitat for bald eagles is typically associated with water features such as rivers, lakes, and coastal shorelines where eagles prey upon fish, waterfowl, and seabirds. During the breeding season from the beginning of January to mid-August, eagles establish and maintain territories. Nests are built in large dominant trees, primarily Douglas-fir, within 3,000 ft (914 m) of open water. Bald eagle nesting territories average 2.6 mi^2 (6.7 km^2) in area within the Puget Sound region. They prefer high structures for perching such as trees along the shoreline, but will also use cliffs, pilings, and open ground. They are usually seen foraging in open areas having wide views. Perch sites may be used for a number of activities including hunting, consumption of prey, and resting. Foraging and roosting habitat in winter is typically the same as the nesting season. During the winter, bald eagles often congregate in the evening in communal roosts that are chosen for a favorable microclimate that protects eagles from harsh weather (Stinson et al. 2007).

Three bald eagle nest territories are located within 1 mi (2 km) of the Keyport action area: two on Bainbridge Island to the east and one extending from within the fenced area of NUWC Keyport to the south (WDFW 2004b; NUWC Keyport 2007). (*Note: due to the sensitivity of bald eagle nest locations, a figure depicting these locations is not provided*). Wintering bald eagles occur within the Keyport action area from November through March. Therefore, bald eagles are present in the area all year.

ESA-Listed Species

The only ESA-listed terrestrial species that occurs within the Keyport action area is the threatened marbled murrelet. The marbled murrelet was listed as threatened under ESA in 1992 due to the high rate of habitat loss and fragmentation (primarily related to the loss of old-growth forests through logging), and mortality associated with net fisheries and oil spills. Marbled murrelets typically nest high in the canopy of old-growth forests where there are at least some trees greater than 32 inches (in) (81 centimeters [cm]) diameter at breast height and/or 200 years of age. The nesting season extends from early April to mid-September (USFWS 1997).

Marbled murrelets are marine birds that forage in shallow waters within 1.6 mi (2.6 km) of the shoreline from Northern California through Alaska (USFWS 1997). They are opportunistic feeders that will consume available prey species, which may include Pacific sandlance, Pacific herring, and surf-smelt (Burkett 1995; Strachan et al. 1995). Marbled murrelets forage actively with repeated dives at dawn and dusk. They do not dive at night and they rest for long periods during the day (Larsen 1994). Their dives generally last 15-60 seconds and diving bouts last over a period of 27 to 33 minutes (Nelson et al. 2006). They are thought to be able to dive to depths of 157 ft (48 m). Resting time spent at the surface between dives varies from approximately 14 seconds up to 20 minutes (Larsen 1994, Strachan 1995).

Abundance of murrelets in marine foraging areas may be related to the availability of nesting habitat in the surrounding area (USFWS 1997; Nelson et al. 2006). Most observations occur on the marine coasts, with fewer in Puget Sound (Strachan et al. 1995). Puget Sound and the northern part of the outer coast of Washington are heavily used during the breeding season. The southern portion of the coast may play an important role as wintering areas. In addition, there may be seasonal movement of marbled murrelets into Puget Sound from British Columbia during the winter (USFWS 1997).

Most of the forest stands in the vicinity of the Keyport action area are second growth that do not provide suitable nesting habitat. The WDFW has mapped several marbled murrelet breeding areas west of Highway 101 in the Big Quilcene River basin, approximately 20 mi (32 km) west of the Keyport action area. Critical habitat was originally designated in 1996 (USFWS 1996) but in 2006 revised critical habitat was proposed and the closest area is within the Olympic National Forest, approximately 20 mi (32 km) to the west of the Keyport action area (USFWS 2006).

Surveys conducted in the fall of 1996 found up to 400 murrelets north of the Hood Canal Bridge and none within Port Madison northeast of Agate Passage. Distribution of birds varied throughout the season and most marbled murrelets were observed within 1,640 ft (500 m) of shore (Sustainable Ecosystems Institute 1997). Based on annual U.S. Forest Service (USFS) surveys for marbled murrelets, the estimated density within the survey area containing the Keyport Range Site (Stratum 3 of Conservation Zone 1, which also includes southern Hood Canal, Southern Puget Sound, the outer coastline of Whidbey Island, and the northern mainland coastline of Puget Sound) was approximately 3.7 birds/mi^2 (1.4 birds/km^2) during the 2003 breeding season (Miller et al. 2006). Based on the preceding information, marbled murrelets are known to aggregate in small numbers in Agate Passage, but they are expected to be uncommon within Port Orchard Reach and the Keyport action area due to the narrowness of the area and relatively frequent human activity.

Other Wildlife

River otters, which are not considered marine mammals under MMPA (Section 3.5), are also common along the shoreline. River otters are opportunistic feeders, eating a wide variety of food items, but mostly fish. River otters usually feed on 4- to 6-inch long, slowly moving fish species, such as carp, mud minnows, stickle backs, and suckers. However, otters actively seek out spawning salmon and will travel far to take advantage of a salmon run. River otters can smell concentrations of fish in upstream ponds that drain into small, slow moving creeks, and will follow the smell to its origin, even in urban areas. River otters are relatively common and are found statewide in Washington in ponds, lakes, rivers, sloughs, estuaries, bays, and in open waters along the coast (WDFW 2005a).

3.1.2.2 Environmental Consequences

Keyport Range Alternative 1 – Preferred Alternative

Migratory Birds

Acoustic Impacts. In general, little is known of avian hearing under water, and there have been no studies or documented effects of sonar on diving birds when submerged. As a result, there are no established thresholds for threshold shift impacts or behavioral disruption in diving birds due to underwater noise, including sonar. In the absence of direct observations or established thresholds for sonar effects on seabirds, evaluations of potential impacts from other sources of acoustic energy are further discussed below.

The seismic airguns used in geophysical exploration have overlapping sound source characteristics compared to the sound sources in the Proposed Action. The seismic airguns emit greater sound source levels and lower frequencies. The lower frequency sources at greater amplitude and longer duration with broader bandwidth would propagate farther and overlap bird hearing to a greater extent. Observations of diving birds exposed to underwater noise from seismic testing using airguns have shown no effect on numbers or distribution, nor suggested any adverse physiological effects (Stemp 1985, Lacroix et al. 2003, Flint et al. 2003). The airguns generate a broadband impulse at low to middle frequencies (10 Hz to 3 kHz), with source levels of 225-240 dB, although the sound is directed downward and hence has a relatively narrow field. The aforementioned observational studies have supported findings that the use of airguns in geophysical surveys in the Pacific Northwest would not have significant effects on seabirds (MMS 2005, 2006). Since sonar associated with the Proposed Action has overlapping sound source characteristics within the range of avian hearing (1 to 5 kHz), extrapolation of these findings would suggest that the use of sonar as proposed would not significantly affect migratory bird numbers or distributions.

An evaluation of potential effects on seabirds of mid-high frequency sonar used to track the movements of gray whales found adverse effects on seabirds unlikely based on the following (NMFS 2003):

- There is no evidence seabirds use underwater sound.
- Seabirds spend a small fraction of time submerged.
- Seabirds could rapidly fly away from the area and disperse to other areas if disturbed.

This evaluation (NMFS 2003) is applicable to current and proposed activities because the acoustic sources evaluated overlap the frequencies and sound pressure levels of the Proposed Action and No-Action Alternative. The Proposed Action involves a relatively small incremental increase above current baseline activities. Based on the foregoing, the use of sonar as proposed would not impact migratory bird numbers or distribution.

Non-Acoustic Impacts. Potential non-acoustic impacts to migratory birds could result from the following project-related activities:

- Surface vessel movements. Vessel movements have some potential to affect bird movements and foraging, to the extent that birds may avoid or leave the area of vessel activity. The risk of collisions between project vessels and migratory birds is considered negligible given the mobility of the animals and generally slow-moving, conspicuous nature of the vessels engaged in RDT&E or training activities.
- Use of expendable materials. Expendable materials would briefly affect relatively small areas of surface water habitat for migratory birds. Once the materials sink, there would be no risk of entanglement or ingestion.

The Keyport action area currently experiences regular fishing, recreational, and commercial boat traffic associated with Keyport, Poulsbo, Bainbridge Island, and communities to the south. Under Alternative 1, Navy activities within the Keyport Range Site and proposed range extension would increase from the current 55 days/year to 60 days/year, an increase of only 5 days per year and 15 activities per year (Tables 2-2 and 2-7). The previous AUV Fest EA (Navy 2003b) considered the same types of activities for which relatively small increases are currently proposed and concluded that the in-water activities were similar to those ongoing in the general vicinity and would not disturb or otherwise affect bird species. Impacts on other terrestrial biota were considered negligible given the absence of construction or new disturbance on land, and therefore were not discussed. Potential underwater acoustic effects on diving birds, however, were not considered.

Agness (2006) provided a thorough, critical review of peer-reviewed publications on effects of boating activity on water birds. Behavioral responses to vessels were species-specific, and breeding birds tended to be less responsive to vessels than non-breeding birds. Motorized watercraft were more disturbing to birds than non-motorized vessels. Airboats, jet skis, and personal watercraft were especially likely to cause disturbance; this was attributed to their greater wake spray, high speed, and engine noise. Flight, which is energetically costly, was a frequently observed behavioral response. Bird densities were negatively associated with vessel activity in some but not all studies.

The activities associated with the Proposed Action involve relatively slow-moving vessels engaged in RDT&E, which the above evidence indicates have a low likelihood of causing disturbance. The above evidence suggests that temporary behavioral responses - diving or flying in response to the vessel's presence – might occur, but that these are not likely to have persistent effects on the use of foraging habitat, and that the birds may compensate for energetic costs by increased foraging. In general, the proposed Navy activities may result in individuals being temporarily displaced or avoiding the immediate area of activity, but such behavioral effects on individuals would be brief and very localized, and no effect on wildlife habitat, distributions, or populations in the action area as a whole would be anticipated. Therefore, implementation of Alternative 1 within the Keyport Range Site and proposed range extension would result in minimal impacts to migratory birds or other terrestrial wildlife species.

Migratory birds utilize the waters of the Keyport Range site to forage during wintering and migratory movements. The proposed activities within the Keyport Range site would not be expected to increase effects to migratory bird populations over the existing conditions in the No-Action Alternative. The temporal and spatial variability of the proposed activities, in combination with temporal and seasonal distributions of seabird species, would minimize the potential for effects. The overall populations of migratory birds and their habitat would not be negatively affected by activities within the proposed extension. Since the proposed activities at the Keyport Range Site qualify as military readiness activities, and they would not result in a significant adverse effect on the population of a migratory bird species, they are exempt from the take prohibitions of the MBTA.

Bald Eagles

Despite the aforementioned fishing, recreational, and commercial boat traffic in the vicinity, there are currently three bald eagle nest territories within the Keyport action area. Since bald eagles nesting or foraging in the Keyport action area appear to be tolerant of such vessel traffic, Navy vessels used during RDT&E and other proposed activities at the Keyport Range site would not be expected to disturb (as defined under the Eagle Act at 50 CFR 22.3), adversely affect, or result in any takes of bald eagles. Therefore, implementation of Alternative 1 within the Keyport Range Site and proposed range extension would have no impacts on nesting, foraging, or wintering bald eagles.

ESA-Listed Species

Implementation of Alternative 1 would not affect marbled murrelet nesting areas since the closest nesting area is over 20 mi (32 km) from the Keyport action area.

Acoustic Impacts. As discussed in the previous section, the use of sonar is unlikely to have a significant impact on seabird numbers and distribution in general, and this conclusion would be applicable to the marbled murrelet as well. In Washington State, concerns about the effects of underwater detonations and pile driving on diving marbled murrelets led USFWS to identify thresholds for potential behavioral effects on this species of 180 dB peak and 153 dB root-mean-square (WSDOT 2007). The species is presumed to be especially vulnerable to waterborne disturbance during molting, when it cannot fly. This is based on the assumption that the birds' hearing and responses to sound would be the same underwater as on land, which is untested. For acoustic sources within the hearing range of birds, it is unlikely that murrelets would exceed the USFWS distance threshold for injury, which would be within a few meters to tens of meters of the source, using reasonable assumptions about sound propagation under water (Appendix C). The presence of marbled murrelets within the USFWS distance threshold for behavioral effects (153 dB root-mean-square), which would be on the order of 100s of meters, can reasonably be anticipated. Hence the species may be affectedbut is not likely to be adversely affected, and accordingly, the Navy consulted with USFWS and will implement the required terms and conditions of the BO (see Section 5.4.1). Given the temporary, localized nature of any disturbance to individuals, the impact is considered minimal and unlikely to affect individual survival, reproduction, or distribution.

Non-Acoustic Impacts. A rigorous field observational study and analysis was conducted on Kittlitz's murrelet responses to boating activity in Glacier Bay, which is a prime nesting and foraging area for the species (Agness 2006; Agness et al. 2008). Some observations of marbled murrelets were tallied, and behavioral reactions of the two species, which are closely related and ecologically similar when foraging, are probably similar. The study found that high levels of boating activity were associated with temporary reductions in the density of birds, but that there was no effect (or a weak positive effect) on a daily time scale, indicating that vessel activity did not cause a persistent loss of foraging habitat, as birds returned to the area within a short time. Vessel activity did not affect group size, which is important because murrelets forage cooperatively. The proportion of individuals flying versus loafing or diving increased temporarily in the presence of vessels, but was not affected on a short-term (30 minutes before versus after) basis. Larger numbers of non-breeding birds took flight in response to larger vessels (tour boats and cruise ships). Breeding birds carrying fish dove, rather than flying in response to vessels; such dives can result in the loss of the fish for nestlings. On a daily time scale, individuals spent more time diving, i.e. there was increased foraging effort on days with higher rates of vessel traffic. Overall, faster moving vessels were more likely to affect behavior.

The energetic consequences of changes in behavior caused by vessel disturbance have been modeled but not directly measured (Agness 2006). Flight is energetically expensive, and the previous evidence suggests that murrelets may attempt to offset the cost of flight by increasing their foraging effort. Breeding birds that dive in response to vessel disturbance may consume fish that would otherwise have fed nestlings. In such cases, additional foraging effort is needed to provide a meal for the nestling.

The foregoing confirms the possibility that marbled murrelets may be affected where vessel activity overlaps their foraging areas, as was recognized to be the case with the Proposed Action. Accordingly, the Navy consulted with USFWS and will implement the required terms and conditions of the BO. A potential behavioral effect would be considered a "take" under the ESA if it would significantly disrupt normal behavior patterns, or otherwise cause injury to the individual. The activities associated with the Proposed Action involve relatively slow-moving vessels engaged in RDT&E, which the above evidence indicates have a low likelihood of causing disturbance. The above evidence suggests that temporary behavioral responses - diving or flying in response to the vessel's presence – might occur, but that these are not likely to have persistent effects on the use of foraging habitat, and that the birds may compensate for energetic costs by increased foraging. No effect on social foraging behavior would be expected. Finally, the widely dispersed, mobile, nature of the proposed activities, coupled with their distance from marbled murrelet nesting areas, suggests that the effect, if any, would be limited to minor, temporary behavioral reactions by individuals, not a significant (consequential) disruption of foraging. This supports the conclusion that the marbled murrelet is not likely to be adversely affected by the Proposed Action.

Other Wildlife

Acoustic Impacts. No published information on underwater hearing in river otters is available and nothing is known of the sensitivity of river otters to sonar, but a reasonable inference is that animals in close proximity to the more intense mid-frequency sound sources are likely to hear them, and may react by avoidance. Any such effects would be localized and temporary, and unlikely to affect numbers or distribution.

Non-Acoustic Impacts. It is not expected that the proposed activities within the Keyport Range Site would pose a risk of injury or mortality to river otters. Navy activities may result in river otters being temporarily displaced or avoiding the immediate area of activity, but such behavioral effects on individuals would be brief and very localized, and no effect on river otter habitat, distributions, or populations in the action area as a whole would be anticipated.

<u>No-Action Alternative</u>

Under the No-Action Alternative, the current activities conducted in the Keyport Range Site would be essentially the same as were previously analyzed in the AUV Fest EA, resulting in a FONSI and findings of no effects on listed species including marbled murrelet and, at the time, bald eagles (Navy 2003b). Based on the "no effect" conclusion, consultation with USFWS was not required. However, potential underwater acoustic effects on diving birds due to the types of sonar being used were not recognized as a concern at the time. Based on the foregoing considerations, the No-Action Alternative may affect, but is not likely to adversely affect, marbled murrelets. Terms and conditions of the BO (see Section 5.4.1) would also apply to this alternative. In other respects, since the distribution and intensity of activities would be less than previously analyzed, previous findings would continue to apply with the implementation of the No-Action Alternative.

3.1.2.3 Mitigation Measures

The Navy will implement the measures developed through section 7 consultation and required by the USFWS BO (USFWS 2010), as listed in Section 5.4.1. Apart from these measures, because there would be minimal impacts to terrestrial wildlife from implementing the Proposed Action or alternatives, no mitigation measures would be necessary.

3.1.3 DBRC Site

3.1.3.1 Existing Conditions

Migratory Birds

Migratory birds that occur within the marine or nearshore environment of the DBRC action area include numerous species of seabirds and waterfowl including harlequin duck, surf scoter, pigeon guillemot, common merganser, pied-billed grebe, western grebe, Barrow's and common goldeneye, bufflehead, American wigeon, ruddy duck, double-crested cormorant, glaucous-winged gull, and ring-billed gull. Although most of these species would not breed within the vicinity, they would forage, rest, or overwinter in the waters of Hood Canal and Dabob Bay. In addition, Hood Canal contains a number of waterfowl concentration areas where numerous individuals of a variety of species congregate, predominantly during the winter. These waterfowl areas are generally found associated with river mouths, inlets, and estuaries such as the mouth of the Hamma Hamma, Duckabush, and Little and Big Quilcene rivers. Species commonly found within these areas include brant, American wigeon, mallard, harlequin duck, northern pintail, hooded merganser, trumpeter swan, and common goldeneye (WDFW 2004b). Other bird species that are known to nest in the vicinity and forage within the waters of Hood Canal include belted kingfisher and osprey, with osprey being particularly abundant. All of the above species would forage on marine flora, invertebrates, and fish primarily within the nearshore and upper water column at depths of 1-33 ft (0.3-10 m). All are protected under the MBTA.

Bald Eagles

A total of 23 bald eagle nest territories are located within 2 mi (3 km) of the DBRC action area. Of these 23 territories, 6 are within 2 mi (3 km) of the proposed southern range extension and 2 are within 2 mi (3 km) of the proposed northern range extension (WDFW 2004b) (*Note*: *due to the sensitivity of bald eagle nest locations, a figure depicting these locations is not provided*). During the breeding season from the beginning of January to mid-August, eagles establish and maintain territories. Wintering bald eagles occur within the DBRC action area from November through March. Therefore, bald eagles are considered to be present in the area year-round.

ESA-Listed Species

The only ESA-listed terrestrial species that occurs within the DBRC action area is the threatened marbled murrelet. Most of the forest stands in the vicinity of the DBRC action area are second growth that do not provide suitable marbled murrelet nesting habitat. The WDFW has mapped only one marbled murrelet breeding area within the vicinity, approximately 3 mi (5 km) north of Quilcene Bay (WDFW 2004b). Critical habitat was originally designated in 1996 (USFWS 1996) but in 2006 revised critical habitat was proposed. Under the proposed revision, the nearest critical habitat is within the Olympic National Forest, approximately 5 mi (8 km) to the west of the DBRC action area (USFWS 2006).

Surveys conducted in the fall of 1995 and 1996 found up to 438 murrelets south of the Hood Canal Bridge. Distribution of birds varied throughout the season and most marbled murrelets were observed within 1,640 ft (500 m) of shore (Sustainable Ecosystems Institute 1996, 1997). Summer surveys in 1995 found a small population of 8-11 individuals in Dabob Bay that were believed to be breeding birds. Murrelets elsewhere in Hood Canal are possibly non-breeders or immigrants. In fall, murrelets enter Quilcene Bay and other protected waters (Sustainable Ecosystems Institute 1996). Based on annual USFS surveys for marbled murrelets, the estimated density within the survey area containing northern Hood Canal and the DBRC action area (Stratum 2 of Conservation Zone 1, which also includes waters around the San Juan Islands and between Whidbey and Camano islands) was approximately 2.1 birds/mi^2 (0.8 birds/km^2) during the 2003 breeding season (Miller et al. 2006).

Other Wildlife

River otters, which are not considered marine mammals under MMPA (Section 3.5), are also common along the shoreline of the DBRC action area (see description under Keyport). River otters are relatively common statewide in Washington and are found in ponds, lakes, rivers, sloughs, estuaries, bays, and in open waters along the coast. River otters are opportunists, eating a wide variety of food items, but mostly fish such as carp, mud minnows, stickle backs, and suckers (WDFW 2005a).

3.1.3.2 Environmental Consequences

DBRC Site Alternative 1 (Southern Extension Only)

Migratory Birds

Acoustic Impacts. In general, little is known of avian hearing under water, and there have been no studies or documented effects of sonar on diving birds when submerged. As a result, there are no established thresholds for threshold shift impacts or behavioral disruption in diving birds due to underwater noise, including sonar. In the absence of direct observations or established thresholds for sonar effects on seabirds, evaluations of potential impacts from other sources of acoustic energy are further discussed below.

The seismic airguns used in geophysical exploration have overlapping sound source characteristics but probably represent a worse case than the Proposed Action based on greater sound source levels and lower frequencies (which propagate farther and overlap bird hearing to a greater extent). Observations of diving birds exposed to underwater noise from seismic testing using airguns have shown no effect on numbers or distribution, nor suggested any adverse physiological effects (Stemp 1985, Lacroix et al. 2003, Flint et al. 2003). The airguns generate a broadband impulse at low to middle frequencies (10 Hz to 3 kHz), with source levels of 225-240 dB, although the sound is directed downward and hence has a relatively narrow field. The aforementioned observational studies have supported findings that the use of airguns in geophysical surveys in the Pacific Northwest would not have significant effects on seabirds (MMS 2005, 2006). Since sonar associated with the Proposed Action has overlapping sound source characteristics within the range of avian hearing (1 to 5 kHz), extrapolation of these findings would suggest that the use of sonar as proposed would not significantly affect seabird numbers or distributions.

An evaluation of potential effects on seabirds of mid-high frequency sonar used to track the movements of gray whales found adverse effects on seabirds unlikely based on the following (NMFS 2003):

- There is no evidence seabirds use underwater sound.
- Seabirds spend a small fraction of time submerged.
- Seabirds could rapidly fly away from the area and disperse to other areas if disturbed.

This evaluation (NMFS 2003) is applicable to current and proposed activities because the acoustic sources evaluated overlap the frequencies and sound pressure levels of the Proposed Action and No-Action Alternative. The Proposed Action involves no appreciable change in RDT&E and other NUWC Keyport managed activities compared to current baseline activities in the DBRC Range Site. Based on the foregoing, the use of sonar as proposed would not negatively impact seabird numbers or distribution.

Non-Acoustic Impacts. Potential non-acoustic impacts to migratory birds could result from the following project-related activities:

- Surface vessel movements. Vessel movements have some potential to affect bird movements and foraging, to the extent that birds may avoid or leave the area of vessel activity. The risk of collisions between project vessels and migratory birds is considered negligible given the mobility of the animals and the generally slow-moving, conspicuous nature of the vessels engaged in RDT&E or training activities.
- Aircraft operations. Bird-aircraft collisions and disturbance of migratory birds by overflights are possible.
- Use of expendable materials. Expendable materials would briefly affect relatively small areas of surface water habitat for migratory birds. Once the materials sink, there would be no risk of entanglement or ingestion.

The proposed DBRC Site southern range extension area currently experiences regular fishing, recreational, and commercial boat traffic associated with communities along Hood Canal. In addition, the number of proposed annual activities within the DBRC Site and the proposed southern range extension would not change from the current estimated annual activities occurring within the existing DBRC Site and there would be no increase in the number of surface support vessels (Tables 2-2 and 2-8). Activities within the proposed southern range extension would take place over a larger area but impacts to wildlife would continue to be the same as those from current activities within the existing DBRC Site, which were found to have no significant impact on terrestrial flora and fauna in a previous EA resulting in a FONSI (Navy 2002a). This conclusion was based on the absence of new land disturbance or modification to existing facilities and their uses, plus the implementation of *Range Operating Policies and Procedures Manual* (ROP) flight rules establishing minimum altitudes for the flyover of sensitive habitats.

Agness (2006) provided a thorough, critical review of peer-reviewed publications on effects of boating activity on water birds. Behavioral responses to vessels were species-specific, and breeding birds tended to be less responsive to vessels than non-breeding birds. Motorized watercraft were more disturbing to birds than non-motorized vessels. Airboats, jet skis, and personal watercraft were especially likely to cause disturbance; this was attributed to their greater wake spray, high speed, and engine noise. Flight, which is energetically costly, was a frequently observed behavioral response. Bird densities were negatively associated with vessel activity in some but not all studies.

The activities associated with the Proposed Action involve relatively slow-moving vessels engaged in RDT&E, which the above evidence indicates have a low likelihood of causing disturbance. The above evidence suggests that temporary behavioral responses - diving or flying in response to the vessel's presence – might occur, but that these are not likely to have persistent effects on the use of foraging habitat, and that the birds may compensate for energetic costs by increased foraging.

Migratory birds utilize the waters of the DBRC Site to forage during wintering and migratory movements. The proposed DBRC Site southern range extension would not be expected to increase effects to migratory bird populations as compared to the existing conditions in the No-Action Alternative. Continued implementation of the ROP flight rules in Table 2-11 would minimize the effects of aerial activities on migratory birds. With implementation of the ROP flight rules in Table 2-11, there would be no impacts to birds from aircraft conducting launch, retrieval, and surveillance activities associated with the proposed NUWC Keyport activities within the proposed DBRC range extension. Few, if any, bird strikes by aircraft and associated bird mortalities or injuries are expected to occur. For example, from 2002 through 2004 only five known bird strikes involving vessel-based aircraft occurred Navy-wide. One percent of the Navy-wide wildlife strike events from for 2002 through 2004 involved seabirds (Navy Safety Center 2004). Based on this data, the odds of a bird strike are very low and consequences to any bird population would be negligible.

The ROP flight rules establish protection relevant to conventional military aircraft. With respect to UAS operations, UAS aircraft are small, quiet, and do not have the same potential to disturb wildlife. Reactions, if any, of wildlife to the presence of a UAS aircraft are expected to be momentary and inconsequential in terms of energetics or potential harm to the individuals, with no effects on individuals or populations. The temporal and spatial variability of proposed RDT&E and other NUWC Keyport managed activities, in combination with temporal and seasonal distributions of seabird species, minimizes the potential for effects. The overall populations of migratory birds and their habitat would not be negatively affected by activities within the proposed DBRC Site southern range extension. Since the proposed activities at the DBRC Site qualify as military readiness activities, and they would not adversely affect the population of a migratory bird species, they are exempt from the take prohibitions of the MBTA.

Bald Eagles

As for the Keyport Range site, the presence of bald eagle nesting territories within the action area suggests bald eagles' tolerance of civilian and military vessel traffic, such that Navy vessels used during proposed activities would not be expected to disturb (as defined under the Eagle Act at 50 CFR 22.3), adversely affect, or result in any takes of bald eagles. Therefore, there would be no significant impacts to bald eagles with implementation of Alternative 1 within the DBRC Site and the proposed southern range extension.

ESA-Listed Species

The number of proposed annual activities within the DBRC Site and the proposed southern range extension would not change from the current estimated annual activities occurring within the existing DBRC Site (Tables 2-2 and 2-8). Activities within the proposed southern range extension would take place over a larger area but impacts to ESA-listed species would continue to be the same as those from current activities within the existing DBRC Site. A previous EA resulting in a FONSI and Biological Assessment (BA) covering current activities within the existing DBRC Site concluded no significant impacts or effects, respectively, to ESA-listed species (Navy 2001b, 2002a). Continued implementation of the ROP flight rules in Table 2-11 would minimize any potential effects of aerial activities on marbled murrelets.

Acoustic Impacts. As discussed in the previous section, the use of sonar is unlikely to have a significant impact on seabird numbers and distribution in general, and this conclusion would be applicable to the marbled murrelet as well. In Washington State, concerns about the effects of underwater detonations and pile driving on diving marbled murrelets led USFWS to identify thresholds (across broadband frequencies) for potential behavioral effects on this species of 180 dB peak and 153 dB root-mean-square (WSDOT 2007). The species is presumed to be especially vulnerable to waterborne disturbance during molting, when it cannot fly. This is based on the assumption that the birds' hearing and responses to sound would be the same under water as on land, which is untested. For acoustic sources within the hearing range of birds, it is unlikely that murrelets would exceed the USFWS distance threshold for injury, which would be within a few meters to tens of meters of the source, using reasonable assumptions about sound propagation under water (Appendix C). The presence of marbled murrelets within the USFWS distance threshold for behavioral effects (153 dB root-mean-square), which would be on the order of 100s of meters, can reasonably be anticipated. Therefore, this alternative may affect, but is not likely to adversely affect, the marbled murrelet. Terms and conditions of the BO (see Section 5.4.1) would also apply to this alternative. Given the temporary, localized nature of any disturbance to individuals, the impact is considered minimal and unlikely to affect survival, reproduction, or distribution.

Non-Acoustic Impacts. A rigorous field observational study and analysis was conducted on Kittlitz's murrelet responses to boating activity in Glacier Bay, which is a prime nesting and foraging area for the species (Agness 2006; Agness et al. 2008). Some observations of marbled murrelets were tallied, and behavioral reactions of the two species, which are closely related and ecologically similar when foraging, are probably similar. The study found that high levels of boating activity were associated with temporary reductions in the density of birds, but that there was no effect (or a weak positive effect) on a daily time scale, indicating that vessel activity did not cause a persistent loss of foraging habitat, as birds returned to the area within a short time. Vessel activity did not affect group size, which is important because murrelets forage cooperatively. The proportion of individuals flying versus loafing or diving increased temporarily in the presence of vessels, but was not affected on a short-term (30 minutes before versus after) basis. Larger numbers of non-breeding birds took flight in response to larger vessels (tour boats and cruise ships). Breeding birds carrying fish dove, rather than flying in response to vessels; such dives can result in the loss of the fish for nestlings. On a daily time scale, individuals spent more time diving, i.e. there was increased foraging effort on days with higher rates of vessel traffic. Overall, faster moving vessels were more likely to affect behavior.

The energetic consequences of changes in behavior caused by vessel disturbance have been modeled but not directly measured (Agness 2006). Flight is energetically expensive, and the previous evidence suggests that murrelets may attempt to offset the cost of flight by increasing their foraging effort. Breeding birds that dive in response to vessel disturbance may consume fish that would otherwise have fed nestlings. In such cases, additional foraging effort is needed to provide a meal for the nestling.

The foregoing confirms the possibility that marbled murrelets may be affected where vessel activity overlaps their foraging areas, as was recognized to be the case with the Proposed Action. A potential behavioral effect would be considered a "take" under the ESA if it would significantly disrupt normal behavior patterns, or otherwise cause injury to the individual. The activities associated with the Proposed Action involve relatively slow-moving vessels engaged in RDT&E, which the above evidence indicates have a low likelihood of causing disturbance. The above evidence suggests that temporary behavioral responses - diving or flying in response to the vessel's presence – might occur, but that these are not likely to have persistent effects on the use of foraging habitat, and that the birds may compensate for energetic costs by increased foraging. No effect on social foraging behavior would be expected. Finally, the widely dispersed, mobile, nature of the proposed activities, coupled with their distance from marbled murrelet nesting areas, suggests that the effect, if any, would be limited to minor, temporary behavioral reactions by individuals, not a significant (consequential) disruption of foraging. This supports the conclusion that the marbled murrelet is not likely to be adversely affected by this alternative.

Other Wildlife

Acoustic Impacts. No published information on underwater hearing in river otters is available and nothing is known of the sensitivity of river otters to sonar, but a reasonable inference is that animals in close proximity to the more intense mid-frequency sound sources are likely to hear them, and may react by avoidance. Any such effects would be localized and temporary, and unlikely to affect numbers or distribution of river otters.

Non-Acoustic Impacts. It is not expected that the proposed activities within the DBRC Site would pose a risk of injury or mortality to river otters. Navy activities may result in river otters being temporarily displaced or avoiding the immediate area of activity, but such behavioral effects on individuals would be brief and very localized, and no effect on river otter habitat, distributions, or populations in the action area as a whole would be anticipated.

<u>DBRC Site Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Implementation of Alternative 2 would result in the same impacts to terrestrial wildlife, including threatened and endangered species, as previously described under Alternative 1. The type and number of activities under Alternative 2 are the same as Alternative 1. Activities under Alternative 2 would occur across a larger area (i.e., within both the northern and southern extensions) without an increase in the number of surface support vessels. Therefore, there would be minimal impacts to terrestrial wildlife. Implementation of Alternative 2 within the DBRC Site and the proposed southern and northern range extensions may affect, but is not likely to adversely affect, the ESA-listed marbled murrelet due to its presence in the action area. Any such effects on individuals would be very localized and transitory, unlikely to result in changes to survival, reproduction, or distribution. The Navy consulted with USFWS on this alternative and will implement the terms and conditions of the BO (see Section 5.4.1).

<u>No-Action Alternative</u>

Under the No-Action Alternative, current activities would continue within the existing boundaries of the DBRC Site. A previous EA resulting in a FONSI and concurrence letter from USFWS covering current activities within the existing DBRC concluded no significant impacts to terrestrial wildlife species and may affect but would not adversely affect ESA-listed terrestrial species, including the marbeled murrelet, spotted owl, and previously listed bald eagle (Navy 2001b, Navy 2002a). However, potential underwater acoustic effects on diving birds due to the types of sonar being used were not recognized as a concern at the time. Based on the foregoing considerations, the No-Action Alternative may affect, but is not likely to adversely affect, marbled murrelets. Terms and conditions of the BO (see Section 5.4.1) would also apply to this alternative. In other respects, these findings would remain applicable to implementation of the No-Action Alternative within the DBRC Site.

3.1.3.3 Mitigation Measures

The Navy will implement the measures developed through section 7 consultation and required by the USFWS BO (USFWS 2010), as listed in Section 5.4.1. Apart from these measures, because there would be minimal impacts to terrestrial wildlife from implementing the Proposed Action or alternatives, no mitigation measures would be necessary.

3.1.4 QUTR Site

3.1.4.1 Existing Conditions

Migratory Birds

All of the species discussed in this section are protected under the MBTA. Migratory birds that occur within the marine and nearshore environment of the QUTR action area during the breeding season, as seasonal migrants, or as winter residents include numerous species of seabirds and waterfowl including Pacific loon, common murre, brown pelican, sooty shearwater, tufted puffin, harlequin duck, surf scoter, pigeon guillemot, common merganser, pied-billed grebe, western grebe, Barrow's and common goldeneye, bufflehead, American wigeon, ruddy duck, double-crested cormorant, Brandt's cormorant, pelagic cormorant, parasitic jaeger, and glaucous-winged, California, Heermann's, and ring-billed gulls. All of these bird species forage on marine flora, invertebrates, or fish, primarily within the nearshore and upper water column at depths of 1-33 ft (0.3-10 m). Other bird species that are known to nest in the vicinity and forage within the nearshore waters include peregrine falcon and osprey, with the peregrine feeding on seabirds, shorebirds, and waterfowl, and the osprey feeding on fish (WDFW 2004b, 2005b, 2006a; USFWS 2005b).

Offshore rocks and islands that lie between the eastern boundary of the proposed QUTR Site range extension and the coast support a number of seabird colonies. Point Grenville rocks, the Split Rock area, Destruction Island, and other rocky islets along the coast support nesting double-crested, Brandt's, and pelagic cormorants; common murre; glaucous-winged gull; pigeon guillemot; rhinoceros auklet; and tufted puffin. In addition, peregrine falcons nest on Split Rock and on the adjacent rocky islets, and the rocky islets offshore of Point Grenville. Cape Elizabeth also supports nesting peregrine falcons (USFWS 2005b; WDFW 2005b, 2006a). There are no seabird colonies within 5 miles (8 km) of any of the proposed QUTR Site surf-zone access areas. The closest seabird colonies would be within the Quillayute Needles National Wildlife Refuge (NWR) associated with offshore rocks (e.g., Destruction Island, South Rock) east and north of the QUTR action area and north of Kalaloch (WDFW 2005b).

The habitat of all three surf-zone access areas is similar from the breaker line to inshore. At the Kalaloch surf-zone alternative, the approach from sea is a 300-ft (91-m) wide sandy beach which ends at a high bluff approximately 10 ft (3 m) high. At the Pacific Beach surf-zone alternative there are some rocky outcrops before a 500-ft (152-m) wide sand beach which ends at a high bluff approximately 90 ft (27 m) high. At the Ocean City surf-zone alternative, the beach is up to 0.3-mile (0.4 km) wide and ends inshore among low dunes. Due to the bluffs inshore of the Kalaloch and Pacific Beach surf-zone alternatives, vehicle access is limited to designated entry points along the beaches. Since there is no bluff at Ocean City, the beach is readily accessible via vehicle or on foot.

Although Washington coast beaches support a large number and diversity of resident and migrating shorebirds, due to the easy accessibility and frequent use of the proposed surf-zone access areas by the public (including use by motorized vehicles, horses, and dogs [refer to Section 3.9, *Land and Shoreline Use*]) during the day, particularly in spring, summer and fall, birds are not that prevalent along the three surf-zone alternative locations. Sanderling, willet, marbled godwit, western sandpiper, semipalmated plover, and dunlin can be expected to occur along the coast, primarily during spring and fall migration (USFWS 2005b).

Bald Eagles

Six bald eagle nest territories are located along the western coast of Washington adjacent to the QUTR action area: five are along the coast of the Quinault Indian Reservation and the sixth is between Pacific Beach and Copalis Beach; additional bald eagle nest territories are found along the coastline of Grays Harbor (WDFW 2004b, 2005b) (*Note*: *due to the sensitivity of bald eagle nest locations, a figure depicting these locations is not provided*). None of these nesting territories are within 5 mi (8 km) of any proposed surf-zone access area. Although no known winter roosts occur in the vicinity, wintering bald eagles may occur within the vicinity of the proposed surf-zone access areas from November through March (USFWS 1999b, c).

ESA-Listed Species

Two ESA-listed threatened species occur within or in the vicinity of the QUTR action area: marbled murrelet and snowy plover.

Marbled Murrelet

The northern part of the outer coast of Washington is heavily used by marbled murrelets during the breeding season. Birds generally disperse and are less concentrated in nearshore coastal waters during the non-breeding season. Their preferred marine habitat includes sheltered, nearshore waters within 3 mi (5 km) of shore but will occur further offshore during the non-breeding season. The southern portion of the coast may play an important role as wintering areas (Nelson et al. 2006). Based on annual USFS surveys for marbled murrelets, the estimated density within the survey area containing the QUTR action area (Strata 1 and 2 of Conservation Zone 2, which extends along the entire Washington coast in nearshore waters within 5 mi (8 km) of shore from the Columbia River to Cape Flattery) was approximately 5.2 birds/mi^2 (2.0 birds/km^2) during the 2003 breeding season (Miller et al. 2006). Although critical habitat has been proposed (USFWS 2006), none is within the QUTR action area.

Snowy Plover

The snowy plover is a small shorebird that breeds primarily above the high-tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, and salt pans within lagoons and estuaries from southern Washington to southern Baja California. Snowy plovers do not build a nest but lay their eggs in a scrape in the sand. The breeding season is usually from the beginning of March through September. During winter, they are found along the same beaches they used for nesting as well as beaches where they do not nest and on estuarine sand and mud flats. Snowy plovers feed primarily on small invertebrates in wet or dry beaches, tide-cast kelp, and low foredune vegetation (USFWS 2007b).

In Washington, snowy plovers formerly nested at only five locations: Copalis Spit, north of Copalis Beach; Westport; Leadbetter Point, in Willapa Bay; Damon Point, in Grays Harbor; and Midway Beach, south of Westport. Since 1993, they had nested at only Leadbetter Point, Damon Point, Midway Beach, and Graveyard Spit, a site discovered in 2006 (USFWS 2007b). The closest nesting location to any of the surf zone alternatives is Damon Point, which is also designated critical habitat for the species (USFWS 2005c), and is approximately 8 mi (13 km) south of the Ocean City surf-zone alternative.

During the breeding seasons from 2000-2005, fewer than 90 plovers have been found during standardized surveys along the Washington coast (USFWS 2007b). WDFW records indicate two juvenile snowy plovers were observed in August 2001 south of Copalis Beach (WDFW 2005b). Wintering plovers, which may number less than 60 birds, are known to occur only at Midway Beach and Leadbetter Point, 13 mi (21 km) and 60 mi (96 km), respectively, south of Pacific Beach (USFWS 2007b). Based on a literature search snowy plovers are not expected to be present at any of the surf zone alternatives.

Other Wildlife

Other wildlife occurring along the outer coast of Washington are described in the OCNMS EIS (NOAA 1993).

3.1.4.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Migratory Birds

Acoustic Impacts. In general, little is known of avian hearing under water, and there have been no studies or documented effects of sonar on diving birds when submerged. As a result, there are no established thresholds for threshold shift impacts or behavioral disruption in diving birds due to underwater noise, including sonar. In the absence of direct observations or established thresholds for sonar effects on seabirds, evaluations of potential impacts from other sources of acoustic energy are further discussed below.

The seismic airguns used in geophysical exploration have overlapping sound source characteristics but probably represent a worse case than the Proposed Action based on greater sound source levels and lower frequencies (which propagate farther and overlap bird hearing to a greater extent). Observations of diving birds exposed to underwater noise from seismic testing using airguns have shown no effect on numbers or distribution, nor suggested any adverse physiological effects (Stemp 1985, Lacroix et al. 2003, Flint et al. 2003). The airguns generate a broadband impulse at low to middle frequencies (10 Hz to 3 kHz), with source levels of 225-240 dB, although the sound is directed downward and hence has a relatively narrow field. The aforementioned observational studies have supported findings that the use of airguns in geophysical surveys in the Pacific Northwest would not have significant effects on seabirds (MMS 2005, 2006). Since sonar associated with the Proposed Action has overlapping sound source characteristics within the range of avian hearing (1 to 5 kHz), extrapolation of these findings would suggest that the use of sonar as proposed would not significantly affect migratory bird numbers or distributions.

An evaluation of potential effects on seabirds of mid-high frequency sonar used to track the movements of gray whales found adverse effects on seabirds unlikely based on the following (NMFS 2003):

- There is no evidence seabirds use underwater sound.
- Seabirds spend a small fraction of time submerged.
- Seabirds could rapidly fly away from the area and disperse to other areas if disturbed.

This evaluation (NMFS 2003) is applicable to current and proposed activities because the acoustic sources evaluated overlap the frequencies and sound pressure levels of the Proposed Action and No-Action Alternative. The Proposed Action involves no appreciable change in RDT&E and other NUWC Keyport managed activities compared to current baseline activities in the QUTR action area. Based on the foregoing, the use of sonar as proposed would not negatively impact seabird numbers or distribution.

Non-Acoustic Impacts. Potential non-acoustic impacts to migratory birds could result from the following project-related activities:

- Surface vessel movements. Vessel movements have some potential to affect bird movements and foraging, to the extent that birds may avoid or leave the area of vessel activity. The risk of collisions between project vessels and migratory birds is considered negligible given the mobility of the animals and generally slow-moving, conspicuous nature of the vessels engaged in RDT&E or training activities.

- Aircraft operations. Bird-aircraft collisions and disturbance of migratory birds by overflights are possible.
- Use of expendable materials. Expendable materials would briefly affect relatively small areas of surface water habitat for migratory birds. Once the materials sink, there would be no risk of entanglement or ingestion.

Migratory seabirds utilize the offshore waters to forage during wintering and migratory movements. The proposed Kalaloch surf-zone access area would be used approximately 30 days per year and is not near any known seabird breeding colony or other sensitive terrestrial wildlife breeding or feeding area. The proposed QUTR Site range extension area currently experiences regular fishing, recreational, commercial boat traffic, and other Navy activities. Under Alternative 1, Navy activities within the proposed QUTR Site extension would increase from 14 days/year to 16 days/year for offshore activities, an increase of only 2 days per year involving test vehicles and there would be no increase in the number of surface support vessels (Tables 2-2 and 2-9). Besides activities in the surf-zone access area, NUWC Keyport activities within the proposed QUTR Site range extension would occur more than 5 mi (8 km) from shore, beyond the usual nearshore foraging areas of seabirds and other terrestrial wildlife, including the bald eagle and the ESA-listed marbled murrelet.

With implementation of the ROP flight rules in Table 2-11, there would be no impacts to migratory birds from aircraft conducting launch, retrieval, and surveillance activities associated with the proposed NUWC Keyport activities within the proposed QUTR range extension. Few, if any, bird strikes by aircraft and associated bird mortalities or injuries are expected to occur. For example, from 2002 through 2004 only five known bird strikes involving vessel-based aircraft occurred Navy-wide. One percent of the Navy-wide wildlife strike events from for 2002 through 2004 involved seabirds (Navy Safety Center 2004). Based on this data, the odds of a bird strike is very low and consequences to any bird population would be negligible. Therefore, with implementation of Alternative 1 within the QUTR Site, proposed range extension, and associated Kalaloch surf-zone access area, there would be minimal impacts to terrestrial wildlife and birds within Territorial Waters (less than or equal to 12 nm [22.2 km] from shore) and non-Territorial Waters (greater than 12 nm [22.2 km] from shore).

The ROP flight rules establish protection relevant to conventional military aircraft. With respect to UAS operations, UAS aircraft are small, quiet, and do not have the same potential to disturb wildlife. Reactions, if any, of wildlife to the presence of a UAS aircraft are expected to be momentary and inconsequential in terms of energetics or potential harm to the individuals, with no effects on individuals or populations. The proposed activities in the QUTR Site would not be expected to affect the numbers or distributions of migratory bird populations. The temporal and spatial variability of RDT&E and other NUWC Keyport managed activities, in combination with temporal and seasonal distributions of seabird species minimizes the potential for effects. The overall populations of migratory birds and their habitat would not be negatively affected by activities within the proposed QUTR Site. Since the proposed activities at the QUTR Site qualify as military readiness activities, and they would not adversely affect the population of a migratory bird species, they are exempt from the take prohibitions of the MBTA.

Bald Eagles

Based on the distance of proposed activities from bald eagle nests and the relatively small areas and brief durations of surf-zone activities, the proposed activities would not be expected to disturb (as defined under the Eagle Act at 50 CFR 22.3), adversely affect, or result in any takes of bald eagles.

ESA-Listed Species

The snowy plover does not occur in the action area, so there would be no effect on this species and no consultation was required. As discussed for the Keyport and DBRC range sites (refer to previous sections), the marbled murrelet may be affected as the proposed range extension overlaps areas where the species is likely to forage and thus could be present in the area of proposed activities. However, due to the relatively small areas subject to use and the brief duration of activities, no impact on murrelet survival or reproduction is anticipated. Therefore, the Navy has concluded that the action may affect, but is not likely to adversely affect, the marbled murrelet. Terms and conditions of the BO (see Section 5.4.1) would also apply to this alternative.

Other Wildlife

Interactions with other types of terrestrial wildlife would be minimal and insignificant because of the confinement of activities to the surf zone and offshore waters.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of QUTR Alternative 2 would result in the same impacts to terrestrial wildlife within Territorial Waters and non-Territorial Waters as previously described under QUTR Alternative 1. Under Alternative 2, Navy activities within the proposed QUTR Site extension would increase from 14 days/year to 16 days/year for offshore activities, an increase of only 2 days per year involving test vehicles and there would be no increase in the number of surface support vessels (Tables 2-2 and 2-9). NUWC Keyport activities within the proposed QUTR Site range extension would occur more than 5 mi (8 km) from shore, beyond the usual nearshore foraging areas of seabirds and other terrestrial wildlife, including the bald eagle and the ESA-listed marbled murrelet. The proposed Pacific Beach surf-zone access area would be used approximately 30 days per year and is not near any known seabird breeding colony or other sensitive terrestrial wildlife breeding or feeding area. With implementation of the ROP flight rules in Table 2-11, there would be minimal impacts to terrestrial wildlife from aircraft conducting launch, retrieval, and surveillance activities associated with the proposed NUWC Keyport activities within the proposed QUTR range extension. Therefore, with implementation of Alternative 2 within the QUTR Site, proposed range extension, and associated Pacific Beach surf-zone access area, there would be minimal impacts to terrestrial wildlife and birds within Territorial Waters and non-Territorial Waters. Proposed activities would not be expected to disturb (as defined under the Eagle Act at 50 CFR 22.3), adversely affect, or result in any takes of bald eagles.

Migratory seabirds utilize the offshore waters to forage during wintering and migratory movements. The proposed activities in the QUTR Site would not be expected to increase effects to migratory bird populations over the existing conditions in the No-Action Alternative. The temporal and spatial variability of RDT&E and other NUWC Keyport range activities, in combination with temporal and seasonal distributions of seabird species, minimizes the potential for effects. The overall populations of migratory birds and their habitat would not be negatively affected by activities within the proposed QUTR Site.

ESA-Listed Species

The snowy plover does not occur in the action area, so there would be no effect on this species and no consultation was required. The marbled murrelet may be affected as the proposed range extension overlaps areas where the species is likely to forage and thus could be present in the area of proposed activities. However, due to the relatively small areas subject to use and the brief duration of activities, no impact on murrelet survival or reproduction is anticipated. Therefore, the Navy has concluded that the action may affect, but is not likely to adversely affect, the marbled murrelet. The Navy consulted with USFWS on this alternative and will implement the required terms and conditions of the BO (see Section 5.4.1).

<u>QUTR Alternative 3 (Ocean City Surf Zone Access Area)</u>

Implementation of QUTR Alternative 3 would result in the same impacts to terrestrial wildlife within Territorial Waters and non-Territorial Waters as previously described under QUTR Alternative 1. Under Alternative 3, Navy activities within the proposed QUTR Site extension would increase from 14 days/year to 16 days/year for offshore activities, an increase of only 2 days per year involving test vehicles and there would be no increase in the number of surface support vessels (Tables 2-2 and 2-9). NUWC Keyport activities within the proposed QUTR Site range extension would occur more than 5 mi (8 km) from shore, beyond the usual nearshore foraging areas of seabirds and other terrestrial wildlife, including the bald eagle and the ESA-listed marbled murrelet. The proposed Ocean City surf-zone access area would be used approximately 30 days per year and is not near any known seabird breeding colony or other sensitive terrestrial wildlife breeding or feeding area. With implementation of the ROP flight rules in Table 2-11, there would be minimal impacts to terrestrial wildlife from aircraft conducting launch, retrieval, and surveillance activities associated with the proposed NUWC Keyport activities within the proposed QUTR range extension. Therefore, with implementation of Alternative 3 within the QUTR Site, proposed range extension, and associated Ocean City surf-zone access area, there would be minimal impacts to terrestrial wildlife and birds within Territorial and non-Territorial Waters. Proposed activities would not be expected to disturb (as defined under the Eagle Act at 50 CFR 22.3), adversely affect, or result in any takes of bald eagles.

Migratory seabirds utilize the offshore waters to forage during wintering and migratory movements. The proposed activities in the QUTR Site would not be expected to increase effects to migratory bird populations. The temporal and spatial variability of proposed RDT&E and other NUWC Keyport range activities, in combination with temporal and seasonal distributions of seabird species, minimizes the potential for effects. The overall populations of migratory birds and their habitat would not be negatively affected by activities within the proposed QUTR Site.

ESA-Listed Species

The snowy plover does not occur in the action area, so there would be no effect on this species and no consultation was required. The marbled murrelet may be affected as the proposed range extension overlaps areas where the species is likely to forage and thus could be present in the area of proposed activities. However, due to the relatively small areas subject to use and the brief duration of activities, no impact on murrelet survival or reproduction is anticipated. Therefore, the Navy has concluded that the action may affect, but is not likely to adversely affect, the marbled murrelet. Terms and conditions of the BO (see Section 5.4.1) would also apply to this alternative.

No-Action Alternative

Under the No-Action Alternative, current activities would continue within the existing boundaries of the QUTR Site and NUWC Keyport would maintain the Kalaloch facility and associated cabling and instrumentation. The annual number of NUWC Keyport activities would not increase and activities within the proposed surf-zone access areas would not occur. Alternative 1 is inclusive of the analysis for the existing activities. Since there are minimal impacts under any of the action alternatives with implementation of the proposed range extension, and the No-Action Alternative has fewer activities within a smaller geographic area, there would be minimal impacts to terrestrial wildlife and no effects to threatened and endangered species within the existing QUTR Site for both Territorial Waters and non-Territorial Waters with implementation of the No-Action Alternative.

3.1.4.3 Mitigation Measures

The Navy will implement the measures developed through section 7 consultation and required by the USFWS BO (USFWS 2010), as listed in Section 5.4.1. Because there would be minimal impacts to terrestrial wildlife from implementing the Proposed Action or alternatives, no mitigation measures would be necessary.

3.2 Marine Flora and Invertebrates

This section describes the existing condition of marine flora and invertebrates that might be affected by the proposed range extensions and associated Navy activities that would occur within each range site. As defined for all biological resources analyses in this EIS/OEIS, the "action area" for each range site includes the existing range site plus the area of the proposed range extension. No ESA-listed species or critical habitat for marine flora or invertebrates occur within the vicinity of the Keyport, DBRC, or QUTR action areas. For the purposes of this EIS/OEIS, references to substrate types and sea floor conditions for all three range sites use the common term 'mud' rather than 'silty clay' or other more specific terms. Where relevant to the underlying analysis, however, appropriate distinctions regarding substrate components have been made.

3.2.1 Acoustic Capabilities of Marine Invertebrates

There has been very limited research done on the hearing capabilities of marine invertebrates. Experiments have been conducted using electro-mechanically produced sound to see if an invertebrate responds (Breithaupt 2002). Scientific research suggests that invertebrates hear or sense sound because of their observed reactions to acoustic sources. Marine invertebrates can sense the vibrations that are produced from underwater sounds, causing them to react (i.e., hydrodynamic stimulation) (Popper and Fay 1999; Breithaupt 2002).

More research has been conducted on acoustic detection by decapods (e.g., shrimps, crabs, lobsters) than for any other marine invertebrate group. Typically, decapods have an extensive array of external hair-like receptors upon their body surface that could potentially respond to water- or substrate-borne movement. These external hairs may be tuned to different frequencies by virtue of their lengths (Tautz and Sandeman 1980). In addition, decapods are also equipped with an abundance of internal mechanoreceptors (chordotonal organs associated with joints of antennae, legs and other appendages) (Hawkins and Myrberg 1983). Mechanoreceptors are organs that can sense pressure, movement, and tension. The chordotonal organs are capable of responding to low frequency water-borne vibrations. For example, the fiddler crab uses chordotonal organs to sense movement, which aid in the capture of prey. Shrimp use mechanoreceptors to sense the sounds of nets from shrimp trawlers. The fiddler crab and spiny lobster can sense sounds and react based on the type of vibrations they sense (Budelmann 1992).

The most extensive studies on decapod crustacean sound detection have been conducted on crayfish and lobsters. Research results indicate that lobsters and crayfish respond primarily to hydrodynamic stimulation. Response to sound stimuli appears to be in reaction to particle movement rather than pressure (Tautz and Sandeman 1980; Goodall et al. 1990). Shrimp and lobsters appear to be more sensitive to sounds at lower frequencies (less than 1 kHz) (Budelmann 1992; Popper et al. 2001). Heinisch and Wiese (1987) investigated the sensitivity of North Sea shrimp to movement and vibration of water and found that their maximum sensitivity was at 170 Hz.

It is likely that cephalopods (e.g., octopi, squid) also use statocysts to detect low-frequency aquatic vibrations (Packard et al. 1990; Budelmann and Williamson 1994; Popper 2008 [Appendix B]).

Of the marine invertebrates, only decapods and cephalopods are known to sense only low-frequency sound (less than 1 kHz) and generally less than 100-200 Hz. The only proposed acoustic sources at this low of a frequency would be systems like the target simulator (100 Hz – 10 kHz at an estimated source level of 170 dB re 1 μPa @ 1 m). The thresholds for sound sensitivity of cephalopods and lobsters are estimated to be 146 dB and 150 dB, respectively (Offutt 1970; Budelmann and Williamson 1994). Given these thresholds, the target simulator could only have a potential impact on these animals if they are very close to the acoustic source. The probability of an individual cephalopod or decapod that could possibly be found close to the target simulator would be small. Therefore, because of their poor sound sensing and the negligible number that could be affected by the proposed acoustic sources within the range sites, potential acoustic impacts to marine invertebrates are not addressed further in this EIS/OEIS.

3.2.2 Keyport Range Site

3.2.2.1 Existing Conditions

Marine Flora

Marine flora consist of floating algae (phytoplankton) and attached plants which include both algae and vascular plants such as eelgrass. As described by Gustafson et al. (2000), phytoplankton productivity in the open waters of the central basin of Puget Sound is dominated by intense blooms of microalgae beginning in late April or May and recurring through the summer. Annual primary productivity in the central basin of the Sound is about 465 grams of carbon per square meter. This high productivity is due to intensive upward transport of nitrate by the estuarine mechanism and tidal mixing.

Substrates for attached plants in the Keyport action area consists of riprap along the shorelines of Port Orchard Reach as well as tide flats, marshes, and a shallow lagoon. The subtidal and intertidal habitat in and around the action area consists mostly of sand with a little mixed mud, clay, and wood substrates (Navy 2003b). The subtidal and intertidal areas of the Keyport action area are dominated by brown and green algae as well as eelgrass beds. Figure 3.2-1 shows the linear distribution of kelp along the shoreline in the Keyport action area. Kelp has a patchy distribution along Port Orchard Reach, Port Madison Reservation (Suquamish Tribe), Agate Passage, and Liberty Bay (Figure 3.2-1) (WDNR 2001). A few areas of continuous distribution are found along the Port Madison Reservation and Agate Passage (WDNR 2001). Kelp generally occurs where solid substrate is present in the lower intertidal and subtidal zones to a depth of approximately 66 feet (20 m), depending on light levels (Mumford 2007).

Eelgrass beds occur in continuous beds on the Port Madison reservation across the channel from the NUWC Keyport facility site but have a patchy distribution along the western shoreline (WDNR 2001). Figure 3.2-1 shows the linear distribution of eelgrass along the shoreline in the Keyport action area. Eelgrass grows in the muddy or sandy substrate of the shallow subtidal zone, down to a depth of approximately 22 ft (7 m), and forms a complex and highly productive ecosystem that is an important component of nearshore habitat in estuaries and bays throughout Puget Sound. Eelgrass meadows are biologically rich habitats, sheltering a diverse group of fish and invertebrate species that are dependent on eelgrass beds for food resources and cover (Phillips 1984). Gammarid amphipods are dependent on ingesting eelgrass particles for their growth and development and are preferred prey items of juvenile salmon. Epibenthic harpacticoid copepods are an important food resource for juvenile chum salmon and were reported to be four times more prevalent in a stand of eelgrass compared to a neighboring habitat without eelgrass (Simenstad and Kenney 1978). Pacific herring, another commercially important species, utilize eelgrass beds as a spawning substratum to deposit their eggs and as a nursery ground for young herring. Apart from Pacific herring and juvenile salmon, numerous other commercially and non-commercially important fish are associated with eelgrass meadows. In addition to supporting fish fishery resources, eelgrass beds also support many invertebrate fishery resources like clams, oysters, shrimps, crabs, etc.

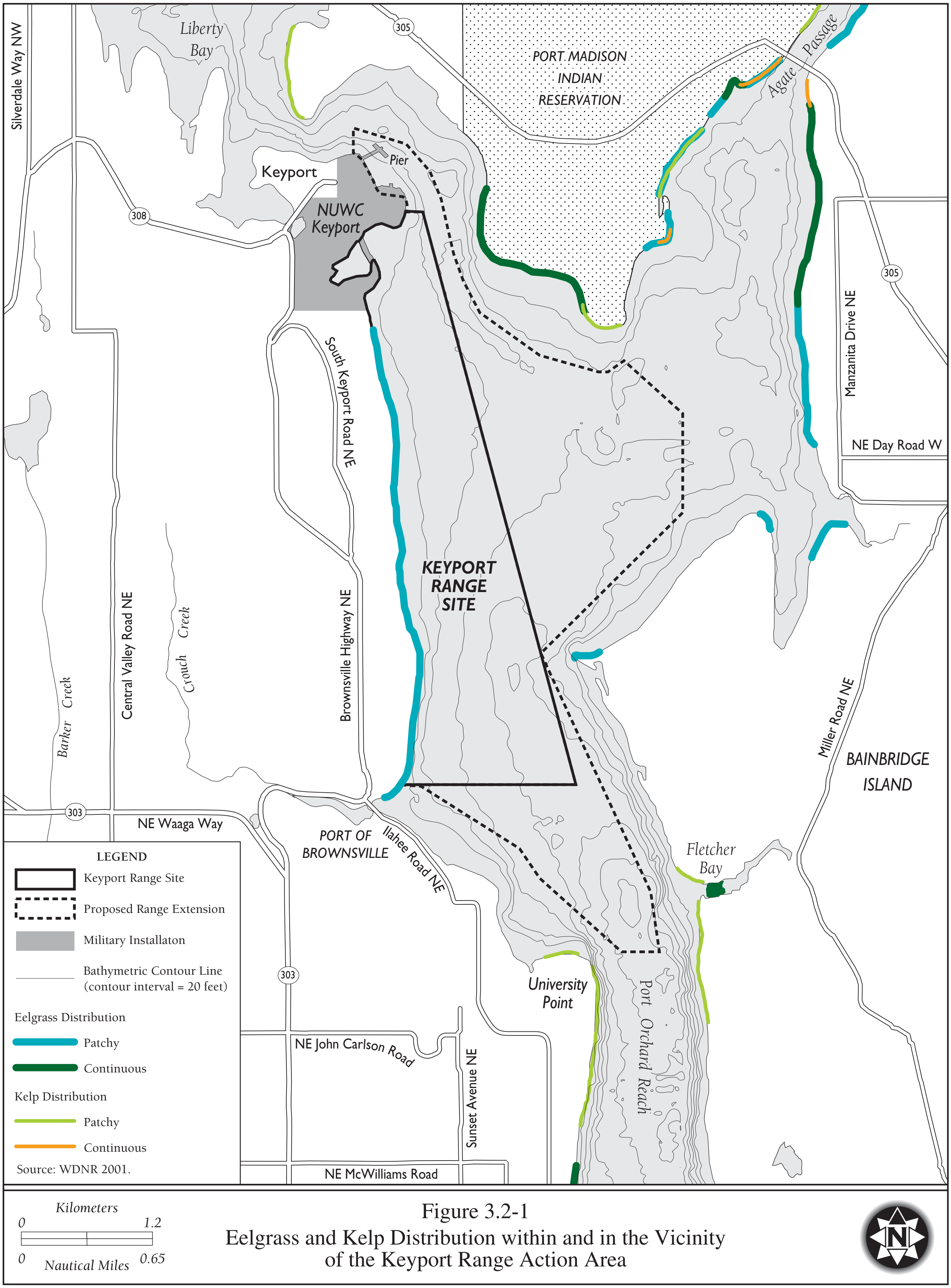


Figure 3.2-1
Eelgrass and Kelp Distribution within and in the Vicinity of the Keyport Range Action Area

Marine Invertebrates

Pelagic Invertebrates. Pelagic habitat comprises the water column and is defined by the depth to which light can penetrate, or the photic zone, allowing photosynthesis to occur with existing marine flora. Depth of this layer varies seasonally and locally, generally ranging to depths of 66 to 262 ft (20 to 80 m) (NOAA 1993). Light, temperature, and nutrients all determine the occurrence and succession of zooplankton species (Gustafson et al. 2000). Zooplankton exhibit daily vertical migration patterns and will go deeper than the photic zone. However, during the high phytoplankton production months of spring and summer, zooplankton tend to stay near their food source.

Zooplankton such as ciliates, copepods, euphausiids, and pelagic tunicates as well as larval stages of crabs, worms, mollusks, and barnacles occur in the pelagic habitat of the Keyport action area. The most dominant zooplankton species in Puget Sound are calanoid copepods as well as cnidarians and polychaetes that thrive throughout the year (Gustafson et al. 2000). Amphipods in particular are abundant in the action area through Port Orchard Reach and serve as a major food source for juvenile fish rearing in the nearshore areas (Grosse et al. 1986).

Subtidal Benthic Invertebrates. Subtidal benthic or bottom habitat is defined as depths not uncovered by the tides (i.e., below the level of the extreme-low-spring tide at a given location). The most abundant (in terms of biomass) bivalve in the subtidal benthic habitat is the Pacific geoduck. Geoducks occur in soft bottom habitat from the intertidal zone to the deep subtidal zone. In Puget Sound they have been found as deep as 360 ft (110 m), but occur in the Keyport action area at -18 to -70 ft (-6 to -21 m) (Figure 3.2-2). Although a highly productive and popular fishery, geoduck associated with eelgrass beds are not harvested out to a 2-ft (1-m) buffer zone around rooted eelgrass to protect the eelgrass beds (Bradbury et al. 2000).

Other marine invertebrate species utilizing the sand/mud habitat in and around the Keyport action area include cockles and horse mussel. Other bivalves found in the area include numerous species of hardshell clams such as piddocks, littleneck clam, butter clam, and horse clam (WDFW 2004b; Figure 3.2-2). Dungeness crab occurs throughout Puget Sound, both intertidally and subtidally on a variety of substrates; juveniles and subadults are often associated with eelgrass (Fisher and Velasquez 2008; Figure 3.2-2).

Intertidal Benthic Invertebrates. In addition to their utilization of subtidal habitat, clams and cockles inhabit the intertidal areas within the vicinity of the Keyport action area. Other invertebrates found in the intertidal and subtidal areas include shrimp, tunicates, crab, barnacles, sun star, sea cucumber, and sea anemones (Navy 2003b; WDFW 2004b). Clams and cockles as well as crab, oyster, sea anemones, and barnacles are most associated with a hard substrate bottom. Sea anemones and barnacles adhere to rocks and other hard structures found in the intertidal areas.

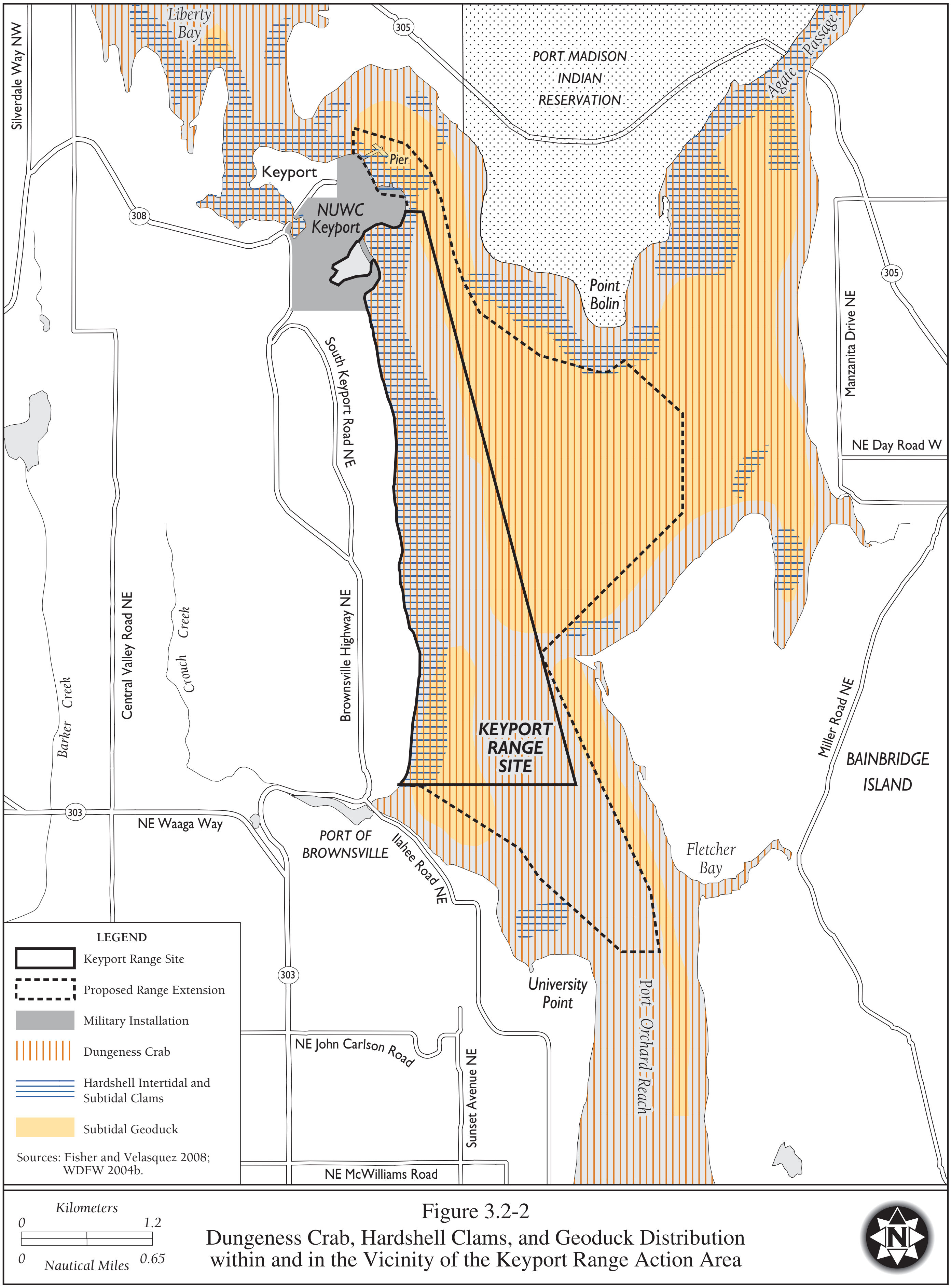


Figure 3.2-2
Dungeness Crab, Hardshell Clams, and Geoduck Distribution within and in the Vicinity of the Keyport Range Action Area

3.2.2.2 Environmental Consequences

Keyport Range Alternative 1 – Preferred Alternative

Marine Flora. Based on analytical studies of the same activities in the marine environment (i.e., DBRC Site), previous Navy activities have not resulted in elevated sediment or water concentrations of metals relative to background levels at other locations, which might indirectly affect marine flora (Navy 2002a, ESG 2005; refer to Section 3.6 for a more detailed discussion of water quality impacts). In addition, the potential impacts from accidental spills of petroleum products and other harmful fluids from test components or support vessels during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1).

Although marine flora could be affected by the deposition of expendable materials, the annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 76 losses of expendable materials per year over a 3.2-nm^2 (11.0-km^2) area, which represents approximately 24 expendables lost per nm^2 or 0.03 per acre. Because activities would occur in different areas of the Keyport Range, it is reasonable to assume that the expended materials would be randomly distributed within the range, and would not significantly impact marine flora distribution or abundance.

Marine flora could also be affected by activities involving placement or movement of items on the bottom (e.g., anchors, targets, crawler UUVs) or recovery activities. However, these effects would be short term, would affect a very small portion of the area, and would not result in long-term changes in the distribution or abundance of these populations. When recovery occurs it usually lasts less than a day and is localized within the area where the item being recovered is located. Given that the size of the disturbed area would be small (several yards at most) and placement and recovery activities would be short term and infrequent, impacts would be minimal. In addition, the disturbed area would likely be re-colonized within a relatively short time as the disturbed sediments would not be removed, but rather re-distributed in the same location. Therefore, there would be minimal impacts to marine flora with the implementation of Alternative 1 within the Keyport Range action area.

Marine Invertebrates. Benthic invertebrates could be affected by the deposition of expendable materials. However, as described above, the annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 76 losses of expendable materials per year over a 3.2-nm^2 (11.0-km^2) area, which represents approximately 24 expendables lost per nm^2 or 0.03 per acre. Because activities would occur in different areas of the Keyport Range, it is reasonable to assume that the expended materials would be randomly distributed within the range, and would not significantly impact marine invertebrate distribution or abundance.

Benthic invertebrates could also be affected by activities involving placement or movement of items on the bottom (e.g., anchors, targets, crawler UUVs) or recovery activities. However, these effects would be short term, would affect a very small portion of the area, and would not result in long-term changes in the distribution or abundance of these populations. When recovery occurs it usually lasts less than a day and is localized within the area where the item being recovered is located. Given that the size of the disturbed area would be small (several yards at most) and placement and recovery activities would be short term and infrequent, impacts would be minimal. Many of the disturbed benthic invertebrates would likely re-bury in the sediments and/or re-colonize the affected area within a relatively short time as the disturbed sediments would not be removed, but rather re-distributed in the same location.

Hydrocarbon spills and material potentially released into the marine environment from vessels, sonobuoys, torpedoes, and range targets have the potential to impact invertebrates and their habitats. Previous analysis of the same activities at the DBRC Site concluded that in the unlikely event of a worst-case torpedo rupture, pollutants would be rapidly dispersed without significant effects on water quality or associated biota. The loss of non-recovered metallic components were also found to have insignificant effects on water quality due to the adsorption of dissolved metals to sediments (Navy 2002a; refer to Section 3.6 for a more detailed discussion of water quality impacts). The potential impacts from accidental spills of petroleum products and other harmful fluids from test components or support vessels during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1). Therefore, there would be minimal impacts to marine invertebrates with the implementation of Alternative 1 within the Keyport Range action area.

No-Action Alternative

Under the No-Action Alternative, no change in operating area or RDT&E and other NUWC Keyport managed activities would occur; the activities conducted at the Keyport Range Site would be similar to those previously analyzed in the AUV Fest EA (Navy 2003b). Impacts of these activities would be limited to temporary, small-scale disturbances of water column and benthic habitats and temporary, localized effects, if any, effects on associated flora and fauna. Current NUWC Keyport-coordinated activities would continue within the existing boundaries of the Keyport Range Site. Since Keyport Range Alternative 1 includes the entire No-Action Alternative area, the effects analysis described above for Alternative 1 would also apply to the No-Action Alternative. Since there would be minimal impacts under Alternative 1 with 60 days per year of usage within the Keyport Range Site, then there would be minimal impacts under the No-Action Alternative with 55 days of usage per year within a smaller area. Therefore, there would be minimal impacts to marine flora and invertebrates under the No-Action Alternative.

3.2.2.3 Mitigation Measures

Since there would be minimal and temporary impacts to marine flora and invertebrates with implementation of Keyport Range Alternative 1 and/or the No-Action Alternative, mitigation measures would not be necessary.

3.2.3 DBRC Site

3.2.3.1 Existing Conditions

Marine Flora

Marine flora consist of floating algae (phytoplankton) and attached plants which include both algae and vascular plants such as eelgrass. As described by Gustafson et al. (2000), phytoplankton productivity in the open waters of the central basin of Puget Sound is dominated by intense blooms of microalgae beginning in late April or May and recurring through the summer. Annual primary productivity in the central basin of the Sound is about 465 g C/m^2. This high productivity is due to intensive upward transport of nitrate by the estuarine mechanism and tidal mixing.

Representative macroalgae found within the littoral zone of Hood Canal include *Ulva*, *Enteromorpha,* and *Fucus*; *Sargassum* is also present but is absent during winter. In the subtidal zone, the flora is dominated by a host of red algal species. As with intertidal algae, kelp are poorly represented in the area and are characterized by *Laminaria saccharina*, *Agarum fimbriatum*, and *Costaria costata*. In general, there is a lack of kelp beds in Dabob Bay and southern Hood Canal. Kelp is patchily distributed along the coastline near the Hood Canal North and South MOAs. A few small areas of continuous kelp beds are found in this area as well. Figure 3.2-3 shows the linear distribution of kelp along the shoreline. In the areas where kelp is found, it generally occurs to a depth of approximately 66 feet (20 m), depending on light levels (Mumford 2007).

Eelgrass is abundant along the intertidal and subtidal areas of the entire Hood Canal arm as well as Dabob Bay (Figure 3.2-3). Sparse and patchy distribution of eelgrass occurs on the west side of Dabob Bay. Maximum depth of eelgrass beds in Hood Canal and Dabob Bay are -15 to -20 ft (-5 to -6 m) (WDNR 2001; Battelle 2002).

Marine Invertebrates

Pelagic Invertebrates. Strong upward transport of nitrates from tidal mixing along with algal blooms in April and May result in high microalgae production, which provides food for numerous species of zooplankton. The most common zooplankton species found in Hood Canal are copepods (e.g., krill). Pacific krill are abundant in Hood Canal during the spring and absent in winter (Gustafson et al. 2000).

Pacific squid inhabit the waters of Washington's coast (Neah Bay), Puget Sound, Hood Canal, and Strait of Juan de Fuca. They are fished for successfully in these areas from late spring at Neah Bay through winter in Puget Sound (Squidfish 2005). Due to low dissolved oxygen (DO) levels, the squid fishery is closed in Hood Canal (WDFW 2007).

Subtidal Benthic Invertebrates. The subtidal areas of Hood Canal consist primarily of mud with some mixed gravelly sand. The sandy habitat contains sand dollars and both Dungeness and red rock crab. White-plumed anemones can be found attached to hard substrates. Burrowers such as polychaete worms and shrimp are abundant in Dabob Bay and other areas of Hood Canal (Gustafson et al. 2000; Battelle 2002). Hardshell clams occur throughout Hood Canal in small sparse populations and geoduck are abundant throughout Hood Canal (Figure 3.2-4) (WDFW 2004b). Dungeness and red rock crab as well as shrimp are fished recreationally and also commercially and tribally harvested (Navy 2002a).

The giant Pacific octopus lives along rocky shores in tide pools and in areas from the low-tide line to depths of 1,650 ft (503 m at other sites) (National Parks Conservation Association 2006). This species, which potentially occurs within Hood Canal, is known to be highly mobile and typically spends approximately a month in any one den before moving on. Females will block up their dens with rocks making them virtually undetectable. Octopi populations fluctuate from year to year and by location (Anderson 2001). The octopus hunts predominantly at night and preys on shrimp, crabs, scallops, abalones, clams, and fish. Predators of the giant Pacific octopus include harbor seal and sea otter (Smithsonian National Zoological Park 2006). Dive surveys conducted in 2001 and 2002 recorded 15 and 70 octopi, respectively, in Puget Sound.

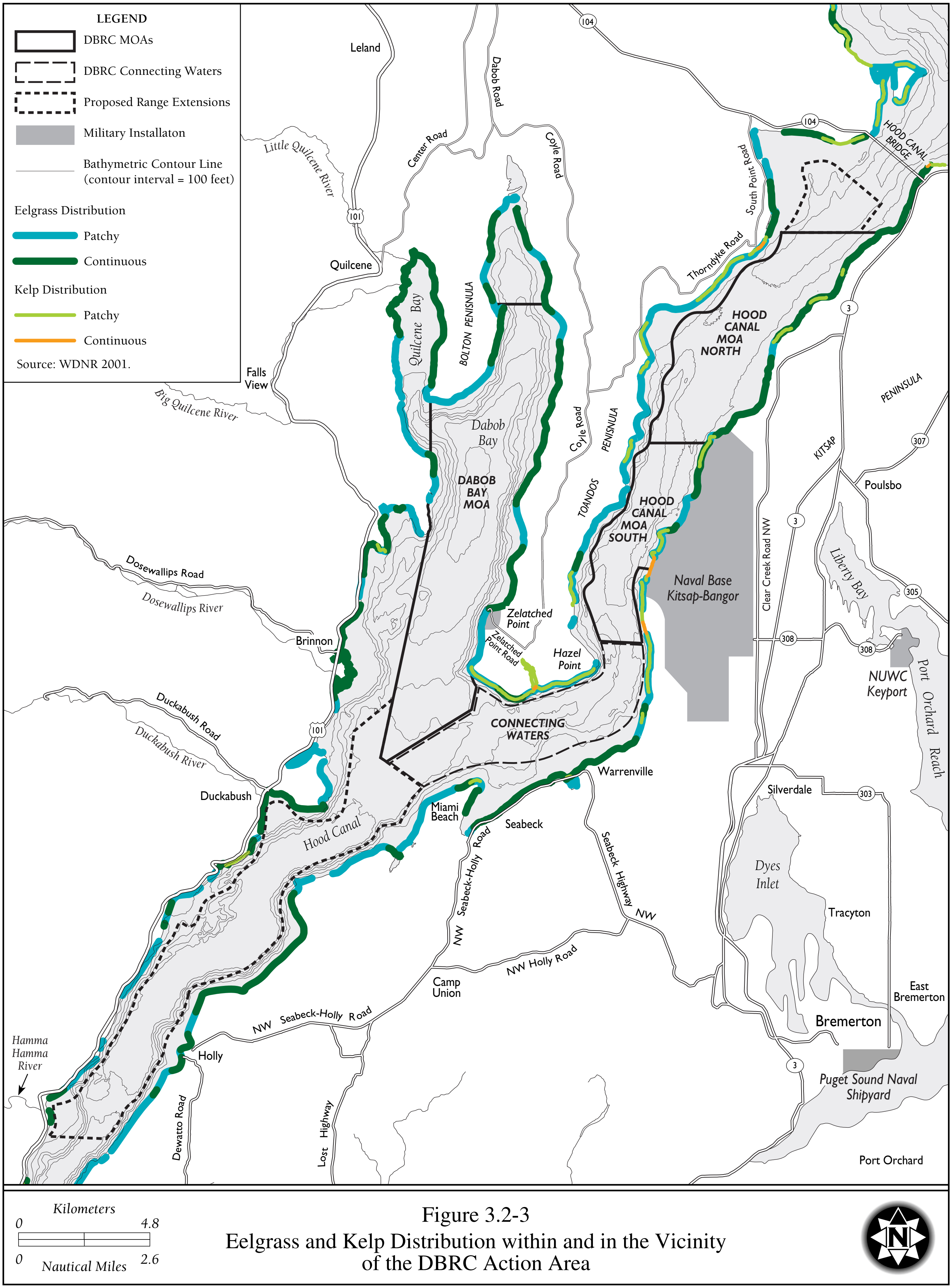


Figure 3.2-3
Eelgrass and Kelp Distribution within and in the Vicinity of the DBRC Action Area

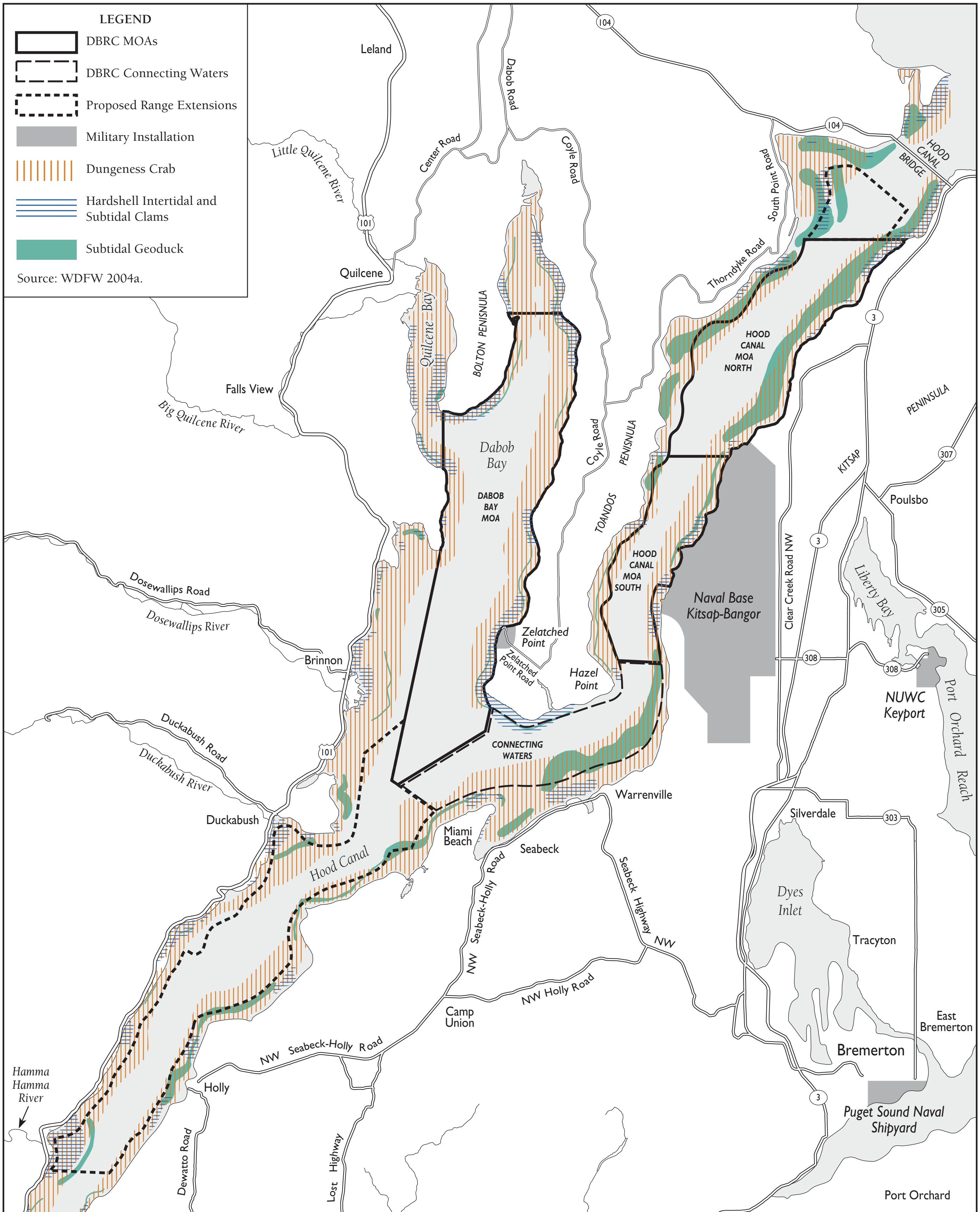


Figure 3.2-4
Dungeness Crab, Hardshell Clam, and Geoduck Distribution within and in the Vicinity of the DBRC Action Area

There were 18 octopi counted in Hood Canal in 2001 but surveys did not detect any in the same location in 2002 (Anderson 2001, 2003). Due to low DO levels, the octopi fishery is closed in Hood Canal (WDFW 2007).

Intertidal Benthic Invertebrates. Benthic infauna include polychaete worms, bivalves, and crustaceans. Crustaceans such as various species of crabs and shrimp occur within Hood Canal. Five shrimp species in the genus *Pandalus*, collectively known as pandalid shrimp, occur within Hood Canal. The most abundant intertidal species in Hood Canal include Pacific oysters, Dungeness crab, and pandalid shrimp. Intertidal hardshell clams occur in small populations throughout Hood Canal (Figure 3.2-5) (WDFW 2004b). Pacific oysters occur throughout the intertidal areas of Hood Canal (Figure 3.2-5). There are two commercial oyster hatcheries in Quilcene. The Point Whitney Shellfish Laboratory, operated by WDFW and located near Brinnon, also runs a shellfish hatchery. These hatcheries utilize seawater pumped in from Dabob Bay. Recreational fishing for oysters, mussels, and intertidal clams occurs year-round in Hood Canal (Navy 2002a). Native American Indian Tribes and Nations also have usual and accustomed fishing rights to these stocks.

3.2.3.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension Only)

The number of proposed annual activities within the DBRC Site and the proposed southern range extension would not change from the current estimated annual activities occurring within the existing DBRC Site and there would be no increase in the number of surface support vessels (Tables 2-2 and 2-8). Activities within the proposed southern range extension would take place over a larger area but impacts to marine flora and invertebrates would continue to be the same as those from current activities within the existing DBRC Site. The impacts of current activities were evaluated in a previous EA and found to have resulted in no adverse impacts on sediment or water quality which could affect marine flora and invertebrates (Navy 2002a). Continuing use of the DBRC site was found to have only minor, temporary effects on marine flora and invertebrates resulting from temporary disturbances of the benthic and water column habitats, and from the implementation of standard procedures for the containment and rapid cleanup of any accidental spills (Navy 2002a). Therefore, there would be minimal impacts to marine flora and invertebrates with implementation of Alternative 1 within the DBRC Site and proposed southern range extension.

DBRC Alternative 2 – Preferred Alternative (Northern and Southern Extensions)

Implementation of Alternative 2 would result in the same impacts to marine flora and invertebrates as previously described under Alternative 1. The type and number of activities under Alternative 2 are the same as Alternative 1. Activities under Alternative 2 would occur across a larger area (i.e., within both the northern and southern extensions) without an increase in the number of surface support vessels. Therefore, there would be minimal impacts to marine flora and invertebrates with implementation of Alternative 2 within the DBRC Site and the associated proposed southern and northern range extensions.

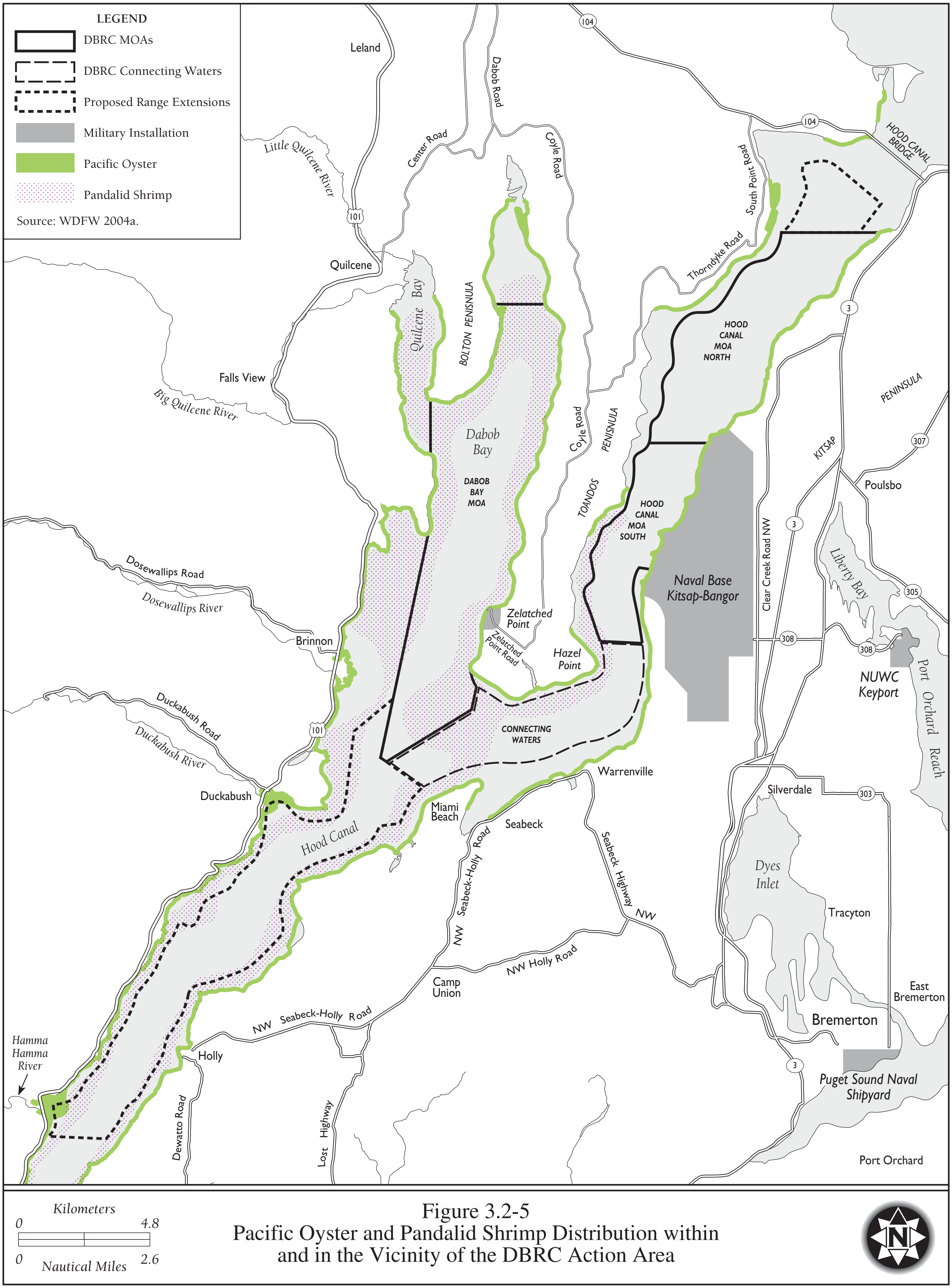


Figure 3.2-5
Pacific Oyster and Pandalid Shrimp Distribution within and in the Vicinity of the DBRC Action Area

3.2.3.3 No-Action Alternative

Under the No-Action Alternative, current activities would continue within the existing boundaries of the DBRC Site. The impacts of current activities were evaluated in a previous EA and found to have resulted in no adverse impacts on sediment or water quality which could affect marine flora and invertebrates (Navy 2002a). Continuing use of the DBRC site was found to have only minor, temporary effects on marine flora and invertebrates resulting from temporary disturbances of the benthic and water column habitats, and from the implementation of standard procedures for the containment and rapid cleanup of any accidental spills (Navy 2002a). Therefore, there would be minimal impacts to marine flora and invertebrates with implementation of the No-Action Alternative within the existing DBRC Site.

3.2.3.4 Mitigation Measures

Since there would be minimal impacts to marine flora and invertebrates with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.2.4 QUTR Site

3.2.4.1 Existing Conditions

Although there is a separate surf-zone access area associated with each QUTR Site range extension alternative, they all occur along sandy beaches and within 30 nm (57 km) of each other along the Olympic Coast, the existing habitat within each surf-zone area is considered the same across all three sites. Therefore, the following discussion of nearshore marine resources applies to all three surf-zone access areas.

<u>Marine Flora</u>

Marine flora include floating algae (phytoplankton) and attached algae and vascular plants. Phytoplankton are the source of primary productivity in the open ocean waters, whereas in shallow waters, primary production by attached plants is more important. In general, the open coastal waters of the Pacific Northwest support relatively high primary productivity, with chlorophyll concentrations greater than 3.0 mg per cubic meter throughout the spring, summer, and fall within 40 km of shore (Navy 2006a). Phytoplankton production is correlated with seasonal upwelling and current patterns which increase the availability of nutrients to algae (Navy 2006a).

Attached aquatic vegetation occurring in the subtidal and intertidal areas along the Olympic Coast includes many species of kelp, surfgrass, and other seaweeds. Because of their dependence on light for growth and reproduction, marine plants tend to occur within the photic zone. Depth of this layer varies seasonally and locally, generally ranging between 66 to 262 ft (20 to 80 m) deep (NOAA 1993).

Over 120 species of microalgae and macroalgae occur in the rocky intertidal areas along the Olympic Coast. Microalgae species include diatoms that coat the rocks and are grazed upon by invertebrates (e.g., gastropods, chitons). Macroalgae include numerous species of red algae (*Rhodophyta*), brown algae (*Phaeophyta*), and green algae (*Chlorphyta*). The main marine flora found in unprotected rocky surf areas include diatoms and surfgrass. Algae occurs abundantly in the protected areas as does surfgrass (NOAA 1993).

Kelp forests are abundant along the subtidal areas of the coast. Figure 3.2-6 shows the linear distribution of kelp forests in the vicinity of the QUTR action area. The kelp is a large brown algae (*Laminariales*) that attaches to rocky bottom substrate at depths of -7 to -66 ft (-2 to -20 m) and grows toward the surface.

Strong rooting ability allows kelp to withstand strong wave action. The floating portions serve as habitat for invertebrates such as sea urchins, limpets, chitons, starfish, crabs, snails, amphipods, and isopods. They also provide shelter and food for numerous species of fish and sea otters (NOAA 1993).

Surfgrass flourishes in the intertidal areas and can be found from intertidal to -23 ft (-7 m), occurring less abundantly in subtidal areas. Surfgrass is able to withstand low-tide exposure that occurs in the intertidal areas. It does not root, but rather attaches to rocky substrate by fibers. Surfgrass provides important habitat for invertebrates and other intertidal species (NOAA 1993).

Marine Invertebrates

Pelagic Invertebrates. Marine pelagic invertebrates inhabiting the QUTR action area are mostly planktonic species. Many species of copepods, euphausiids, amphipods, shrimp, and larval crabs thrive in the pelagic habitat. Gammarid amphipods in particular are abundant along the Olympic Coast (Grosse et al. 1986; NOAA 1993). Pacific squid also occur within the nearshore and offshore waters of the Washington coast. The pelagic environment is a productive environment for zooplankton during the late summer and fall due to longer day lengths and warmer waters yielding high phytoplankton production providing an abundant food source for zooplankton (NOAA 1993).

Subtidal Benthic Invertebrates. The subtidal areas along the Pacific coast of Washington can be broken up into three habitat types: rocky benthic, muddy benthic, and sandy benthic. Rocky benthic habitat endures more wave and current activity with very little fine sediment deposit. This habitat is beneficial for invertebrates that attach to hard surfaces. Muddy benthic habitat is composed of a mixture of fine grained silts, sand, and clays. Shrimp and snails thrive in this type of habitat. Sandy benthic habitat is optimal for crabs, clams, and sand dollars (NOAA 1993).

Species typically found in the subtidal rocky habitats along the coast include mussels, sea stars, whelks, and chitons. Crabs, sea urchins, and sand dollars inhabit mud mixed with sand habitats along the coast. (NOAA 1993). Giant Pacific octopi also occur within the nearshore and offshore waters of the Washington coast.

The Olympic Coast has a great deal of mud mixed with sand substrate. Dungeness crab are abundant along the Olympic Coast (Figure 3.2-6) (WDFW 2004b). Other dominant marine invertebrates present along the coast include anemones, sea cucumbers, and nudibranchs (NOAA 1993).

The proposed QUTR extension area extends offshore beyond the continental shelf, to depths of approximately 6,000 ft (1,800 m). Deep rocky substrate is prevalent along the steeper portions of the continental slope, e.g., in Quinault Canyon, and is expected to support a high diversity of invertebrates as well as fish (Navy 2006a). In addition, habitat-forming deep-sea coral communities occur along the continental slope, at depths of roughly 1,600 to 5,000 ft (500 to 1,500 m), within the outer-seaward portion of the proposed extension area (Navy 2006a). Examples include stony corals, hydrocorals, soft corals, black corals, and lace corals. Stony corals and hydrocorals build large, three-dimensional coral reefs that are comparable in size and complexity to shallow-water coral reefs. The biological diversity of deep-sea coral communities is high, and includes sponges, polychaetes (bristleworms), crustaceans (crabs and lobsters), mollusks (clams and snails), cephalopods (octopus), echinoderms (starfish, sea urchins, brittle stars, and feather stars), bryozoans (sea moss), and fish (Navy 2006a).

Other deep-sea communities and habitats of interest which occur in the region to the northwest and farther offshore but are not known within the proposed extension area include seamounts, sponge reefs and chemosynthetic communities (Navy 2006a).

Intertidal Benthic Invertebrates. The Olympic Coast is exposed to direct wave action causing much of the beach and intertidal habitat along the coast to endure sediment shifts, addition and subtraction of sand, as well as gravel and cobble changes brought on by tides, currents, and winds. The intertidal areas along the coast can be categorized into four habitat types: protected rocky surf, protected beach surf, unprotected rocky surf, and unprotected beach surf. These habitats have fluctuating species composition in both invertebrates and marine vegetation from season to season. Species inhabiting these areas have evolved to withstand these fluctuations and habitat changes. Protected areas (beach and rocky habitat) do exist in small pockets along the coast, created by rock islands or headlands that deflect some of the ocean action away from these smaller cove-like areas of the coast. These areas endure less scouring with an ability to achieve a more consistent habitat with very little fluctuation throughout the year. Unprotected rocky and beach surf habitats are populated by species that are able to adapt to extreme temperature and salinity fluctuation as well as pounding surf (NOAA 1993).

Rocky intertidal surf areas tend to be more productive than intertidal beach surf areas. Representative invertebrate species that inhabit the rocky intertidal habitat along the Olympic Coast include sponges, barnacles, sea urchins, snails, red rock crabs, mussels, and sea cucumbers. Sandy intertidal habitat along the coast is home to razor clams (Figure 3.2-6), isopods, and crabs.

Protected beach surf habitat associated with a muddy/sandy bottom is home to invertebrates such as crabs and sand dollars as well as burrowers such as amphipods, polychaete worms, and bivalves. Sediment dwelling invertebrates living between the rocks include mud shrimp, brittle stars, and many species of clams (NOAA 1993).

3.2.4.2 Environmental Consequences

<u>QUTR Alternative 1 (Kalaloch Surf Zone Access Area)</u>

Marine Flora. Previous analyses conducted at the DBRC Site, which has been subject to intense use in a relatively confined area, found no impacts on sediment or water quality attributable to Navy activities, and only very localized, temporary effects on marine flora and invertebrates due to disturbances of benthic and water column habitats (Navy 2002a; refer to Section 3.6 for a more detailed discussion of water quality impacts; see also ESG 2005). Activities in the ocean at the QUTR site would be more widely dispersed and therefore are inferred to have lesser impacts on marine flora and invertebrates. In addition, the potential impacts from accidental spills of petroleum products and other harmful fluids from test components or support vessels during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1).

Although marine flora could be affected by the deposition of expendable materials, the annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 617 losses of expendable materials per year over a 1,840.4-nm^2 (6,312.4-km^2) area, which represents approximately 0.34 expendables lost per nm^2 or 0.0004 per acre. Because activities would occur in different areas of the QUTR site, it is reasonable to assume that the expended materials would be randomly distributed within the range, and would not significantly impact marine flora distribution or abundance.

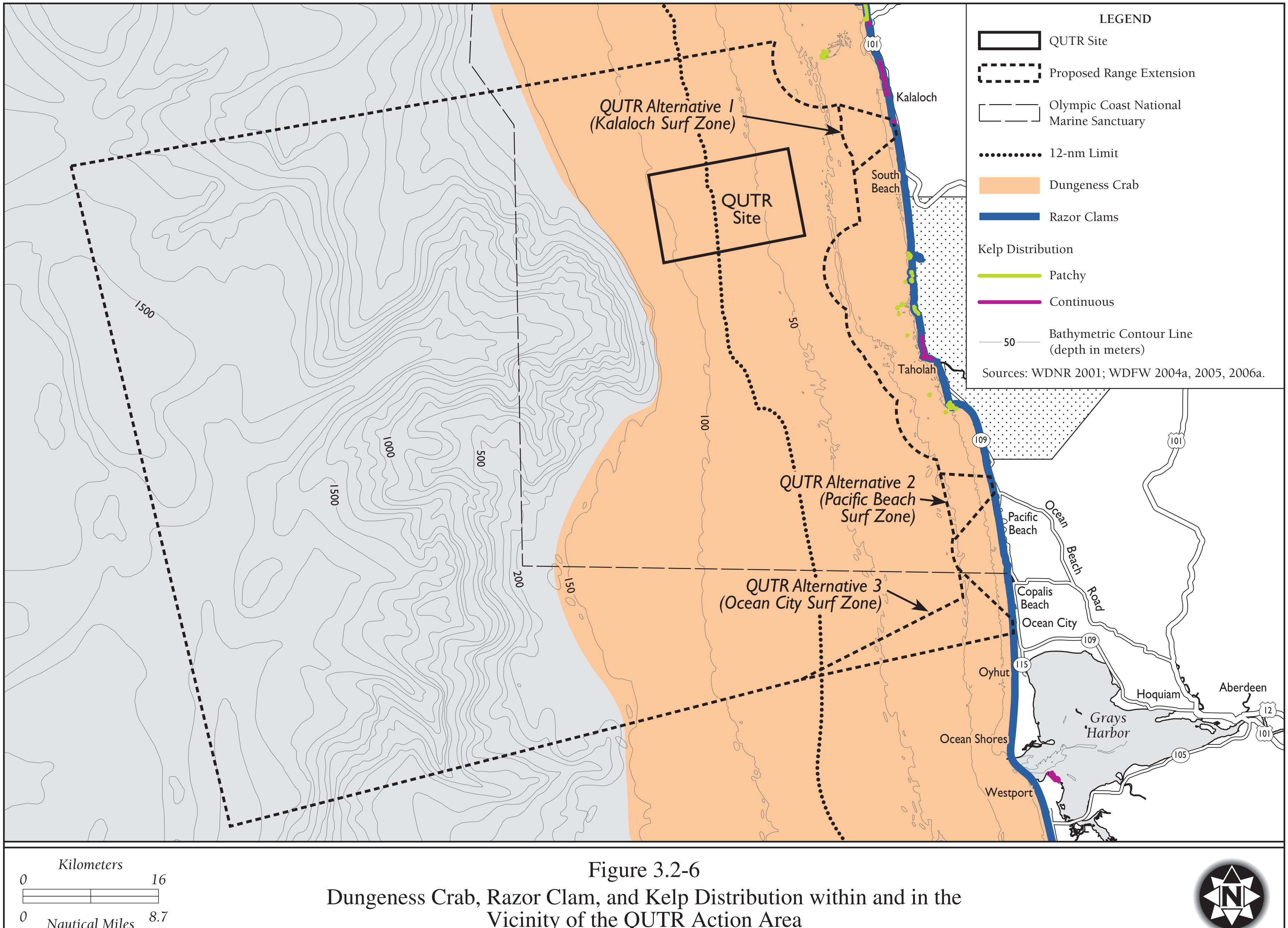


Figure 3.2-6
Dungeness Crab, Razor Clam, and Kelp Distribution within and in the Vicinity of the QUTR Action Area

Marine flora could also be affected by activities involving placement or movement of items on the bottom (e.g., anchors, targets, crawler UUVs) or recovery activities. However, these effects would be short term, affect a very small portion of the area, and would not result in long-term changes in the distribution or abundance of these populations. When recovery occurs it usually lasts less than a day and is localized within the area where the item being recovered is located. Given that the size of the disturbed area would be small (approximately several yards) and placement and recovery activities would be short term and infrequent, impacts would be minimal. In addition, the disturbed area would likely be re-colonized within a relatively short time as the disturbed sediments would not be removed, but rather re-distributed in the same location. Therefore, there would be minimal impacts to marine flora within and outside Territorial Waters with implementation of Alternative 1 within the QUTR Site, proposed range extension, and Kalaloch surf-zone access area.

Marine Invertebrates. Although marine invertebrates could be affected by the deposition of expendable materials, the annual number of expended materials is low when compared to the area of the Proposed Action. As described above, there would be approximately 617 losses of expendable materials per year over a 1,840.4-nm^2 (6,312.4-km^2) area, which represents approximately 0.34 expendables lost per nm^2 or 0.0004 per acre. Because activities would occur in different areas of the QUTR site, it is reasonable to assume that the expended materials would be randomly distributed within the range, and would not significantly impact marine flora distribution or abundance.

Marine invertebrates could be affected by activities involving placement or movement of items on the bottom (e.g., anchors, targets, crawler UUVs) or recovery activities. However, these effects would be short term, affect a small portion of the area, and would not result in long-term changes in the distribution or abundance of these populations. When recovery occurs it usually lasts less than a day and is localized within the area where the item being recovered is located. Given that the size of the disturbed area would be small (approximately several yards) and placement and recovery activities would be short term and infrequent, impacts would be minimal. In addition, the disturbed area would likely be re-colonized within a relatively short time as the disturbed sediments would not be removed, but rather re-distributed in the same location. A very small proportion of the existing benthic habitat would be disturbed by expendable as well as recovered materials. Therefore, there would be minimal impacts to marine invertebrates within and outside Territorial Waters with implementation of Alternative 1 within the QUTR Site, proposed range extension, and Kalaloch surf-zone access area.

Hydrocarbon spills and material potentially released into the marine environment from test components or surface support vessels have the potential to impact invertebrates and their habitats. Previous review of continuing Navy activities at the more heavily used DBRC Site found that the potential consequences of accidental spills would be of very limited extent, and effectively minimized by standard response procedures (Navy 2002a; refer to Section 3.6 for a more detailed discussion of water quality impacts). The potential impacts from accidental spills of petroleum products and other harmful fluids from test components or support vessels during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1). Therefore, there would be minimal impacts to marine invertebrates within and outside Territorial Waters with implementation of Alternative 1 within the QUTR Site, proposed range extension, and Kalaloch surf-zone access area.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Because the distribution and occurrence of marine flora and invertebrates would be the same across all surf-zone access areas, implementation of QUTR Alternative 2 would result in the same impacts to marine flora and invertebrates within Territorial Waters and non-Territorial Waters as previously described under QUTR Alternative 1. Therefore, there would be minimal impacts to marine flora and invertebrates with implementation of QUTR Alternative 2 within the QUTR Site, proposed range extension, and associated Pacific Beach surf-zone access area.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Because the distribution and occurrence of marine flora and invertebrates would be the same across all surf-zone access areas, implementation of QUTR Alternative 3 would result in the same impacts to marine flora and invertebrates within Territorial Waters and non-Territorial Waters as previously described under QUTR Alternative 1. Therefore, there would be minimal impacts to marine flora and invertebrates with implementation of QUTR Alternative 3 within the QUTR Site, proposed range extension, and associated Ocean City surf-zone access area.

No-Action Alternative

Under the No-Action Alternative, current RDT&E and other NUWC Keyport managed activities would continue within the existing boundaries of the QUTR Site and NUWC Keyport would maintain the Kalaloch facility and associated cabling and instrumentation. The action alternatives are inclusive of the analysis for the existing range activities scheduled and managed by NUWC Keyport. Since there are only minimal impacts under the action alternatives with implementation of the proposed range extension, and the No-Action Alternative has fewer activities within a smaller geographic area, there would be minimal impacts to marine flora and invertebrates within the existing QUTR Site for both Territorial Waters and non-Territorial Waters with implementation of the No-Action Alternative.

3.2.4.3 Mitigation Measures

Since there would be minimal impacts to marine flora and invertebrates with implementation of the Proposed Action or Alternatives, no mitigation measures would be necessary.

3.3 Sea Turtles

This section describes the existing condition of sea turtles and their habitat that might be affected by the proposed range extensions and associated Navy activities that would occur within each range. The "action area" for each range site includes the existing range site and the proposed range extension: existing Keyport Range Site and proposed range extension (Keyport action area); existing DBRC Site and proposed northern and southern extension areas (DBRC action area); and existing QUTR Site, proposed range extension, and surf-zone access areas (QUTR action area).

Sea turtles are occasionally sighted within the Strait of Juan de Fuca but are rare visitors to Puget Sound (NMFS and USFWS 1998) and are not expected to occur within the Keyport and DBRC action areas (NMFS 2005a). Therefore, the discussion of sea turtles is limited to their potential occurrence within the QUTR action area. The leatherback is the only species of sea turtle to occur in appreciable numbers in the QUTR action area, and is therefore the only species addressed. Although other species of the family Cheloniidae occur in the warm, subtropical areas of southern California and Hawaii, the QUTR Site is considered beyond their normal range of occurrence because of cold water temperatures. In addition, in accordance with section 7 of ESA, a BE has been prepared to assess the impacts of the Preferred Alternative on ESA-listed species.

3.3.1 Acoustic Capabilities of Sea Turtles

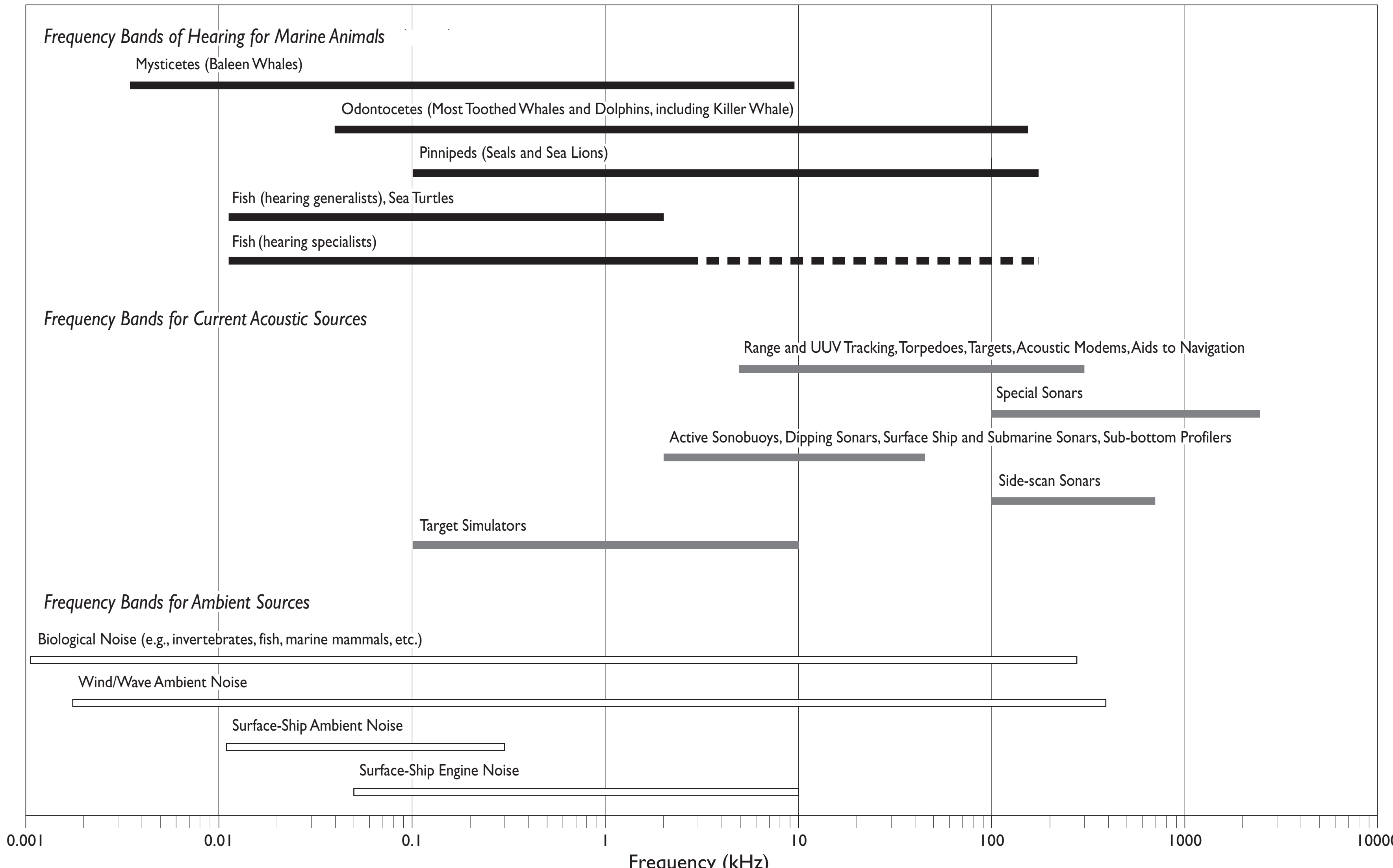
There have been a limited number of studies on sea turtle hearing, but the available data are not very comprehensive and little is known about how turtles detect sound or species-specific hearing abilities (Croll et al. 1999; Bartol and Musick 2003). The available data show that in general sea turtles can hear moderately low frequency sounds and are insensitive to high frequencies (Ridgway et al. 1969; Mrosovsky 1972; O'Hara and Wilcox 1990; Bartol et al. 1999; Ketten and Bartol 2005) (Figure 3.3-1). The following discussion of the available acoustic data for sea turtles is generally considered applicable across species, particularly for those species for which specific hearing studies have not been conducted (e.g., leatherback).

The majority of sea turtle hearing studies have looked at adult green sea turtles (Ridgway et al. 1969) and loggerhead sea turtles (Bartol et al. 1999). These studies generally indicate that at least some species are capable of hearing low-frequency sounds (Ridgway et al. 1969; Lenhardt et al. 1983; Bartol et al. 1999). The range of maximal sensitivity for sea turtles is 100–800 Hz, with an upper limit of about 2,000 Hz. Hearing below 80 Hz is apparently less sensitive but still potentially of use (Lenhardt 1994). Green turtles are most sensitive between 200 and 700 Hz, with a peak sensitivity at 300–400 Hz and an overall range of 60–1,000 Hz (Ridgway et al. 1969). Juvenile loggerheads were reported to have a hearing range of 250–1,000 Hz (Bartol et al. 1999). Loggerheads avoid sources of low-frequency sound in the 25–1,000 Hz range (O'Hara and Wilcox 1990). Finally, sensitivity within the hearing range is apparently low: threshold detection levels of 160–200 dB re 1 μPa were found in one study (Lenhardt 1994). However, a recent laboratory study indicated that, based on neural activity, a captive green sea turtle was able to hear sounds at 100-120 dB re 1 μPa (Bartol and Ketten 2006).

3.3.2 Keyport Range Site

3.3.2.1 Existing Conditions

Sea turtles are not expected to occur within the Keyport Range Site or the proposed range extension (NMFS and USFWS 1998; NMFS 2005a).



Sources: Urick 1983; Richardson et al. 1995; Ketten 1998; Mann et al. 2001; Frisk et al. 2003; Popper et al. 2003 (and references cited within these documents).

Figure 3.3-1
Frequency Bands of Current Acoustic Sources Compared to Underwater Ambient Noise and Hearing Frequencies of Marine Animals

3.3.2.2 Environmental Consequences

As sea turtles are not expected to occur within the Keyport Range Site or associated proposed range extension, there would be no effects to sea turtles with implementation of Keyport Range Alternative 1 or the No-Action Alternative.

3.3.2.3 Mitigation Measures

Since there would be no impacts to sea turtles from implementing the Keyport Range Alternative 1 or the No-Action Alternative, no mitigation measures would be necessary.

3.3.3 DBRC Site

3.3.3.1 Existing Conditions

Sea turtles are not expected to occur within the DBRC action area (NMFS and USFWS 1998; NMFS 2005a).

3.3.3.2 Environmental Consequences

As sea turtles are not expected to occur within the DBRC Site or associated proposed range extensions, there would be no effects to sea turtles with implementation of DBRC Alternative 1, Alternative 2, or the No-Action Alternative.

3.3.3.3 Mitigation Measures

Since there would be no impacts to sea turtles from implementing the DBRC Alternative 1, Alternative 2, or the No-Action Alternative, no mitigation measures would be necessary.

3.3.4 QUTR Site

3.3.4.1 Existing Conditions

Sea turtle distribution is a function of oceanic conditions, primarily water temperature (Radovich 1961). In general, sightings increase during summer as warmer temperatures move northward along the U.S. West Coast (Stinson 1984). Sightings may also be more numerous in warm years as opposed to cold ones. Depending on their activity, sea turtles can remain submerged for periods ranging from several minutes to several hours (Standora et al. 1984, 1994; Renaud and Carpenter 1994), which can hamper their detection and make it difficult to calculate population sizes.

Only the federally endangered leatherback sea turtle may occur at sea within the QUTR action area. Leatherback sea turtles are the largest of all sea turtles, reaching 8 ft (2 m) and weighing 1,600 pounds (lbs) (726 kilograms [kg]). They were listed as endangered in 1970 due to nesting habitat degradation, illegal harvest of adults and eggs, incidental take, and pollution. Leatherbacks range widely through the tropics and subtropics, migrate seasonally into Arctic and Antarctic waters, and typically nest between 40º N to 35º S latitudes; no nesting occurs on beaches under U.S. jurisdiction. They feed mainly on jellyfish near the surface or within the water column and generally do not occur at the bottom (NMFS and USFWS 1998).

Sea surface temperatures where leatherback turtles have been observed are usually in the 59 to 61 degrees Fahrenheit (°F) (15 to 16 degrees Celsius [°C]) range, suggesting that leatherbacks can range as far north as Washington and British Columbia waters when sea surface temperatures are highest in the summer and fall (Dohl et al. 1983; Green et al. 1992). Leatherback turtles have been observed along the coast of Washington including areas close to shore. During vessel and aerial surveys in 1990, Green et al. (1992) observed leatherback turtles in both Oregon and Washington waters, but most sightings were along the coast of Washington. Turtles were observed between June and September with most sightings in July in continental-slope waters, while fewer occur over the continental shelf (NMFS and USFWS 1998). Leatherback turtles may potentially occur during the summer in small numbers in the deeper, offshore waters of the QUTR Site and proposed range extension. Based on previous surveys and the habitat off the coast of Washington the density of sea turtles is very low, with only a few individuals likely to occur over hundreds to thousands of square miles (Navy 2006a).

On 5 January 2010, NMFS issued a notice of proposed rule and request for comments on the revised designation of critical habitat for the leatherback sea turtle. The proposed designation includes an area from Winchester Bay, Oregon, north along the shoreline to Cape Flattery, Washington, and extending offshore to approximately the 2,000-meter isobath, overlapping both the existing QUTR site and proposed extension. The proposed rule identifies the occurrence of prey species, especially jellyfish, and migratory pathway conditions as primary constituent elements (PCEs) of critical habitat for the species. Identified threats to PCEs included point source pollution, agricultural pesticides, oil spills, power plants, aquaculture, desalination plants, wave energy projects, and liquefied natural gas projects. .

3.3.4.2 Environmental Consequences

Since the proposed offshore activities within the QUTR Site and proposed range extension would be the same under Alternatives 1, 2, and 3, potential impacts to leatherback sea turtles would be the same with implementation of QUTR Alternative 1 (Kalaloch Surf Zone Access Area), QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area), or QUTR Alternative 3 (Ocean City Surf Zone Access Area). Although there are different surf-zone access options under each alternative, leatherback sea turtles are not expected to occur within the surf zone. Therefore, the discussion below pertains to all three action alternatives and applies to Territorial Waters and non-Territorial Waters.

Acoustic Impacts. As stated above, among those sea turtle species for which hearing data are available, they are generally capable of hearing low-frequency sound (i.e., less than 1 kHz) with a peak sensitivity around 300 to 400 Hz (Ridgway et al. 1969). The only proposed acoustic source at this low of a frequency would be systems like the target simulator (100 Hz – 10 kHz at an estimated source level of 170 dB re 1 µPa @ 1 m). The thresholds for hearing for sea turtles are relatively high at 160 to 200 dB re 1 µPa (Lenhardt 1994). Given these high levels of hearing thresholds, the target simulator could only have a potential effect on sea turtles if they are very close to the acoustic source. That is, at a source level of 170 dB the sound energy would attenuate to below 160 dB within approximately 30 ft (9 m) from the target simulator, and therefore below the hearing threshold at which a sea turtle could hear the target simulator. Due to their poor hearing sensitivity, the very low densities of sea turtles within the QUTR action area, and the very low level of acoustic activities proposed within the QUTR action area (maximum 16 days per year), the likelihood of an individual leatherback sea turtle being close enough to a target simulator to receive or hear an acoustic impulse is very low. Therefore, implementation of any of the QUTR alternatives would have no effect on leatherback sea turtles due to acoustic exposures.

Ingestion and Entanglement. Sea turtles appear to be particularly susceptible to mortality associated with ingestion of plastics and other materials. Sea turtles ingest a wide variety of marine debris, including plastic bags, plastic sheeting, balloons, styrofoam, and fishing line. Ingestion of these foreign materials can cause intestinal blockage, release toxic chemicals, inhibit feeding or mating, and result in suffocation, ulceration, malnutrition, and starvation (Wehle and Colemar 1983; Wallace 1985; O'Hara et al. 1986). In one 22-month study, plastic was found in nearly 80 percent of turtle stomachs (Stanley et al. 1988). NMFS estimates that one-third to one-half of all turtles have ingested plastic products or byproducts (Cottingham 1988).

Aircraft-launched test items (e.g., torpedoes, sonobuoys, targets) may deploy nylon parachutes or other launch accessories such as nose caps and suspension bands. Parachutes and other accessories would not remain at the surface but would sink to the bottom. Since leatherbacks reside and feed in the pelagic environment (NMFS and USFWS 1998), once parachutes or other accessories have sunk to the bottom they would not pose a risk of entanglement or ingestion. Even while at the surface or as they are descending, ingestion of a parachute by a sea turtle is unlikely as parachutes are much larger compared to plastic bags commonly ingested. Because parachutes sink, the probability of a sea turtle swimming into it on the surface and becoming entangled is low. Due to the very low densities of sea turtles within the QUTR action area and the relatively few RDT&E and other NUWC Keyport managed activities proposed within the QUTR action area (maximum 16 days per year), and the small number of materials expended annually (617 per 1840.4 nm^2 or 0.0004 per acre), the likelihood of a sea turtle encountering a parachute or launch accessory as they descend through the water column is very low. Since leatherback sea turtles feed primarily on gelatinous zooplankton, such as jellyfish (Navy 2006a), they are not expected to frequent the ocean bottom within the QUTR action area; once the parachute and launch accessories reach the bottom they pose no entanglement or ingestion threat. Therefore, implementation of any of the QUTR alternatives would not impact and would have no effect on leatherback sea turtles

Most known instances of entanglement involve fishing gear. Cables, lines, chains, guidance wire, sonobuoy debris, fiber optic cables, and other items that are proposed for use during activities within the QUTR action area sink rapidly and therefore are not expected to create an entanglement hazard for sea turtles. Due to the very low densities of sea turtles off the coast of Washington, the NUWC Keyport vessel discharge policy that no shipboard waste materials are disposed at sea, and the relatively few activities per year within the range, entanglement or ingestion is not expected. Therefore, no impact to leatherback sea turtles is expected and there would be no effect on sea turtles with implementation of any alternative within the QUTR Site and proposed extension. Further discussion of potential entanglement issues under each exercise type are discussed below.

LIDAR. LIDAR is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship or submerged object. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, underwater LIDAR uses light in the blue-green part of the spectrum as it attenuates the least. Common civilian uses of LIDAR in the ocean include seabed mapping and fish detection. There are three generic types of LIDAR:

- Range finders: used to measure the distance from the LIDAR instrument to a solid target.
- Differential Absorption LIDAR (DIAL): used to measure chemical concentrations in the air.
- Doppler LIDARs: used to measure the velocity of a target.

LIDARs proposed for use within the QUTR action area currently meet human laser safety standards. Because the human eye is more sensitive to laser radiation than the sea turtle eye, the use of LIDAR is not expected to have a harmful effect on the eyes of sea turtles (Zorn et al. 1998). Therefore, there would be no effect on sea turtles and no impact on individuals or to the population as a whole with the use of LIDAR within the QUTR Site and proposed range extension under Alternatives 1, 2, and 3.

Inert Mine Hunting and Inert Mine Clearance Exercises. This is done for detection, classification, and localization of inert mines. Inert mine shapes are made of many composite materials and are often put on the bottom or float in the water column above an anchor, often in groups. A series of inert mine fields can be laid to test the detection, classification, and localization capability of the system under test. For example, a concrete clump can be put on the bottom. It may be initially identified as a possible inert mine, but as the sensor becomes more sophisticated it will mark the clump as false target and move on to locate other more probable inert mine shapes. Leatherback sea turtles are not expected to frequent the ocean bottom within the QUTR action area; once the inert mine shapes are placed on the bottom they pose no entanglement threat. Anchor chains within the water column do not pose an entanglement risk as they are fairly conspicuous and are easily avoided by sea turtles. Major components of all inert mine systems used as 'targets' for inert mine hunting systems are removed after use or within two years of deployment. Due to the very low densities of sea turtles in the QUTR action area and the relatively few activities proposed within the QUTR action area (maximum 16 days per year), interaction between sea turtles and inert mine-hunting or inert mine-clearing exercises is unlikely. In addition, vessels would avoid sea turtles if/where they are present (see Mitigation Measures below). Therefore, implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles.

UUVs. There are two types of UUVs proposed for use: swimmers and crawlers. Swimmer UUVs are self-powered, submersible vehicles controlled by an onboard navigation system. Swimmers are typically placed into and retrieved from the water with a crane located on a pier or surface vessel. Crawler UUVs are self-powered underwater vehicles designed to operate on land, in the surf zone, and in very shallow water. Crawlers have many of the same capabilities as swimmers except that they move along the bottom and they can operate in shallower water than swimmers. Due to the relative size of leatherback sea turtles, their very low densities in the QUTR action area, and the relatively few activities that would occur within the QUTR action area (maximum 16 days per year), the likelihood is negligible that a sea turtle would be struck by a UUV during activities within the QUTR action area. Therefore, there would be no impacts and no effects to sea turtles due to the activity of UUVs with the implementation of any of the QUTR alternatives.

Some UUVs trail thin guidance or communication wires as they conduct their activities within the range. Guidance wire associated with testing torpedoes or other test vehicles is used to enable remote dynamic control of the vehicle. These wires fall to the bottom substrate. The plastic-jacketed copper guidance wire used for communication to the launch platform is specified to be approximately 26 ft-lbs (4 m-kg) of tensile strength. UUVs can also communicate with a surface vessel or shore-based facility via a 0.01 inch (254-micron) diameter fiber-optic wire. Leatherback sea turtles are not expected to frequent the ocean bottom within the QUTR action area and proposed range extension; once the guidance or communication wires settle on the bottom they pose no entanglement threat. The possibility that a sea turtle would encounter a communication wire while it sinks in the water column is remote. The Navy previously analyzed the potential for entanglement of torpedo control wires (the same as the copper guidance wires of the UUVs) with sea turtles and marine mammals and concluded that the potential for entanglement would be low (Navy 2005b). Due to the very low densities of sea turtles in the QUTR action area and the relatively few activities proposed within the QUTR action area (maximum 16 days per year), the potential for entanglement by a sea turtle with control or communication wire within the water column is considered highly unlikely. Therefore, implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles due to guidance or communication wires.

Vessels and Torpedoes. Routine lookout procedures implemented as part of the ROP are expected to be sufficient to avoid vessel interactions with a sea turtle in the highly unlikely event that one is present on the range in the immediate vicinity of an activity (see Mitigation Measures below). Although during reduced visibility conditions (i.e., fog, high sea state, darkness), detecting sea turtles can be difficult, the likelihood of random collision between a Navy vessel and a leatherback sea turtle is considered negligible due to the very low densities of sea turtles in the QUTR action area and the relatively few activities proposed within the QUTR action area (maximum 16 days per year). Therefore implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles due to potential ship strikes.

Exercise torpedoes are equipped with a control wire, which pays out behind the torpedo. The wire sinks rapidly and settles as a single line. Because the control wire is held in a straight line as it is pulled from the torpedo, entanglement of sea turtles is unlikely. The Navy previously analyzed the potential for entanglement of torpedo control wires with sea turtles and marine mammals and concluded that the potential for entanglement would be low (Navy 2005b). As discussed previously for UUV guidance and communication wires, due to the very low densities of sea turtles within the QUTR action area, the relatively few RDT&E and other NUWC Keyport managed activities proposed within the QUTR action area (maximum 16 days per year), and the low probability of a sea turtle encountering a control wire, the potential for entanglement by a sea turtle is considered highly unlikely. In addition, due to the rare occurrence of leatherback sea turtles, the potential for a turtle being struck by a torpedo during RDT&E activities is unlikely. Therefore, implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles due to the operational use of torpedoes.

Stationary, Bottom-Anchored Targets. Associated with the units being tested, a series of about 20 target shapes are set out in a uniform or random pattern. They can be made of plastic, metal, and concrete. Varying in shape, they measure about 1.8 by 10 ft (0.5 by 3 m) and weigh about 800 lbs (363 kg). Targets either sit on the bottom or are tethered by an anchor to the bottom at various depths. Targets are placed approximately 200 to 300 yards (183 to 274 m) apart using a support craft and remain on the bottom until they need to be replaced.

Temporary inert mine shapes would be recovered to the maximum extent practicable. NUWC Keyport routinely recovers all major test components including targets and inert mine shapes. Components either sink into a soft bottom or lie on a hard bottom where they may be recovered or eventually covered by shifting sediments. Small pieces or anchoring would be in the sediment and depending on their construction, these accessories, devices, and targets would gradually disappear over time by degrading, corroding, and becoming incorporated into the sediments. The chance of physical contact between an expendable training target and a sea turtle is low during deployment. Anchor chains within the water column do not pose an entanglement risk as they are fairly conspicuous and are easily avoided by sea turtles. Therefore, implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles due to the use of stationary, bottom-anchored targets.

Countermeasures and Sonobuoys. Underwater countermeasures, such as mechanical or electronic countermeasure devices (3 to 5 inches [8 to 13 cm] in diameter and 2 to 6 ft [0.6 to 1.8 m] long) would be deployed during test and training activities within the QUTR action area. These countermeasures have steel housings and batteries and would sink to the bottom. Due to the very low densities of sea turtles in the QUTR action area and the relatively few activities proposed within the QUTR action area, the potential for a sea turtle to encounter countermeasures within the water column is considered highly unlikely. Once on the bottom, there is a very low probability of a leatherback sea turtle encountering a countermeasure, since they do not frequent the ocean bottom.

Acoustic listening devices known as sonobuoys would also be deployed during test and training activities within the QUTR action area. As with the electronic countermeasures, these devices have steel housings and batteries, and would sink to the bottom. Once on the bottom, there is a very low probability of a leatherback sea turtle encountering a sonobuoy. Therefore, implementation of any of the QUTR alternatives would have no effect on and would not impact leatherback sea turtles due to the use of countermeasures and sonobuoys.

Contaminants. During testing activities a variety of liquid and solid materials could potentially be released into the marine environment (e.g., targets, anchors, battery components from sonobuoys). The Navy has strict requirements and guidelines at sea regarding the use of petroleum products or other potential contaminants (Section 3.6 for a complete discussion of potential water quality issues and impacts). The potential impacts from accidental spills of petroleum products and other harmful fluids from UUVs or support craft during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1).

Therefore, based on the above analysis, implementation of any of the QUTR Site alternatives would have no effect on and would not impact sea turtles from LIDAR, inert mine-hunting and inert mine-clearing exercises, UUVs, ship strikes, targets, countermeasures and sonobuoys, and contaminants within the QUTR Site and proposed range extension. As indicated by the foregoing analysis, there would be no adverse effect on the area of proposed critical habitat for the leatherback sea turtle.

No-Action Alternative

Under the No-Action Alternative, current activities would continue within the existing boundaries of the QUTR action area. The existing QUTR site is included in the analysis of the alternatives, and since there are no effects to sea turtles under any of the action alternatives, there would be no effects to sea turtles under the No-Action Alternative.

3.3.4.3 Mitigation Measures

The draft NMFS BO did not identify adverse effects that would be likely to occur. To the extent practicable, NUWC Keyport will comply with any reasonable and prudent measures and terms and conditions that are issued by NMFS in their final BO. Because of the rarity of sea turtles as far north as the QUTR action area, the possibility of any interaction with sea turtles is very low. As part of the ROP, safety lookouts are maintained on vessels during range activities and are assigned to watch for objects in the water, including sea turtles; such objects are avoided. Navy lookouts undergo Marine Species Awareness Training (MSAT) (https://portal.navfac.navy.mil/go/msat), which familiarizes them with sea turtles, their legal protection under the ESA, and Navy policy to avoid negative interactions with sea turtles, as well as improving their abilities to detect sea turtles. No other measures for sea turtles are necessary with implementation of Alternative 1, Alternative 2, Alternative 3, or the No-Action Alternative, within the QUTR action area.

3.4 FISH

This section describes the finfish resources that could be affected by the proposed range extensions and associated Navy activities that would occur within each range site. The "action area" for each range site includes the existing range site and the proposed range extension: existing Keyport Range Site and proposed range extension (Keyport action area); existing DBRC Site and proposed northern and southern extension areas (DBRC action area); and existing QUTR Site, proposed range extension, and surf-zone access areas (QUTR action area). The discussion includes fish that are considered important fisheries, are listed under ESA, or are associated with designated Essential Fish Habitat (EFH). In accordance with section 7 of ESA, a BE has been prepared to assess the impacts of the Preferred Alternative on ESA-listed species. Fish are further addressed and discussed relative to their known sensitivity to underwater sound. The following introductory discussion of acoustic capabilities of fish is presented as context for the environmental consequences analysis.

3.4.1 Overview of Existing Conditions at All Three Range Sites

The following discussion provides an overview of the stock status, distribution, and occurrence of those species that are either resident or migratory through each of the action areas but for which there is little site-specific information. This is because many of the finfish species that occur in the affected areas are managed on a region-wide (e.g., Puget Sound), state-wide (Washington), or larger (Pacific Northwest) basis. For the purposes of this discussion, finfish have been divided into ecologically related groups of species that also reflect their management as fishery resources and the designation of EFH. The subsections following the overview of finfish provide more detailed information (e.g., abundance, distribution, occurrence, habitat use) for those finfish that occur within each action area.

3.4.1.1 Coastal Pelagic and Forage Fish Species

Pelagic fishes inhabit the open, upper portion of marine waters rather than waters adjacent to land or near the sea floor. Some pelagic fish rear in intertidal or freshwater environments for periods of time, but move into marine waters for two to five years until they are sexually mature. When ready to spawn, these fish move to waters closer to shore. Predominant pelagic fish species found in marine waters adjacent to Washington include: Pacific herring, Pacific sand lance, surf smelt, Pacific sardine, northern anchovy, and eulachon. These species are considered "forage fish" and are important prey for various fish, marine mammals, and seabirds and are also harvested in commercial, recreational, and Tribal usual and accustomed fisheries. Although technically anadromous, eulachon are discussed under the pelagic fish section because of their extensive pelagic life stage and their role as forage fish for other marine animals.

Pacific Herring

Most Washington State herring stocks spawn in intertidal and shallow subtidal areas on hard bottom, algae, and other substrates from late January through early April, and hatching of larvae occurs 10 to 14 days later. The larvae become part of the pelagic community and drift with the ocean currents. Puget Sound herring stocks spend their first year in Puget Sound (Bargmann 1998). Some herring stocks spend their entire lives within Puget Sound ("resident stocks") while other stocks ("migratory stocks") summer in the coastal areas of Washington and southern British Columbia (Trumble 1983).

Herring stocks are defined by spawning grounds. At least 18 stocks spawn inside Puget Sound and one stock spawns on the Washington coast in central Willapa Bay. WDFW's ongoing annual assessment survey results (which indicate stock specific age structures and strong site specificity, spawn timing, and prespawner holding area characteristics) support the assumption of stock autonomy for Puget Sound herring. Therefore, conservation of herring spawning habitat and minimizing disturbance in the pre-spawning holding areas is key to the preservation of the herring stocks inside Puget Sound. Herring stock assessment data are very useful for localized habitat management and planning. The Pacific herring is of considerable interest in the Puget Sound region because of the species' value as forage for other fish, seabirds, and marine mammals; its popularity as recreational fishing bait; its significance to local commercial and Tribal usual and accustomed fisheries; and its importance as an indicator of the general "health and productivity" of Puget Sound (WDFW 1997).

Pacific Sardine

Pacific sardine are small schooling fish. At times, they have been the most abundant fish species in the California current. When the population is large, it is abundant from the tip of Baja California to southeastern Alaska. In the north, sardines tend to appear seasonally. The northern sub-population of sardines is most important to U.S. commercial fisheries. Pacific sardine spawning peaks during April and May but can occur from January to June (Hart 1973). Sardine migrate north in early summer and then return south in autumn. Sardines may live as long as 13 years, but they are usually younger than 5 years of age (Pacific Fishery Management Council [PFMC] 2008).

Pacific sardine are taken by a variety of predators throughout all life stages. Juvenile and adult sardine are consumed by a variety of predators, including commercially important fish (e.g., yellowtail, barracuda, bonito, tuna, marlin, mackerel, hake, salmon, sharks), seabirds (e.g., pelicans, gulls, and cormorants), and marine mammals (e.g., sea lions, seals, porpoises, and whales). It is expected that sardines are consumed by the same predators (including endangered species) that utilize anchovy. As their numbers increase, it is likely that sardines will become an important prey item. For example, while sardines were abundant during the 1930s, they were a major forage species for both Coho and Chinook salmon off Washington (Hill et al. 2006).

Northern Anchovy

Northern anchovy are small, short-lived fish that are typically found in schools near the surface. They are found from British Columbia to Baja California. Northern anchovies are divided into northern, central and southern sub-populations. Northern anchovy are an important part of the food chain for other species, including fish, birds, and marine mammals (PFMC 2008).

Their occurrence in Washington waters is sporadic and unpredictable. Most of the anchovies occur along the coast and well offshore, although at times they can be common in Puget Sound. During the summer months, anchovies may be found in Grays Harbor, Willapa Bay, or the Columbia River mouth. The abundance of anchovies in these inshore areas varies from year to year but this variation appears to be due to changes in behavior, not changes in abundance (WDFW 1997; Bargmann 1998).

Little is known about the life history of the anchovy in Washington, or if anchovies spawn in Washington waters or are merely transient visitors. Larval anchovies have been observed in the Strait of Juan de Fuca, but pelagic eggs have not been found in numbers which suggest recent spawning activity. Anchovies are thought to move inshore in the spring and summer and offshore in the fall and winter, and are particularly susceptible to changes in water temperature. A single female may spawn several times each year with an annual fecundity of about 25,000 eggs. A small percentage of the larvae reach maturity at the end of the first year, while the vast majority reaches maturity at the end of the second year (WDFW 1997; Bargmann 1998).

Anchovies are taken commercially year-round within coastal and estuarine waters of Washington. Anchovies along the coast are migratory and available to fisheries from late spring through the fall. The

Washington commercial anchovy fishery provides bait for recreational fisheries. Westport based anchovy catches are taken predominantly from Grays Harbor, although some of the landings are made from the nearshore coastal area. No anchovy stock condition or habitat assessment activities are presently conducted for Washington coastal anchovies (WDFW 1997).

Eulachon (Oil Fish)

The Southern DPS of Pacific eulachon was recently listed as threatened (NMFS 2010a). Eulachon spend most of their adult lives in the Pacific Ocean and range from Northern California to coastal British Columbia. Adults return to large rivers to spawn in the winter usually starting in December and continuing until spring. The larvae incubate in the gravel until they hatch and drift downstream to the ocean. Very little is known regarding their marine life history. A recreational fishery for eulachon occurs during the spawning season using dip nets from shore or boats. No quantitative stock assessment of eulachon is conducted and stock status is unknown (Bargmann 1998). The eulachon has historically been an important component of aboriginal diet and commerce. There is no evidence of eulachon spawning in Puget Sound, and only occasional or rare occurrences of spawning have been noted in Washington outer coastal rivers (NMFS 2010a). Hence the occurrence of the species in the action areas would be primarily as occasional transient adults. Accordingly, the Navy has concluded that the Proposed Action is not likely to adversely affect this species, and the NMFS draft BO reaches the same conclusion.

Sand Lance

The Pacific sand lance is widespread and can be found from California to Alaska and across the Bering Sea to Japan. Sand lance are found from the intertidal zone to approximately 656 ft (200 m) deep and feed in the upper water column during the day and bury in the sand substrate during the night (Hobson 1986). Puget Sound sand lance populations appear to be obligatory upper intertidal spawners, depositing their eggs in sand-gravel substrates between the mean high-tide line and about 5 ft (2 m) in tidal elevation (WDFW 1997). Spawning takes place annually from approximately the beginning of November through mid-February. Individual broods of eggs incubate in the beach substrate for about 1 month, after which time the larvae are a common component of the nearshore plankton in many parts of Puget Sound. Several spawnings may occur at any given site during the November to February spawning season (Bargmann 1998). Sand lance spawning activity appears to be distributed throughout the shorelines of the Puget Sound basin.

Sand lance are an important part of the trophic link between zooplankton and larger predators in the local marine ecosystem. Like all forage fish, sand lance are a significant component in the diet of many economically important resources in Washington. On average, 35 percent of juvenile salmon diets are composed of sand lance. In particular, 60 percent of the diet of juvenile Chinook are composed of sand lance. Other economically important species, such as Pacific cod, Pacific hake, and dogfish feed heavily on juvenile and adult sand lance (WDFW 1997).

Sand lance populations are widespread within Puget Sound, the Strait of Juan de Fuca, and the coastal estuaries of Washington. They are most commonly noted in more localized areas, such as the eastern Strait and Admiralty Inlet. However, WDFW plankton surveys and ongoing spawning habitat surveys suggest that there are very few if any bays and inlets in the Puget Sound basin that do not support sand lance spawning activity. Sand lance are not regularly harvested for bait or human consumption in Washington and when harvested are commonly dip netted for salmon sport bait. The stock status of sand lance within Washington is unknown (WDFW 1997).

Surf Smelt

Surf smelt occur from Southern California to central Alaska and have an entirely marine/estuarine life history. Surf smelt are very widespread in Washington, occurring in the outer coastal estuaries, the shores of the Olympic Peninsula, and the greater Puget Sound basin from Olympia to the U.S.-Canada border (Bargmann 1998).

Surf smelt within the Puget Sound basin are somewhat unusual in having an extended spawning season, with some areas receiving several months of spawning activity centered in either the summer months or a fall-winter period. Surf smelt deposit adhesive, semitransparent eggs on beaches, which have a specific mixture of coarse sand and pea gravel. Larvae emerge after approximately 11 to 16 days in the summer months and 27 to 56 days in the winter months. After emerging, they are planktonic for a period of time before settling in estuaries and nearshore waters for several months. Juvenile surf smelt rear in the nearshore waters throughout Puget Sound. Spawning maturity may be reached during their first year of life, although the majority reach spawning maturity during their second year. Surf smelt do not die after spawning and may spawn during successive seasons (WDFW 1997).

Surf smelt are harvested in commercial, recreational and Tribal usual and accustomed fisheries in Washington and are currently "passively managed" by the WDFW. Stock status of surf smelt within Washington is unknown (WDFW 1997).

Jack Mackerel

All life stages of the jack mackerel are pelagic (Eschmeyer et al. 1983). Adults occur offshore from the surface to 1,322 ft (403 m), but are most abundant at depths ranging from 30 to 240 ft (9 to 73 m); whereas juveniles are found at depths of 30 to 180 ft (9 to 55 m) around floating debris, kelp beds, piers, oil drilling platforms, shallow rock banks, and islands (Hart 1973). Jack mackerel demonstrate migratory patterns onshore to offshore and along the coast. They are more common on offshore banks during late spring, summer and early fall than during the remainder of the year (PFMC 1998).

Jack mackerel are multiple spawners reproducing in the epipelagic (MBC AES 1987; Mason 1992). Spawning occurs off the Oregon coast from 86 to 864 nm (160 to 1,600 km) and off Washington State from 173 to 972 nm (320 to 1,800 km) from August to October (Mason and Bishop 2001).

3.4.1.2 Groundfish

Groundfish are marine fish species that live near or on the bottom of marine waters for most of their adult lives. These include groundfish species such as rockfish, flatfish (flounder, sole, halibut), roundfish (greenlings, ling cod, Pacific cod, sablefish, walleye pollock, Pacific hake), sharks, and skates. There are over 90 species of groundfish on the Pacific coast of the U.S. managed under the Pacific Coast Groundfish Fishery Management Plan (PFMC 2004), many of which support important commercial, recreational and Tribal usual and accustomed fisheries. There are at least 150 species of groundfish in Puget Sound (Palsson et al. 1998).

While the majority of groundfish on the west coast of Washington are harvested in the commercial trawl fishery, both recreational and Tribal usual and accustomed fisheries also harvest groundfish. Washington coastal treaty Indian tribes (Hoh, Makah, Quileute and the Quinault Indian Nation) hold formal allocations in their usual and accustomed fishing areas for sablefish, Pacific hake, and black rockfish.

A preliminary 2002 assessment of groundfish stocks has shown that over half of key groundfish stocks in South Puget Sound are at or below average abundance (Table 3.4-1) (Puget Sound Water Quality Action

Team [PSWQAT] 2002). Some of the species that once dominated the catches of recreational and commercial fishers are now at depressed or critical abundances, resulting in historic low catches and reduced fisheries (Palsson et al. 1998). Additionally, eight species of West Coast groundfish have recently been declared overfished including widow rockfish, canary rockfish, yelloweye rockfish, darkblotched rockfish, bocaccio, Pacific ocean perch, lingcod, and cowcod.

Table 3.4-1 Status of South Puget Sound Groundfish Stocks (2002)

Species	*Status**
Dover sole	Depressed
English sole	Below average
Greenlings	Above average
Lingcod	Above average
Pacific cod	Critical
Pacific whiting (hake)	Critical
Pacific halibut	Above average
Rock sole	Average
Rockfishes	Depressed
Sablefish	Below average
Sand sole	Above average
Sculpins	Above average
Skates	Depressed
Spiny dogfish	Depressed
Spotted ratfish	Above average
Starry flounder	Average
Surfperches	Depressed
Walleye pollock	Critical
Wolf eel	Average
Other groundfish	Below Average

Notes: South Sound includes Hood Canal, Central Sound, Whidbey Basin, and Southern Sound (south of Tacoma Narrows).
*A comparison of the most recent 2-year average indicators was made to historical or long-term averages of the indicators. Percent changes were categorized into five measures of stock status:
- Above average (change greater than 6 percent above average),
- Average (within 5 percent of average),
- Below average (6-35 percent less than average),
- Depressed (36-75 percent less than average), and
- Critical (at least 76 percent less than average) *Source*: PSWQAT 2002.

Rockfish

Rockfish on the Pacific coast typically inhabit the continental shelf and upper slope regions and consequently are sometimes described as nearshore, shelf, or slope rockfish. As adults, rockfish inhabit rocky reef habitats, slopes, pinnacles, pilings, or submerged debris and typically remain within 100 to 164 ft (31 to 50 m) of their preferred habitat (Matthews 1990). Rockfish are long-lived and sexual maturity is attained between 5 and 20 years of age. Spawning for most species generally takes place in the early spring (April) or late fall. Once hatched (late winter to mid-summer) the juvenile larvae form part of the pelagic community for up to 3 years and use nearshore habitats. Due to their long lives and late sexual maturity, rockfish are extremely susceptible to over harvest and stock depletion.

In 2002, the South Puget Sound rockfish populations were characterized as depressed (Table 3.4-1). This was based on a long-term decline in the success of rockfish catch by recreational fishers targeting rockfish and by a decline in the proportion of large copper rockfish in the recreational catch. The spawning potential of rockfish in Puget Sound has declined by approximately 75 percent since the historic peak levels observed during the 1970s (PSWQAT 2002). Stout et al. (2001) conducted a biological status review of copper, quillback, and brown rockfish and concluded that current management practices and ecosystem changes could result in increased extinction risk for these species in Puget Sound.

Three species of rockfish - bocaccio, canary rockfish, and yelloweye rockfish, all have distinct populations in the Georgia Basin/Puget Sound region that were listed as threatened or endangered on April 28, 2010 (NMFS 2009b, 2010b). Bocaccio occur on a variety of substrates and were historically most common in south Puget Sound. Yelloweye rockfish are most abundant in rocky areas of north Puget Sound. Canary rockfish are broadly distributed in Puget Sound on coarse or rocky substrates. All occur in relatively deep water, especially on rocky reefs, and as such there is little overlap between the Proposed Action activities and known or otherwise suitable habitats of these three species. Accordingly, the Navy has concluded that the Proposed Action is not likely to adversely affect these species, and the NMFS draft BO reaches the same conclusion.

<u>Cod, Hake, Pollock, Sablefish, and Lingcod</u>

Pacific cod are found in continental shelf and upper continental slope waters and are widely distributed in the coastal North Pacific, from the Bering Sea and Alaska south to Santa Monica, California in the east and the Sea of Japan in the west (Hart 1973; Department of Fisheries and Oceans Canada [DFOC] 2001). Garrison and Miller (1982) reported that all Pacific cod life stages are found in various bays in Puget Sound and in the Strait of Juan de Fuca. Adults occur as deep as 2,871 ft (875 m), but the majority occurs from 164 to 984 ft (50 to 300 m). They are typically associated with mixed-coarse and mixed-fine sand substrata on the bottom of Puget Sound (Matthews 1987). Pacific cod migrate from shallow waters in spring and summer to deeper waters in fall and winter. Sexual maturity is reached by 2 to 3 years of age (DFOC 2001) and spawning occurs at depths of 131 to 869 ft (40 to 265 m) from late fall to early spring in Puget Sound (Garrison and Miller 1982). Eggs and larvae are found over the continental shelf between Washington and central California from winter through summer (Dunn and Matarese 1987; Palsson 1990). Small juveniles usually settle into intertidal and subtidal habitats, commonly associated with sand and eel grass, and gradually move into deeper water with increasing age (Miller et al. 1976; NOAA 1990).

The status of Pacific cod in Puget Sound is based primarily on recreational and commercial fishery statistics since 1970 and bottom trawl surveys that were conducted throughout Puget Sound in 1987, 1989, and 1991. A biological review identified several concerns: 1) the apparent loss of the major, known spawning locations in Puget Sound; 2) general synchronicity in declining trends in cod abundance from Puget Sound to Southeast Alaska; and 3) relatively little quantitative information or understanding about the effects of potential risk factors (Gustafson et al. 2000).

Pacific hake or whiting range from the Gulf of California to the Gulf of Alaska (Hart 1973). The offshore stock of Pacific hake is migratory and inhabits the continental slope and shelf within the California current system from Baja California to British Columbia (Quirollo 1992). There are three smaller inshore stocks with much smaller ranges: a Puget Sound stock, a Strait of Georgia stock, and a dwarf stock limited to waters off Baja California (Bailey et al. 1982; Stauffer 1985). In the Strait of Georgia and Puget Sound, Pacific hake are the most abundant resident fish. Inshore stocks spawn in locations near major sources of freshwater inflow and spend their entire lives in these estuaries (McFarlane and Beamish 1985, 1986; Pedersen 1985; Shaw et al. 1990). Pelagic eggs of Puget Sound Pacific hake are found at depths of 164 to 246 ft (50 to 75 m) (Bailey 1982; Moser et al. 1997). Juveniles reside in shallow coastal waters, bays, and estuaries (Bailey 1981; Bailey et al. 1982) and move to deeper water as they get older (NOAA 1990).

Pacific hake biomass in U.S. coastal waters increased to a historical high in 1987, declined for several years after, then stabilized briefly between 1995 and 1997, but then declined continuously to its lowest point in 2001 (Helser et al. 2004). Since 2001, stock biomass has increased substantially and rebuilt to the target level of abundance.

Walleye pollock are found in the northwestern Pacific Ocean along the Canadian and U.S. west coast from Carmel, California north to the Gulf of Alaska (Hart 1973). They are generally a semi-demersal (associated with the seabed) species that inhabit the continental shelf and slope from 328 to 984 ft (100 to 300 m). Through various life history stages they are capable of inhabiting nearshore areas, large estuaries (e.g., Puget Sound), coastal embayments, and open ocean basins. The WDFW recognizes two stocks of walleye pollock in Puget Sound (North Sound and South Sound) which are differentiated by spawning location, growth rates, and other biological characteristics (Palsson et al. 1997). They reportedly form spawning aggregations on localized grounds in Puget Sound during March and April at depths of 361 to 476 ft (110 to 145 m) (Pedersen and DiDonato 1982). Larvae and small juveniles are pelagic, and are generally found in the upper water column to depths of 197 ft (60 m) (Garrison and Miller 1982; Bailey et al. 1999). Juvenile pollock have been found in a variety of habitat types, including eelgrass (over sand and mud), gravel, and cobble (Miller et al. 1976).

Sablefish inhabit shelf and slope waters to depths greater than 4,900 ft (1,494 m) from central Baja California to Japan and the Bering Sea. Spawning occurs from January to March along the continental shelf at depths greater than 3,281 ft (1,000.0 m). Larval sablefish are found in surface waters over the shelf and slope from April to May. Juveniles are commonly encountered in shallower waters, including Puget Sound (Hart 1973).

Lingcod are demersal fish that range from Baja California to Kodiak Island in the Gulf of Alaska (Hart 1973). In Puget Sound, adult lingcod live on and adjacent to rocky bottoms and reefs while juveniles are found on sandy bottom areas adjacent to rocky reefs (Matthews 1987). Spawning occurs between December and March with eggs laid in rocky crevices in shallow areas with strong water motion. After dispersing from their nests, larvae spend two months in pelagic habitat. In late spring-early summer, juveniles move to demersal habitats and settle in shallow-water vegetated habitats (Cass et al. 1990; West 1997). It is likely that juveniles use nearshore habitats for shelter and feeding.

Flatfish

At least 13 species of flatfish occur in Washington waters and include the Pacific halibut, butter sole, rock sole, curlfin sole, Dover sole, flathead sole, English sole, petrale sole, sand sole, rex sole, starry flounder, and Pacific sanddab. Most flatfish are demersal species associated with shallow, soft-bottom (sand and mud) habitats in Puget Sound and Washington coast waters (Emmett et al. 1991). They spawn offshore between September and April (Kruse and Tyler 1983). Larvae are found in nearshore habitats between March and May. Juveniles are found throughout the year in gravel, sand-eelgrass, and mud-eelgrass habitats. English sole is the most numerous flatfish in Puget Sound.

Sharks and Skates

Species of sharks and skates that are known to occur in Washington waters include the spiny dogfish, big skate, and longnose skate. The spiny dogfish occurs worldwide in temperate seas and on the Pacific Coast occurs from the Aleutian Islands to central Baja. It is frequently encountered over rocky reefs up to 2,953 ft (900 m) deep and is known to inhabit estuarine, coastal, and offshore waters. Tagging studies have indicated that they are capable of long migrations and have been documented to travel 4,350 mi (7,001 km) from British Columbia to Japan. The spiny dogfish is ovoviviparous (eggs or embryos develop inside the maternal body, but do not receive nutritive or other metabolic aids from the parent; offspring are released as miniature adults). They have a slow maturity rate (around 12 years) which makes them highly vulnerable to overfishing (Elasmodiver 2006).

The big skate is found in temperate waters of the eastern Pacific Ocean including the eastern Bering Sea and Aleutian Islands, west to Unalaska Island and south to Baja, California. It inhabits waters from the intertidal to depths of 394 ft (120 m) and can be found along the coast in estuaries, bays, and over the continental shelf (Florida Museum of Natural History 2006).

The longnose skate was once frequently encountered in British Columbia and Washington but are now uncommon from Alaska to Southern California. The longnose skate is generally found on gently sloping sand and mud bottoms at depths of 66 to 1,968 ft (20 to 600 m) and inhabits coastal areas, estuaries, bays, and continental shelves (Elasmodiver 2006).

Sharks and skates form part of the demersal and near-bottom fish communities in Puget Sound and are not classified as food fish. These species are often caught as bycatch in groundfish fisheries. Stock status of these species in Washington is unknown.

3.4.1.3 Highly Migratory Species

The term "highly migratory species" (HMS) derives from Article 64 of the United Nations Convention on the Law of the Sea. Although the Convention does not provide an operational definition of the term, an annex to it lists species considered highly migratory by parties to the Convention. In general, these species have a wide geographic distribution, both inside and outside the 200-mile Exclusive Economic Zone (EEZ) zones of countries, and undertake migrations of significant but variable distances across oceans for feeding or reproduction. They are pelagic species, which means they do not live near the sea floor, and mostly live in the open ocean, although they may spend part of their life cycle in nearshore waters. The HMS FMP authorizes the Fishery Management Council to actively manage 13 species, of which 3 may occur within the QUTR Site Extension Area:

- Tunas: north Pacific albacore and northern bluefin
- Sharks: common thresher

These highly migratory species are harvested by U.S. commercial and recreational fishers and by foreign fishing fleets. Only a small fraction of the total harvest is taken within U.S. waters.

3.4.1.4 Salmonids

Salmonids are anadromous fish species that spend at least part of their adult life in the ocean but return to freshwater environments to spawn. They include all five species of Pacific salmon, cutthroat trout, steelhead, bull trout, and eulachon, all of which may inhabit one or more of the action areas for periods of time. Specific information for each action area exists for most species of salmon, but information is more limited for the other anadromous species. Because there are numerous stocks of salmon and/or other anadromous species that pass through each action area, a general description of their distribution and occurrence follows to avoid later repetition.

Full descriptions of Pacific Northwest salmon, steelhead, and cutthroat trout stocks, including their status, life histories and distributions can be found in Myers et al. (1998), Johnson et al. (1997), Gustafson et al. (1997), Hard et al. (1996), Weitkamp et al. (1995), Busby et al. (1996), and Johnson et al. (1999).

Although catch data are often used to determine population strength each year, the stock status of anadromous fish species is based primarily on the abundance of fish escaping through fisheries (termed escapement). Based on recent escapement trends, most Coho, chum, sockeye and pink salmon stocks in Puget Sound are generally considered to be healthy. Within the three action areas, the Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout DPS, and Hood Canal Summer-run Chum Salmon ESU are listed as threatened and have designated critical habitat, and the Coastal-Puget Sound Bull Trout DPS is threatened under the ESA (Table 3.4-2).

In addition to fishes listed in Table 3.4-2, the oceanic stages of seven federally listed anadromous fish populations are widely distributed and could occur in the open-ocean waters of the QUTR site and extension: Pacific eulachon southern DPS (discussed previously), Lower Columbia River Coho Salmon ESU, Lower Columbia River Chinook Salmon ESU, Columbia River Chum ESU, Lower Columbia River Steelhead Trout DPS, Ozette Lake Sockeye Salmon ESU, and the Green Sturgeon Southern DPS. In contrast to the Columbia River and Ozette Lake salmonids, the southern DPS of the green sturgeon, which is indistinguishable from the unlisted northern DPS, spawns in the Sacramento River, California. The green sturgeon spends most of its life in the ocean, returning to spawn every 2-5 years, and after spawning, the post-juvenile and adult stages range from Mexico to the Bering Sea (NMFS 2005g, 2006c). None of these other listed anadromous fishes occur as a breeding resident within the QUTR Site. All the other salmonids, including juvenile and adult salmonids from the Columbia River and Ozette Lake stocks would only occur during their non-breeding marine life stages. As a result, there would be no potential effects on their up- or downstream migration corridors or breeding areas. Data on the occurrence of these species within the QUTR Site or the proposed extension area are not available, so they are considered potentially present. However, the possibility that aircraft, vessels, or materials associated with the Proposed Action could harm (through physical contact) individuals or significantly interfere with their behavior in the open ocean is considered discountable. As discussed later (Section 3.4.1.6), the mid- and high-frequency acoustic transmissions of the Proposed Action would be undetectable. Since the Proposed Action poses no likelihood of harm to individuals or other interference with the oceanic life stages of these species, they are not considered further in this EIS/OEIS. The bull trout is considered further because it inhabits the shallow waters of all three action areas and has designated critical habitat in two of them (DBRC and QUTR).

Table 3.4-2 Potential Occurrence of ESA-Listed Anadromous Fish Species and Associated Critical Habitat within the Action Areas

Species	*ESA Listing Status*	*Potential Occurrence*		
		Keyport	*DBRC*	*QUTR*
Puget Sound Chinook Salmon ESU	T, CH	x	x	
Hood Canal Summer-run Chum Salmon ESU	T, CH		x	
Puget Sound Steelhead Trout DPS	T	x	x	
Coastal-Puget Sound Bull Trout DPS	T, CH	x	x	x

Notes: CH = critical habitat, T = threatened.
Sources: NMFS 1999a, 1999b, 2006b, 2007; USFWS 1999a, 2005a.

For the purposes of ESA, salmonid populations are listed in terms of ESUs or DPSs. This policy indicates that one or more naturally reproducing salmonid populations will be considered to be distinct population segment and, hence, a species under ESA, if they represent an ESU or DPS of the biological species. To be considered an ESU, a population must satisfy two criteria: (1) It must be reproductively isolated from other population units of the same species, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute but must have been strong enough to permit evolutionarily important differences to occur in different population units. The second criterion is met if the population contributes substantially to the ecological or genetic diversity of the species as a whole (NMFS 1999a). The DPS policy adopts criteria similar to, but somewhat different from, those in the ESU policy for determining when a group of vertebrates constitutes a DPS: the group must be discrete from other populations and it must be significant to its taxon (NMFS 2006b).

Chinook Salmon

The two ESUs that are relevant to this review are the Puget Sound Chinook Salmon ESU and Washington Coast Chinook Salmon ESU. Individuals from these ESUs inhabit or migrate through one or more of the action areas. The Puget Sound Chinook Salmon ESU was listed as threatened in March 1999 (NMFS 1999a); the Washington Coast Chinook Salmon ESU is not listed under the ESA. The Puget Sound ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound, and the Strait of Georgia in Washington, as well as 26 artificial propagation programs. Critical habitat was designated for the Puget Sound ESU in September 2005 to include all marine, estuarine, and river reaches accessible to listed Chinook salmon in Puget Sound (NMFS 2005b).

Chinook salmon are common throughout the Pacific Northwest. Fisheries catch data for Puget Sound Chinook salmon show that the ocean migration range extends as far north as northern British Columbia and Alaska for some populations. Some apparently spend their entire marine life within Puget Sound, but most migrate to the open ocean and north along the Canadian coast. The majority are caught inside the Strait of Juan de Fuca, the Strait of Georgia, Puget Sound, and off the west coast of Vancouver Island. Less than 1 percent is caught off the west coasts of Washington and Oregon (NMFS 2004a).

Puget Sound adult Chinook are present in nearshore marine waters from mid-July to the end of October for summer/fall-run stocks and from mid-May to late August for spring-run stocks. The majority of populations in the Puget Sound Chinook salmon migrate to the ocean within their first year following emergence and rear within Puget Sound marine waters for several months. Spring-run juveniles tend to reside longer in natal streams before their ocean migration, and to have different ocean migration patterns than do fall-run juveniles (NMFS 2004b). Chinook stocks in Puget Sound are classified as either early river entry or later river entry depending upon their timing into the river to spawn. Early river entry stocks enter the rivers from April to mid-August and spawn from September to October and later river entry stocks enter rivers from September to late November and spawn from October to December (WDFW 2003).

Many of the rivers in Puget Sound have well-developed estuaries that are important rearing areas for emigrating ocean-type smolts (NMFS 1997). Stream-type Chinook salmon move quickly through the estuary into coastal waters and ultimately to the open ocean (Healey 1983, 1991). Very limited data are available concerning the ocean migration of stream-type Chinook salmon; they apparently move quickly offshore and into the central North Pacific, where they make up a disproportionately high percentage of the commercial catch relative to ocean-type fish (Healey 1983; Myers et al. 1987). The majority of Puget Sound Chinook salmon emigrate to the ocean as subyearlings (Myers et al. 1998).

Juvenile Chinook salmon from the Washington coast emigrate to saltwater primarily as subyearlings and use the productive estuary and coastal areas as rearing habitat in part because of the limited size of many coastal watersheds, high summer water temperatures within natal streams, and low flow conditions that may be responsible for early emigration (Myers et al. 1998). Juvenile migration from the freshwater to marine environment occurs anywhere from April through September (Washington Department of Fisheries [WDF] et al. 1993; Quileute Tribe Natural Resources [QTNR] 1995). Ocean-type Chinook salmon reside in estuaries for longer periods as fry and fingerlings than do yearling, stream-type, Chinook salmon (Reimers 1973; Kjelson et al. 1982; Healey 1991). Marine tag recoveries for Washington coastal Chinook stocks show an oceanic migration pattern that takes them into British Columbia and Alaskan waters. Returning stocks of Chinook salmon from the Washington coast are primarily composed of 4- and 5-year-old fish, with a small proportion of 6-year-olds (Myers et al. 1998).

Chum Salmon

The three ESUs that are relevant to this review are the Hood Canal Summer-run ESU, Puget Sound/Georgia Strait ESU, and Pacific Coast ESU. The Hood Canal Summer-run Chum Salmon ESU was listed as threatened in March 1999 (NMFS 1999a). This ESU includes summer-run chum salmon populations in Hood Canal, Discovery Bay, and Sequim Bay within the Strait of Juan de Fuca region. The Hood Canal Summer-run Chum Salmon ESU may also include summer-run chum salmon in the Dungeness River, but the existence of that run is uncertain at this time. Critical habitat was designated for the Hood Canal ESU in September 2005 to include nearshore areas and various streams in Hood Canal and along the coast of northern Kitsap County (NMFS 2005b). The other two chum salmon ESUs are not listed under the ESA. Individuals from these three ESUs inhabit or migrate through one or more of the action areas.

Chum salmon are common throughout the Pacific Northwest. Puget Sound fall-run adult chum salmon are present in nearshore marine waters from August through January with the peak of migration taking place from October through November. Spawning takes place from November through January. Upon hatching, the juvenile chum salmon migrate rapidly to the ocean environment and spend anywhere from 2 to 7 years in the ocean before returning to their natal streams to spawn and die.

Chum salmon from rivers draining the western Olympic Peninsula display an early- and late-fall return pattern coincident with increasing fall/winter river flows. In general, river entry occurs from September through December with spawning from October (late October in Grays Harbor) to January. Spawning tends to peak in mid-November. Juvenile chum outmigration in Washington streams takes place from late January to May (Johnson et al. 1997). Chum salmon usually spawn in coastal areas, and juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their spawning beds (Salo 1991). Chum salmon, along with ocean-type Chinook salmon, usually have longer residence times in estuaries than do other anadromous salmonids (Dorcey et al. 1978; Healey 1982).

Coho Salmon

The vast majority of adult Coho salmon, from central British Columbia south, are 3-year-old fish, having spent approximately 18 months in fresh water and 18 months in salt water. Coded-wire tag recovery information has shown that Coho salmon released from Washington coastal hatcheries are recovered primarily in British Columbia (37 to 74 percent) and Washington (18 to 53 percent), with few recoveries from Oregon (3 to 16 percent) and almost none (less than 1 percent) from California or Alaska (Weitkamp et al. 1995). Coho adults from coastal Washington rivers return to their natal rivers to spawn from September to January, but have been observed as early as late-July and as late as mid-January (WDF et al. 1993). Approximate timing through nearshore marine waters for juvenile Coho from coastal Washington is May through June. Most juvenile Coho rear in the freshwater environment for up to 2 years before migrating to the ocean between mid-February through mid-July. Coho salmon is not an ESA-listed species.

Pink Salmon

Pink salmon have a 2-year life span and spawning stocks are divided into even-year and odd-year life cycles. In Puget Sound, pink salmon runs only occur during odd numbered years (Heard 1991). Offshore migrations can be extensive and fish can range thousands of kilometers from their natal streams. Upon emergence, juvenile pink salmon migrate quickly to the ocean where they spend approximately 18 months before returning to their natal stream. Puget Sound pink salmon appear to rear in nearshore areas for a few weeks to a few months before moving offshore (NMFS 2004a). Limited information is available for Washington and Puget Sound pink salmon. Pink salmon is not an ESA-listed species.

Sockeye Salmon

Sockeye salmon range from Alaska to Washington. Quinault Lake sockeye are among the most southerly population for this species. There are also sockeye stocks in Puget Sound (Lake Washington, Baker Lake, Lake Sammamish) as well as in the Columbia River drainage. With the exception of certain river-type and sea-type populations, the vast majority of sockeye salmon spawn in or near lakes, where the juveniles rear for 1 to 3 years prior to migrating to sea. Smolt migration typically begins in late April and extends through early July, with southern stocks migrating earliest. Northward migration of juveniles to the Gulf of Alaska occurs in a band relatively close to shore, and offshore movement of juveniles occurs in late autumn or winter. Sockeye salmon enter Puget Sound rivers from mid-June through August and spawn from late September to late December (Gustafson et al. 1997). None of the Puget Sound sockeye salmon are listed under the ESA. The federally listed threatened Ozette Lake Sockeye Salmon ESU spawns in the Ozette Lake watershed on the northern Olympic Peninsula (Gustafson et al. 1997; NMFS 1999c)..

Bull Trout

The only bull trout DPS that is relevant to this review is the Coastal/Puget Sound Bull Trout DPS. The Coastal/Puget Sound Bull Trout DPS was listed as threatened under the ESA in November 1999. The DPS includes all Pacific Ocean drainages in Washington State including Puget Sound (USFWS 1999a). Within this area, bull trout often occur with Dolly Varden. Because the two species are virtually impossible to visually differentiate, the WDFW currently manages bull trout and Dolly Varden together as ‘‘native char” (USFWS 1999a; WDFW 2000). Critical habitat was designated in September 2005 for the DPS to include various Olympic Peninsula streams and lakes, and nearshore marine areas along the Pacific Coast of Washington, Strait of Juan de Fuca, and Hood Canal (USFWS 2005a). Individuals from this DPS inhabit or migrate through all action areas.

Bull trout are native to waters of western North America and are found in many streams within Washington. Bull trout can exhibit a number of different life-history strategies. Stream-resident bull trout complete their entire life history in the tributary streams in which they rear and spawn. Some bull trout are migratory, spawning in tributary streams, where juvenile fish usually rear from 1-4 years before migrating to either a larger river or lake where they spend their adult life, returning to the tributary stream to spawn. Anadromous bull trout rear in natal streams for a period of time, migrate to marine environments to mature, and then return to mountain tributaries to spawn. While in marine waters, anadromous bull trout primarily occupy productive estuarine and nearshore habitat. Subadults use marine habitat to forage, generally from late spring to early fall. At maturity, anadromous bull trout begin re-entering mainstream rivers in late spring and early summer to migrate to their spawning tributaries.

Cutthroat Trout

A status review of coastal cutthroat trout stocks in Washington reported that, despite a lack of data concerning their historical and present abundance, populations in the Puget Sound and Olympic Peninsula regions were not presently in danger of extinction, nor were they likely to become so in the foreseeable future (Johnson et al. 1999). Coastal cutthroat trout range from northern California through Oregon, Washington, and British Columbia to southeastern Alaska (Hart 1973). In Washington, they are found along the Pacific Coast and Puget Sound. Coastal cutthroat trout populations show a great diversity in size and age at migration, timing of migrations, age at maturity, and frequency of repeat spawning. Generally, for the saltwater-migratory coastal cutthroat trout, juveniles migrate from freshwater natal areas in the late winter and spring to feed in marine environments (estuarine or nearshore) during the summer. They then enter freshwater in the winter to feed, seek refuge or spawn, typically returning to seawater in the spring (Johnson et al. 1999). Specific spawn timing for adult cutthroat trout is unknown, but is probably from January through April (WDFW 2002). Cutthroat trout is not an ESA-listed species.

Steelhead

The Puget Sound steelhead trout DPS was listed as threatened under the ESA in May 2007. The DPS includes all naturally spawned anadromous winter-run and summer-run steelhead populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. Steelhead trout range from southern California to the Alaskan Peninsula. Unlike salmon, steelhead may spawn more than once during their lifetime. Life history strategies can be broadly divided into two categories depending upon the season in which they return to spawn: summer-run or winter-run steelhead. Spawning stocks of summer-run and winter-run fish are present within the action area. Puget Sound summer-run fish enter fresh water between May and October and spawning occurs anywhere from December to April of the following year. Puget Sound winter-run fish enter freshwater from December through May with peak spawning occurring between March and May of the following year. Steelhead smolts can be found in the nearshore marine environment from April to June (Busby et al. 1996).

3.4.1.5 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires federal agencies to consult with NMFS on activities that may adversely affect EFH. An adverse effect, as defined by 50 CFR 600.810, is any impact that reduces the quality and/or quantity of EFH for the managed species under consideration. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components if such modifications reduce the quality and/or quantity of EFH. It is Navy policy (OPNAVINST 5090.1C, Section 24-6f) that temporary or minimal impacts, as defined below, are not considered to“adversely affect” EFH. "Temporary impacts" are those that are limited in duration and that allow the particular environment to recover without measurable impact. "Minimal impacts" are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

The Pacific Fishery Management Council (PFMC) manages the fisheries for Groundfish, Coastal Pelagic Species (CPS), and Pacific Salmon through the associated Fisheries Management Plans (FMPs) and has defined EFH for these three groups. All waters that support anadromous fish are considered EFH by NMFS (PFMC 2006c).

The groundfish covered by the PFMC’s Groundfish FMP include over 90 different species that, with a few exceptions, live on or near the bottom of the ocean (PFMC 2006d). These are made up of the following species:

- *Rockfish***.** The FMP covers 64 different species of rockfish including widow, yellowtail, canary, shortbelly, and vermilion rockfish; bocaccio, chilipepper, cowcod, yelloweye, thornyheads, and Pacific ocean perch.
- *Flatfish***.** The FMP covers 12 species of flatfish, including various soles, starry flounder, turbot, and sanddab.
- *Roundfish***.** The six species of roundfish included in the FMP are lingcod, cabezon, kelp greenling, Pacific cod, Pacific whiting (hake), and sablefish.
- *Sharks and skates***.** The six species of sharks and skates are leopard shark, soupfin shark, spiny dogfish, big skate, California skate, and longnose skate.
- *Other species***.** These include ratfish, finescale codling, and Pacific rattail grenadier.

The CPS fishery includes four finfish (Pacific sardine, jack mackerel, Pacific chub mackerel, and northern anchovy) and one invertebrate (market squid). The boundary of EFH for CPS is defined as all marine and estuarine waters from the shoreline along the coast of Washington offshore to the limits of the EEZ (200 nm [370 km] offshore) and above the thermocline where sea surface temperatures range between 50 °F and 79 °F (10 °C and 26 °C) (PFMC 1998).

EFH for highly migratory species includes all marine waters from the shoreline extending out to the full extent of the EEZ 200 nm offshore. Salmon EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington. Salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the EEZ 200 nm offshore of Washington (PFMC 2000).

Habitat Areas of Particular Concern (HAPCs) are a subset of EFH. Fishery Management Councils are encouraged to designate HAPCs under the Magnuson Act. HAPCs are identified based on habitat level considerations rather than species life stages as are identified with EFH. EFH guidelines published in Federal regulations identify HAPCs as types or areas of habitat within EFH that are identified based on one or more of the following considerations:

- The importance of the ecological function provided by the habitat.
- The extent to which the habitat is sensitive to human-induced environmental degradation.
- Whether, and to what extent, development activities are or will be stressing the habitat type.
- The rarity of the habitat type (50 CFR 600.815(a)(8)).

Based on these considerations, the PFMC has designated both ‘areas’ and ‘habitat types’ as HAPCs. In some cases, HAPCs identified by means of specific habitat type may overlap with the designation of a specific area. Designating HAPCs facilitates the consultation process by identifying ecologically important, sensitive, stressed, or rare habitats that should be given particular attention when considering potential nonfishing impacts. Their identification is the principal way in which the PFMC can address these impacts (PFMC 2005).

3.4.1.6 Hearing Abilities of Fish

Factors that must be considered in the assessment of potential impacts on fish include behavioral disturbance; acoustic effects attributable to acoustic devices; acoustic effects attributable to surface vessels, submarines, or aircraft; non-acoustic effects attributable to surface vessels, submarines, aircraft, or deployed devices (e.g., torpedoes); injury to hearing structures; and injury to non-hearing structures.

Some of the devices used by NUWC Keyport during test activities on the ranges are sometimes in excess of 230 dB re 1 μPa @1 m, and the waters in question have complex and, in some cases, rather shallow bathymetry. Near boundaries, such as the air-water interface or the sea floor, sound can interact with the boundary and with itself (after reflection). It is important to carefully consider potential acoustic impacts on fish. The possible effects of sounds produced by Navy surface and underwater vessels, aircraft, active acoustic sources, telemetry, and other systems are analyzed as are other non-acoustic effects such as chemical or fuel spills and general disruptions to fish activities.

The potential for disturbance or injury to fish depends on the nature of the sound, the hearing ability of the fish, and the species-specific response to the sound. A critical review of the state of current knowledge regarding how fish detect sounds in the environment, their hearing sensitivities, and the potential effects of sonar on fishes (Popper 2008) is provided in Appendix B. Relevant to the Proposed Action, the key conclusions of the review include the following:

- The vast majority of fishes studied to date are hearing generalists and cannot hear sounds above 0.5-1.5 kHz (depending on the species), and there are not likely to be behavioral effects on these species from higher frequency sounds.
- The few species that may hear above 1.5 kHz, including sciaenids (drums and croakers) and clupeids (including Pacific herring), have relatively poor hearing above 1.5 kHz, and are therefore unlikely to hear mid- or high-frequency sounds unless the fish and the source are very close to one another.
- Since the vast majority of sounds that are of biological relevance to fish are below 1 kHz, even if a fish detects a mid- or higher frequency sound, these sounds will not mask detection of lower frequency biological relevant sounds.
- Very intense mid- and high-frequency signals could have a physical impact on fish resulting in damage to the swim bladder (in those species that have swim bladders) and other organ systems. However, such effects could only occur when the fish is close to the source, and have never been shown for Navy sonar.

All active acoustic sources being proposed for use by the NUWC Keyport in the NAVSEA NUWC Keyport Range Complex exceed 5 kHz in frequency, with the exception of some systems like target simulators, the sub-bottom profiler, and some sonars (Table 2-10). This exceeds the hearing range of most fish species. Some sonars and the sub-bottom profiler operate at 2-45 kHz, which is higher than the best hearing range of most fishes. Some systems like the target simulators operate at 0.1 to 10 kHz but at source levels (less than or equal to 170 dB re 1 µPa@1 m) that are not expected to impact individuals or populations of fish (Smith et al. 2004a, b; Hastings and Popper 2005; Appendix B).

3.4.2 Keyport Range Site

3.4.2.1 Existing Conditions

Coastal Pelagic and Forage Fish Species

Pelagic fish species known to occur within or in the vicinity of the Keyport action area are Pacific herring, Pacific sand lance, and surf smelt. The Pacific herring stock found within Port Orchard Reach is considered depressed; status of area surf smelt and sand lance stocks is unknown. Peak spawning of Pacific herring within the area occurs from January to April (Bargmann 1998). Herring spawning areas are located along most of the shoreline in the vicinity of the action area and a holding area is located to the south (Figure 3.4-1). Surf smelt and Pacific sand lance spawning areas are also present along sections of shoreline. Surf smelt spawn in the area during the fall and winter months (WDFW 1997).

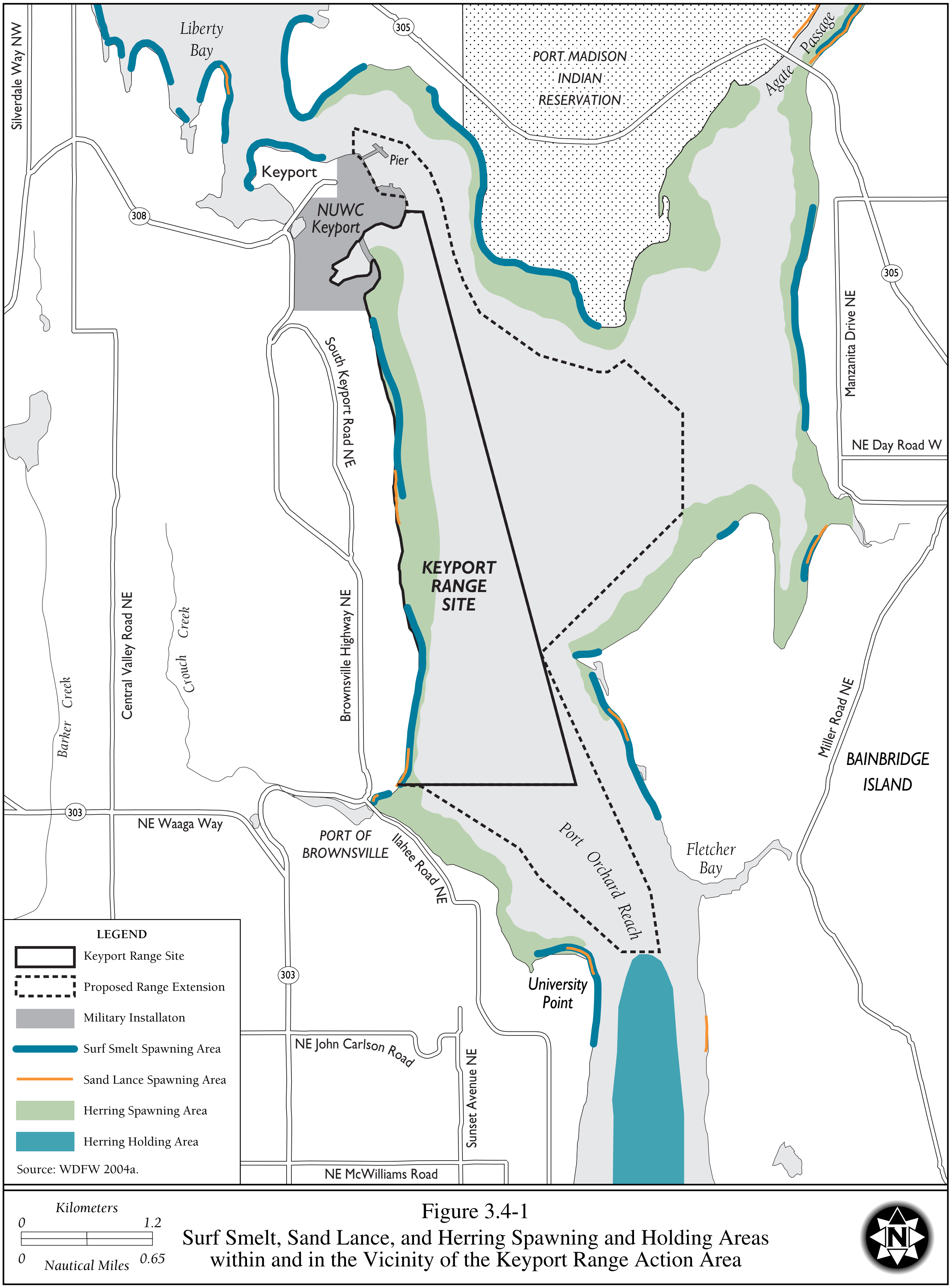


Figure 3.4-1
Surf Smelt, Sand Lance, and Herring Spawning and Holding Areas within and in the Vicinity of the Keyport Range Action Area

Groundfish

Nine species of groundfish are known to occur within or in the vicinity of the Keyport action area, and an additional 11 species occur further south in Port Orchard Reach but are expected to occur in the action area (Table 3.4-3).

Table 3.4-3 Groundfish Commonly Occurring within or in the Vicinity of the Keyport Action Area

Species	
Arrowtooth flounder	Longnose skate
Big skate	Pacific cod
Brown rockfish	Pacific hake
Butter sole	Rex sole
Cabezon	Rock sole
Copper rockfish	Sablefish
Dover sole	Sand sole
English sole	Spiny dogfish
Flathead sole	Spotted ratfish
Lingcod	Starry flounder

Sources: Miller and Borton 1980; Navy 2002a.

Essential Fish Habitat

Within Puget Sound, which includes the Keyport Range Site, EFH has been designated for 45 groundfish species, 4 CPS, and 3 salmon species (Table 3.4-4).

Table 3.4-4 Fish Species with Designated EFH in Puget Sound

Species	*Life Stage Habitat Suitability*	*Habitat Suitability Probability (HSP)*
GROUNDFISH		
Arrowtooth flounder	A, J, L, E	Moderate
Big skate	A, J, E	Very low
Black rockfish	A, J	Low
Bocaccio	A, J, L	Very low
Brown rockfish	A, J, L	High
Butter sole	A	Moderate
Cabezon	A	Moderate
California skate	A, J, E	Low
Canary rockfish	A, J	Very low
China rockfish	A, J	Very low
Copper rockfish	A	Very low
Curlfin sole	A,	Very low
Darkblotched rockfish	A, J, L	Very low
Dover sole	A, J	Low
English sole	A, J, L	Moderate
Flathead sole	A, J	Low
Greenstriped rockfish	A, J	Very low
Kelp greenling	A, L	Low
Lingcod	A, J, L, E	Low
Longnose skate	A, J, E	Moderate
Pacific cod	A, J, L, E	Low
Pacific ocean perch	A, J, L	Very low
Pacific whiting (hake)	A, J, E	Low
Petrale sole	A, J	Low

Table 3.4-4 Fish Species with Designated EFH in Puget Sound (Continued)

Species	*Life Stage Habitat Suitability*	*Habitat Suitability Probability (HSP)*
Quillback rockfish	A, J	Low
Ratfish	A, J, E	Very low
Redbanded rockfish	A	Very low
Redstripe rockfish	A	Very low
Rex sole	A, J	Low
Rock sole	A	Moderate
Rosethorn rockfish	A	Very low
Rosy rockfish	A, J	Very low
Rougheye rockfish	A, J	Very low
Sablefish	A, J, L, E	Low
Sand sole	A, J, L	Low
Sharpchin rockfish	A, J, L	Very low
Shortspine thornyhead	A, J	Very low
Spiny dogfish	A, J	Moderate
Splitnose rockfish	A, J, L	Low
Starry flounder	A, J, E	Low
Stripetail rockfish	A, J	Very low
Tiger rockfish	A	Very low
Vermillion rockfish	A	Very low
Yelloweye rockfish	A, J	Very low
Yellowtail rockfish	A, J	Very low
COASTAL PELAGIC SPECIES (CPS)		
Anchovy	A, L, E	Low
Pacific sardine	A, J, L	Very low
Market squid	A, L, E	Low
Pacific chub mackerel	A, J	Low
SALMON		
Coho	A, J	High
Chinook	A, J	High
Pink	A, J	High

Notes: A = adult, E = eggs. J = juvenile, L = larvae.
HSP scale: very low = <0.01, low = 0.01 - 0.39, moderate = 0.40 - 0.59, high = 0.60 - >0.80

Sources: PFMC 1998, 2000, 2006a, b, c.

Habitat suitability is very low for the Puget Sound DPSs of bocaccio, canary rockfish, and yelloweye rockfish, all of which were recently listed (NMFS 2009b, 2010b). Of the CPS, anchovy, Pacific sardine, market squid, and Pacific chub mackerel can be found within Puget Sound (PFMC 1998, 2006c). Within Puget Sound, EFH has been defined for Coho, Chinook, and pink salmon. Adult and juvenile Coho, Chinook, and Puget Sound pink salmon can all be found within Puget Sound and within the vicinity of the Keyport action area (PFMC 2006c).

Non ESA-Listed Salmonids

Non ESA-listed salmonid species that are known to inhabit streams flowing into Port Orchard Reach within the vicinity of the Keyport action area include chum and Coho salmon (WDFW 2004b; Pacific States Marine Fisheries Commission [PSMFC] 2006) (Figure 3.4-2).

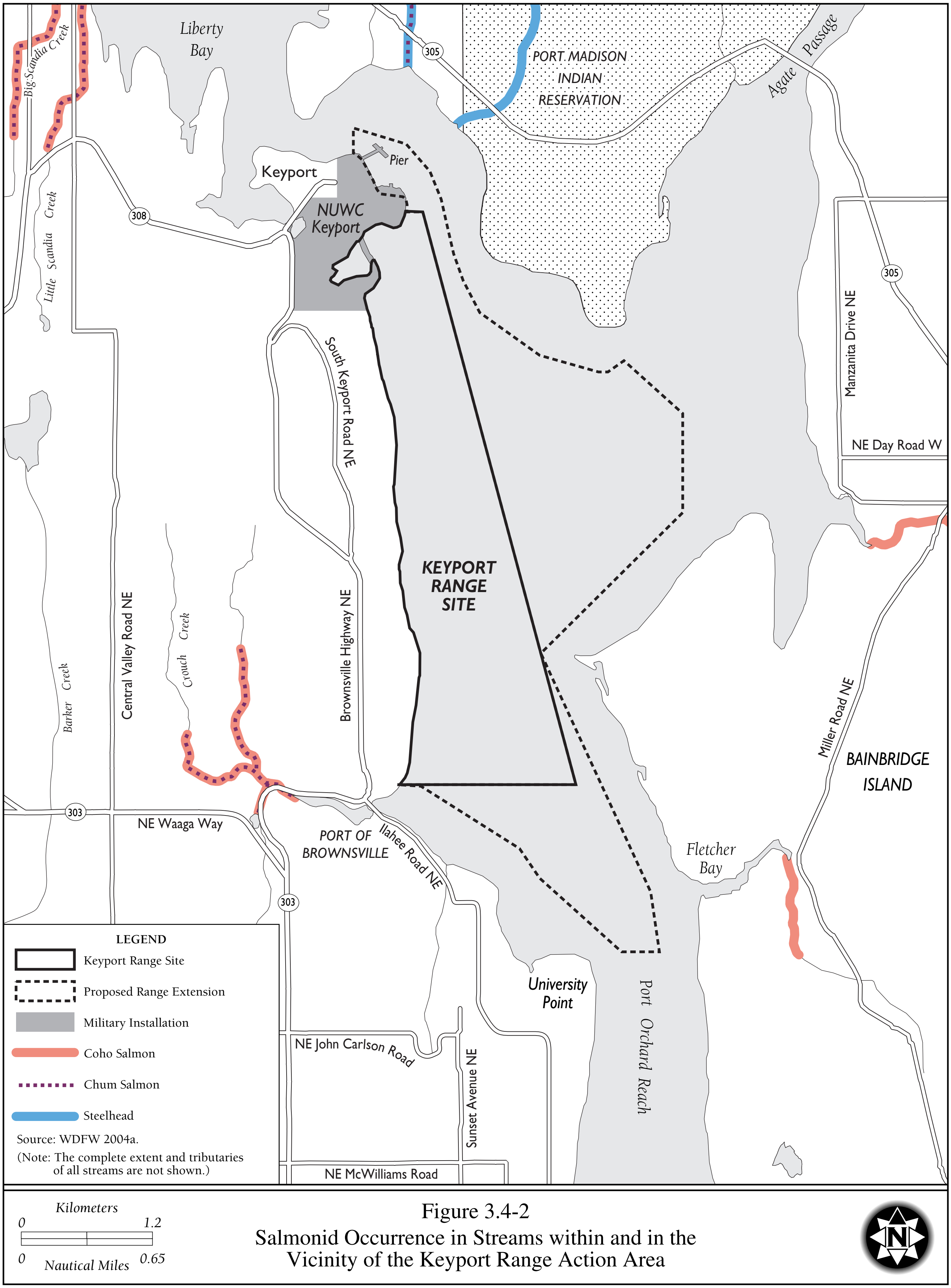


Figure 3.4-2
Salmonid Occurrence in Streams within and in the Vicinity of the Keyport Range Action Area

Chum salmon within the vicinity of the Keyport action area are considered to be part of the Dyes Inlet/Liberty Bay fall chum stock and are found in Big Scandia, Little Scandia, and Crouch creeks, as well as in an unnamed stream located north of the action area (Figure 3.4-2). Other stocks of chum might be present in the action area during their migrations to and from natal streams. The Dyes Inlet/Liberty Bay fall chum stock is considered to be healthy (Table 3.4-5). Escapement estimates based on live spawner counts in Chico, Barker, Dogfish, Clear, Steele, and Scandia creeks have ranged from 5,266 in 1997 to 75,920 in 2003 (WDFW 2003).

Table 3.4-5 Status of Non ESA-listed Anadromous Fish Stocks within the Vicinity of the Keyport Action Area

Species	*No. stocks*	*Run types*	*Stock Origin*		*Production Type*		*2002 Status*
			Mixed	*Native*	*Wild*	*Composite*	
Chum	1	Fall	x	x		x	Healthy
Coho	1	Late Fall	x			x	Healthy

Source: WDFW 2003.

Probable migration timing of juvenile and adult non ESA-listed anadromous fish species within the Keyport action area is presented in Table 3.4-6. Puget Sound fall-run chum enter their natal streams in October and November and spawn from November through January. Outmigrating juvenile fall-run chum are found in nearshore marine waters from January through the end of July. Adult Coho return from the marine environment from early August to the end of December, with spawning occurring from late October to late December. Juvenile Coho out-migration to estuarine areas occurs from mid-February through September, with a few individuals remaining as late as November (Williams et al. 1975; WDFW 2003; Dorn and Namtvedt Best 2005; May et al. 2005; Fresh et al. 2006).

Table 3.4-6 Probable Migration Timing for Non ESA-listed Anadromous Fish Stocks within the Vicinity of the Keyport Action Area

Species	*Lifestage*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Chum	Adults	▨									▨	▨	▨
	Spawning	▨										▨	▨
	Juveniles	▨	▨	▨	▨	▨	▨	▨					
Coho	Adults								▨	▨	▨	▨	▨
	Spawning										▨	▨	▨
	Juveniles		▨	▨	▨	▨	▨	▨	▨	▨			

Sources: Williams et al. 1975; WDFW 2003; Dorn and Namtvedt Best 2005.

Coho salmon within the Keyport action area are considered to be part of the East Kitsap Coho stock due to their distinct spawning distribution and common history of hatchery releases, mainly from Minter Creek Hatchery (WDFW 2003). Coho populations are found in Big Scandia, Little Scandia, and Crouch creeks and in two unnamed streams on Bainbridge Island (Figure 3.4-2). Other Coho stocks are also likely to move through the action area. Escapement estimates for the East Kitsap Coho stock have ranged from 800 in 1992 to 18,000 in 2000. This stock is considered to be healthy (Table 3.4-5).

There are no resident populations of sockeye or pink salmon within the vicinity of the Keyport action area. However, juvenile and adult pink salmon may occur in the area during migrations to and from the Nisqually River and Puyallup River located at the head of Puget Sound. Sockeye are not likely to be found in the action area as the closest populations are in Lake Washington and Lake Sammamish in Seattle.

No known populations of anadromous cutthroat or bull trout/Dolly Varden are present within the action area, although resident populations of cutthroat trout are found in two unnamed streams north of the Keyport action area (WDFW 2003, 2004a, b; PSMFC 2006).

The status of the East Kitsap winter steelhead stock is unknown (WDFW 2003).

ESA-Listed Species and Associated Critical Habitat

As discussed previously, based on little overlap between the Proposed Action areas and the habitats of newly listed species of rockfish (NMFS 2009b, 2010b) and eulachon (NMFS 2010a), the Navy has concluded that the Proposed Action is not likely to adversely affect these species, and the NMFS draft BO reaches the same conclusion. Therefore, they are not discussed further.

Three species of ESA-listed salmonid fish species potentially occur within the Keyport action area: Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout DPS, and Coastal-Puget Sound Bull Trout DPS (Table 3.4-7). Although Chinook and bull trout are not known to occur in any streams within the vicinity of the action area (Figure 3.4-2), they may occur within marine waters.

Table 3.4-7 ESA-Listed Salmonid Fish Species and Associated Critical Habitat Potentially Occurring within the Keyport Action Area

Species	*ESA Listing Status*	*Acreage of Critical Habitat Within Proposed Range Extension**
Puget Sound Chinook Salmon ESU	T, CH	1,270
Puget Sound Steelhead Trout DPS	T	na
Coastal-Puget Sound Bull Trout DPS	T, CH	0

Notes: CH = critical habitat, T = threatened.
*na = not applicable – critical habitat has not yet been proposed for steelhead.
Sources: NMFS 1999a, 2006b, 2007; USFWS 1999a, 2005a.

Puget Sound Chinook Salmon ESU. Approximately 1,270 acres (514 ha) of the proposed Keyport Range Site extension has been designated as critical habitat for the Puget Sound Chinook Salmon ESU (Table 3.4-7, Figure 3.4-3). NMFS determined that since NUWC Keyport is subject to a final INRMP, it is not eligible for designation pursuant to section 4(a)(3)(B)(i) of the ESA (16 USC 1533(a)(3)(B)(i)). Therefore, the existing Keyport Range Site was excluded from critical habitat designation.

Critical habitat was designated in September 2005 to include all marine, estuarine, and river reaches accessible to listed Chinook salmon in Puget Sound (NMFS 2005b). In determining what areas are critical habitat, joint NMFS and USFWS regulations at 50 Code of Federal Regulations [CFR] 424.12(b) require that NMFS must consider those physical or biological features that are essential to the conservation of a given species, including space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historical geographical and ecological distribution of a species. The regulations further direct NMFS to focus on the principal biological or physical constituent elements that are essential to the conservation of the species, and specify that the known primary constituent elements (PCEs) shall be listed with the critical habitat description (NMFS 2005b).

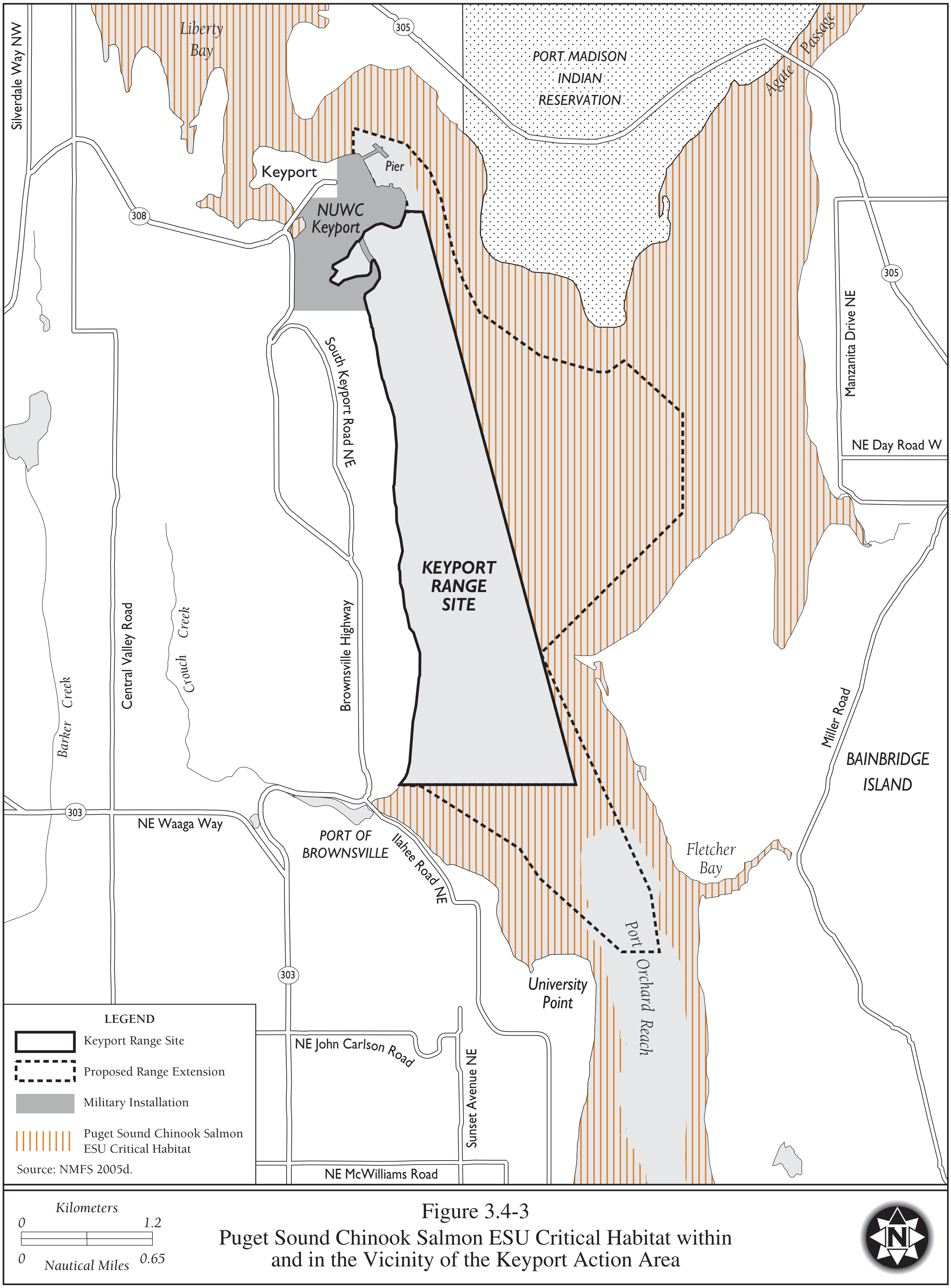


Figure 3.4-3
Puget Sound Chinook Salmon ESU Critical Habitat within and in the Vicinity of the Keyport Action Area

The regulations identify PCEs as including, but not limited to roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types (NMFS 2005b). NMFS developed a list of PCEs that are essential to the species' conservation and based on the unique life history of salmon and their biological needs. These PCEs include sites essential to support one or more life stages of the ESU (sites for spawning, rearing, migration and foraging). These sites in turn contain physical or biological features essential to the conservation of the ESU (e.g., spawning gravels, water quality and quantity, side channels, forage species). The specific PCEs include:

1. *Freshwater spawning sites* with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.
2. *Freshwater rearing sites* with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3. *Freshwater migration corridors* free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
4. *Estuarine areas* free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5. *Nearshore marine areas* free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6. *Offshore marine areas* with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Previous indices of abundance indicate mean annual escapements of about 500 Chinook of the Puget Sound ESU in Port Orchard Reach, with a trend towards increasing escapement since 1950 (Myers et al. 1998). Hatchery supplementation of fall-run Chinook into Dogfish Creek, which flows into the northern end of Liberty Bay to the north of the action area, has been intensive since the mid-1980s, with annual releases of fingerlings ranging from 175,960 to over 1.1 million. Hatchery releases in Port Orchard Reach, including Dogfish Creek, have used fall-run broodstock from within the Puget Sound ESU and no out-of-basin transfers are known to have occurred (PFMC 2004).

Table 3.4-8 provides a general summary of timing for adult and juvenile ESA-listed salmonid fish species that potentially occur within the Keyport action area. Outmigrating juvenile Chinook salmon are present primarily in shallow nearshore areas of Port Orchard Reach from February through October, with a few individuals remaining longer (Dorn and Namtvedt Best 2005; Fresh et al. 2005). Chinook are most common in spring (May et al. 2005). Returning adult Puget Sound Chinook salmon are potentially present annually in marine waters of Port Madison Bay and Port Orchard Reach from May through the end of September. Spawning generally occurs in September and October (Myers et al. 1998).

Table 3.4-8 Probable Migration Timing for ESA-Listed Salmonid Fish Species in Puget Sound

Species	*Lifestage*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Chinook	Adults					■	■	■	■	■			
	Spawning									■	■		
	Juveniles		■	■	■	■	■	■	■	■	■		
Steelhead	Adults					■	■	■	■	■			
	Spawning									■	■		
	Juveniles		■	■	■	■	■	■					
Bull Trout	Adults		No Data										
	Spawning								■	■	■	■	
	Juveniles	No Data											

Sources: Myers et al. 1998; USFWS 1999a.

Puget Sound Steelhead Trout DPS. Recently listed as threatened under the ESA, critical habitat has not been proposed for this DPS (NMFS 2007a). Winter steelhead in the vicinity of the Keyport action area are found in two unnamed streams north of the Keyport Range Site (Figure 3.4-2). Additional passing stocks of steelhead may also be present in the area during their migrations. Timing of migration of adult and juvenile steelhead within the action area is the same as that previously described for Chinook (Table 3.4-8). Although steelhead are not known to spawn in streams within the vicinity of the action area, spawning in the Puget Sound region in general occurs from August through November.

Coastal-Puget Sound Bull Trout DPS. No specific information exists for anadromous populations of bull trout in the North Kitsap Peninsula area of Puget Sound. The closest drainages containing populations of bull trout are located within the Duwamish waterway, south of Seattle, in drainages into Lake Union and Lake Washington including the Sammamish River, and within the South Fork of the Skokomish River (PFMC 2004). The possibility exists that in-migrating adults and out-migrating juveniles from the above mentioned drainages may be present in marine waters of Port Orchard Reach at certain times of the year (summer/fall for adults and spring/summer for juveniles). No designated critical habitat for the Coastal-Puget Sound Bull Trout DPS falls within the Keyport action area (USFWS 2005a).

3.4.2.2 Environmental Consequences

<u>Keyport Range Alternative 1 – Preferred Alternative</u>

Acoustic Effects. Based on current knowledge (Appendix B [Popper 2008]), none of the relatively high-frequency acoustic sources proposed for use during Navy activities are expected to have any adverse effects on fish in the Keyport action area. As stated previously, salmonids are exclusively low-frequency hearing generalists and are not sensitive above about 500 Hz. Most acoustic sources proposed for use in the Keyport action area are greater than 1 kHz except for systems like the target simulator (0.1-10 kHz), which has a signal level that is 170 dB re 1 µPa@1 m. While there are no data on effects of this particular sound on fish hearing, recent studies have shown that rainbow trout, a species in the same taxonomic genus as the Pacific salmonids and with a very similar ear structure, exposed to sounds of about 155 dB re 1 µPa (received level) noise for up to 9 months had no effect on hearing, growth, or the immune system of this species (Wysocki et al. 2007). In addition, studies on another hearing generalist, the oscar, showed that up to 1 month of exposure to band-limited noise of 170 dB re 1 µPa (received level) had no effect on hearing at all, and 100 percent of the fish survived (Smith et al. 2004a). Based on these data, it is highly likely that the only source in the Keyport action area that is audible to hearing generalists, the target simulator, will not have any impact on fish (Appendix B).

Sources greater than 200 dB re 1 µPa @ 1 m are greater than 2 kHz, which exceeds the hearing sensitivity of most fish (Appendix B). The only exceptions are some of the hearing specialists and, in the case of the Keyport action area, only clupeids, including the Pacific herring, northern anchovy, and Pacific sardine, are likely to be able to detect most of these signals (Mann et al. 2005; Appendix B). Even these species are not able to detect most of the sources in use. Since hearing sensitivity of these fish at and above 2 kHz is not great (Mann et al. 2005; Appendix B), the fish would have to be relatively close to the source for the sound to be detectable. Even if detected, the sound would be transitory and it is expected that the impact on behavior (if any) is likely to be low, and the impact on physiology far lower.

Non-Acoustic Effects. Hazardous materials may potentially be released from vessels, sonobuoys, targets, and torpedoes. Hydrocarbon spills and material released into the marine environment have the potential to impact fish and their habitats. Proposed activities within the Keyport Range Site are similar in type and scope with the DBRC Site, but with a smaller tempo and scale. The marine environment of the Keyport Range Site has more mixing with surrounding water bodies than the DBRC Site. Based upon a previous BA prepared for ongoing and future activities at DBRC (Navy 2001b), the existing non-acoustic activities conducted within the DBRC Site are not considered harmful to fish populations, particularly listed salmonid species, which are resident within or use the area during some portion of their life cycles. In their resulting concurrence letter (NMFS 2001a), NMFS concurred with the findings that the Navy activities conducted in DBRC may affect, but are not likely to adversely affect, either the species or habitat based on the analysis in the DBRC BA and the following conclusions:

1) studies have documented that past activities of the same nature have not detectably contributed to the contamination of the deepwater sediment;
2) other studies have shown that propellant from torpedoes cannot be detected in the water column;
3) based on these studies there should not be any detectable impact to critical salmon habitat; and
4) the chance of detecting impacts to the nearshore environment (where juvenile salmon can be found) is insignificant and discountable (NMFS 2001a).

The types of test vehicles, targets, propulsion systems, and other range-associated equipment proposed for use within the Keyport action area would be the same as those analyzed previously for the Keyport Range Site in support of the AUV Fest (Navy 2003b), with the addition of the ATF and the Navy Seal cold-water training, which uses a wider range of application of test vehicles, targets, propulsion systems, and other range-associated equipment. However, the types of equipment used in cold-water training have essentially the same impacts as those previously analyzed, consisting of very localized disturbances to the open water and benthic habitats that would not significantly affect fish populations (Navy 2003b). Since the proposed range extension of the Keyport Range Site contains habitat for marine fish species similar to the existing range area, the proposed range extension would likely not result in an increase in potential effects over the current non-acoustic activities. In addition, the potential effects from accidental spills of petroleum products and other harmful fluids from UUVs or support craft during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1) (Section 3.6, Sediment and Water Quality). No effects on marine organisms would result from the limited use of magnetic sensors (non-acoustic) since they are passive and do not have a magnetic field associated with them. Magnetic sources used in other range activities do generate a weak EMF that attenuates rapidly. Evaluations of EMF (Navy 2002a; 2008a) have found that the magnetic sources used in range activities produce a weak EMF, comparable to the earth's at a distance of 4 m from the source, and diminishing further with distance. Most fish apparently cannot detect an EMF, although some fish (sharks, rays, and eels) can, and may even be attracted to the source; however, no adverse effects are known or likely to occur in any case (Navy 2002a; 2008a). Therefore, activities within the proposed Keyport Range Site extension would likely not result in an increase in potential impacts on marine fish over current non-acoustic activities.

Expendable materials and other bottom disturbance would affect a very small portion of the existing area within the range site, and such effects would be temporary. The annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 76 losses of expendable materials per year over a 3.2-nm^2 (11.0-km^2) area, which represents approximately 24 expendables lost per nm^2 or 0.03 lost per acre. Because activities would occur in different areas of the Keyport Range, it is reasonable to assume that the expended materials would be randomly distributed within the range. Therefore, implementation of Keyport Range Alternative 1 within the Keyport Range Site and range extension would result in minimal impacts to marine fish or their habitat.

ESA-Listed Species and Associated Critical Habitat. The potential effects of Navy activities within the Keyport action area on the habitats of the Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout DPS, and Coastal-Puget Sound Bull Trout DPS are analyzed using an approach developed by NMFS (1996) and USFWS (1998). The analysis develops a matrix of pathways (water quality and physical and biological habitat elements) and indicators (various elements of the pathway categories) for salmonid estuarine habitat present in the action area and then characterizes the baseline environmental conditions of salmonid estuarine habitat present in the action area by level of habitat function using the matrix of pathways. Finally, the potential project effects on salmonid estuarine habitat present in the action area are characterized by their potential to restore, maintain, or degrade existing environmental baseline conditions for each habitat indicator within the matrix of pathways.

Based on the indicators for baseline environmental conditions within the action area, all pathway indicators (water quality, physical habitat elements, and biological habitat elements) are properly functioning. Evaluation of the proposed project activities within the Keyport action area found that implementation of Keyport Range Alternative 1 would not degrade any environmental indicator for salmonid estuarine habitat. The basis for these conclusions is summarized in Table 3.4-9.

Additional analysis of potential effects of the proposed Keyport Range Site extension on Puget Sound Chinook salmon critical habitat considers potential temporary or permanent, direct or indirect effects on the primary constituent elements (PCEs) that were used by the USFWS and NMFS to designate critical habitat (NMFS 2005b). As discussed previously in Section 3.4.2.1, NMFS determined that since NUWC Keyport is subject to a final INRMP, it is not eligible for designation pursuant to section 4(a)(3)(B)(i) of the ESA (16 USC 1533(a)(3)(B)(i)). Therefore, the existing Keyport Range Site was excluded from critical habitat designation.

These PCEs are included in the pathways and indicators of Table 3.4-9. Consideration of project-related impacts on these PCEs and, by extension, on designated critical habitat, indicates no temporary, permanent, direct, or indirect impacts to the PCEs associated with salmonid critical habitat within the Keyport action area. Based upon the impact analysis of NUWC Keyport range activities on the matrix of pathways and indicators for salmonid estuarine habitat and the analysis of potential effects on the critical habitat PCEs, implementation of Alternative 1 within the existing Keyport Range Site and proposed range extension would not compromise the function or relevance of any habitat indicators or critical habitat PCEs. Implementation of Keyport Range Alternative 1 would not increase fragmentation of ESA-listed salmonid populations nor decrease the function of any of the critical habitat PCEs.

Table 3.4-9 Summary of Project Effects of Proposed NUWC Keyport Activities on Salmonid Habitat Elements within or in the Vicinity of the Keyport Action Area

Pathway	*Indicator*	*Effects of the Action*
Water Quality	Turbidity, Dissolved Oxygen (DO), Water Contamination/Nutrients, Sediment Contamination	With implementation of Keyport Range Alternative 1, the temporary placement and recovery of test equipment, anchors, targets, or cabling on the bottom including sensors and tracking equipment or the action of crawler UUVs during test activities along the bottom would cause only short term, temporary increases in turbidity in the localized area. Swimmer UUVs and other test vehicles are not expected to appreciably increase turbidity as they operate in deeper water and higher in the water column, away from the bottom. Proposed activities would not decrease or have any effect on existing DO levels and water or sediment contamination within the action area. Project effects would maintain baseline water quality conditions within the Keyport action area.
Physical Habitat Features	Substrate/Armoring, Depth/Slope, Tideland Conditions, Marsh Prevalence, Refugia, Physical Barriers, Current Patterns, Salt/Fresh Water Mixing Patterns and Locations	No direct physical impacts to intertidal or shallow subtidal substrata or habitats utilized by salmonids would result from proposed activities. Project effects would maintain baseline physical habitat conditions within the Keyport action area.
Biological Habitat Features	Salmon Prey Availability, Forage Fish Community, Aquatic Vegetation, Exotic Species	Proposed NUWC Keyport activities would maintain baseline conditions of demersal prey and forage fish availability within the action area. Although epibenthic invertebrates, preyed upon by juvenile salmonids, could be affected by crawler UUVs as they move along the bottom, and by placement or recovery of test equipment, anchors, or cabling on the bottom including sensors and tracking equipment, these effects would be short term and would not result in long-term changes in prey availability or distribution. In addition, implementation of Keyport Range Alternative 1 would have no direct effect on physical habitat elements of salmonid estuarine habitats, including substrata which maintain eelgrass and macroalgae beds in the action area. Proposed NUWC Keyport activities would also have no effect that would increase the number or abundance of exotic species within the action area. Therefore, project effects would maintain baseline biological habitat elements within the Keyport action area.

Implementation of Keyport Range Alternative 1 would have localized and temporary impacts on water quality or habitats for the marine life stages of Chinook salmon, steelhead trout, or bull trout within the Keyport action area. Therefore, implementation of Keyport Range Alternative 1 may affect, but is not likely to adversely affect, individuals of the Puget Sound Chinook salmon ESU, Puget Sound steelhead trout DPS, the Coastal Puget Sound bull trout DPS, or on designated critical habitat for Puget Sound Chinook salmon ESU. Any such effects would be temporary and localized to the immediate area of the activity and would be unlikely to cause harm to individuals or have a persistent effect on numbers and distribution of the species. USFWS concurred with Navy findings on Coastal Puget Sound Bull Trout DPS and its critical habitat (USFWS 2010).

Essential Fish Habitat. As discussed previously and below (Table 3.4-9), there would be minimal and temporary effects, if any, to water quality and the physical and biological elements of marine or freshwater habitats within the Keyport action area. Activities within the proposed range extension would take place over a larger area but impacts to EFH would continue to be the same to those from current activities within the existing Keyport Range Site. A previous EA covering activities within the proposed Keyport Range extension concluded that these activities would have no adverse effects on water quality and the physical and biological constituents of EFH (Navy 2003b). Use of the ATF and special forces cold-water training do not involve new or different impacts. Therefore, implementation of Keyport

Range Alternative 1 would not adversely affect EFH; any effects would be minimal and temporary and would not reduce the quality or quantity of EFH for any managed species.

No-Action Alternative

Under the No-Action Alternative, current activities would continue within the existing boundaries of the Keyport Range Site. Impacts of increased NUWC Keyport activities within the existing Keyport Range site were analyzed in the previous analysis of Keyport Range Alternative 1. In addition, this area was previously analyzed in the AUV Fest EA, with the conclusion that there would be only localized, temporary disturbances to benthic habitats, resulting in very minor effects on turbidity (Navy 2003b). The analysis concluded there would be no significant impacts on marine fish in general, and no effects on salmonids or EFH. The Puget Sound Steelhead Trout DPS was not listed as threatened under the ESA until 2007, but the same conclusions reached previously regarding salmonids in general would still apply. Therefore, the No-Action Alternative with fewer activities than covered in the AUV Fest EA would result in minimal impacts to fish, no effects on ESA-listed species, and no adverse effect on EFH.

3.4.2.3 Mitigation Measures

Since there would be minimal temporary impacts to marine fish and no adverse effect on EFH from implementing Keyport Range Alternative 1 or the No-Action Alternative, no mitigation measures would be necessary. As a matter of standard practice, to the extent practicable the Navy retrieves expendable materials and avoids and minimizes any loss or discharge of materials incidental to RDT&E and training activities (OPNAVINST 5090.1 series). No further measures are necessary to protect fish and EFH during the proposed activities. Although it is the Navy's conclusion that none of the alternatives would have an adverse effect on Essential Fish Habitat (EFH) that would require mitigation under the Magnuson-Stevens Fishery Conservation and Management Act, the Navy has considered NMFS' EFH conservation recommendations and is in discussion with NMFS regarding appropriate EFH conservation measures that could be implemented (Appendix H).

Neither the final USFWS BO nor the draft NMFS BO identified adverse effects that would be likely to occur for ESA-listed fish species. To the extent practicable, NUWC Keyport will comply with any reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

3.4.3 DBRC Site

3.4.3.1 Existing Conditions

Coastal Pelagic and Forage Fish Species

Pelagic fish species which are known to occur in the Hood Canal and DBRC action area are Pacific herring, Pacific sand lance, and surf smelt. There are three stocks of Pacific herring in Hood Canal: Port Gamble, Quilcene Bay, and South Hood Canal. Two stocks (Quilcene Bay and Port Gamble) are considered healthy and one (South Hood Canal) has an unknown status (Bargmann 1998). Stock status for Pacific sand lance and surf smelt within the action area is unknown (Bargmann 1998).

Within the existing DBRC Site, herring spawning areas are found along the northwestern side of Hood Canal, Quilcene Bay, and along the south side of Hood Canal near Seabeck (Figure 3.4-4). Peak spawning time for Hood Canal herring is from January to April (Bargmann 1998). A herring holding area is also present near the Hood Canal Bridge. Pacific sand lance and surf smelt are also known to spawn in Dabob Bay and northern Hood Canal (Figures 3.4-5 and 3.4-6). In Puget Sound and Hood Canal, Pacific sand lance spawn from approximately the beginning of November to mid-February/late-March. In Puget Sound and Hood Canal, surf smelt spawn in upper intertidal areas in the fall and winter (Navy 2002a).

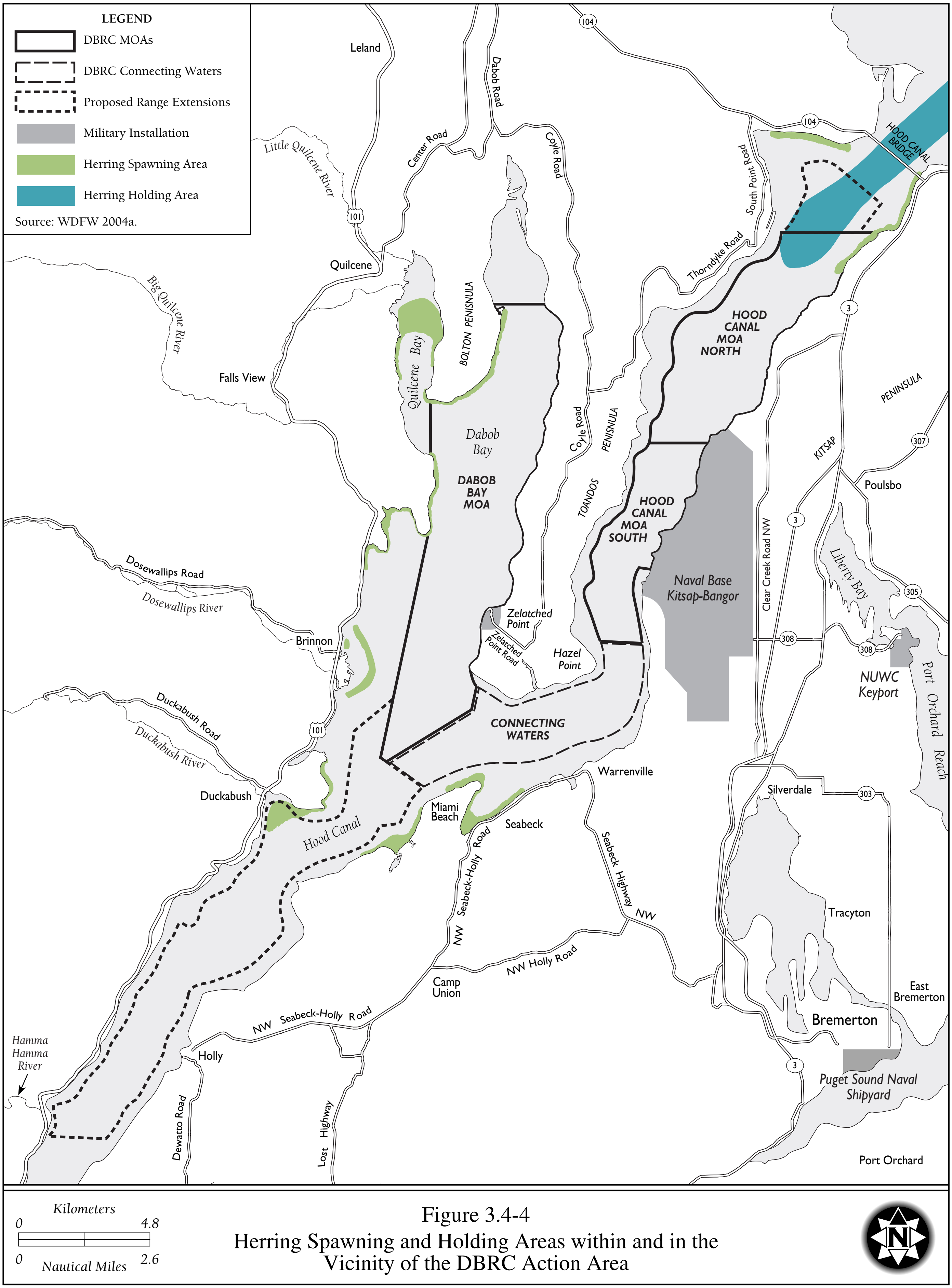


Figure 3.4-4
Herring Spawning and Holding Areas within and in the Vicinity of the DBRC Action Area

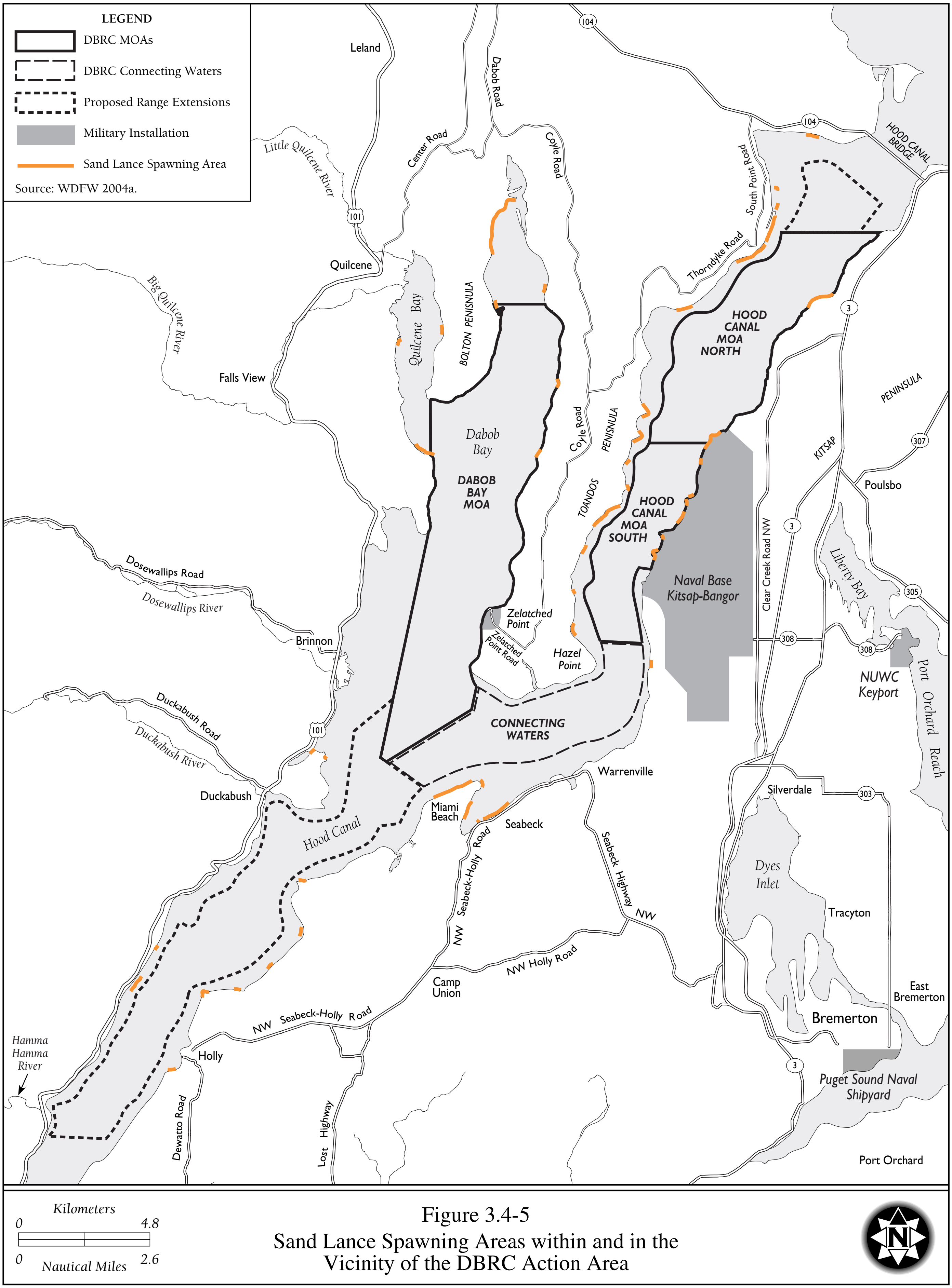


Figure 3.4-5
Sand Lance Spawning Areas within and in the Vicinity of the DBRC Action Area

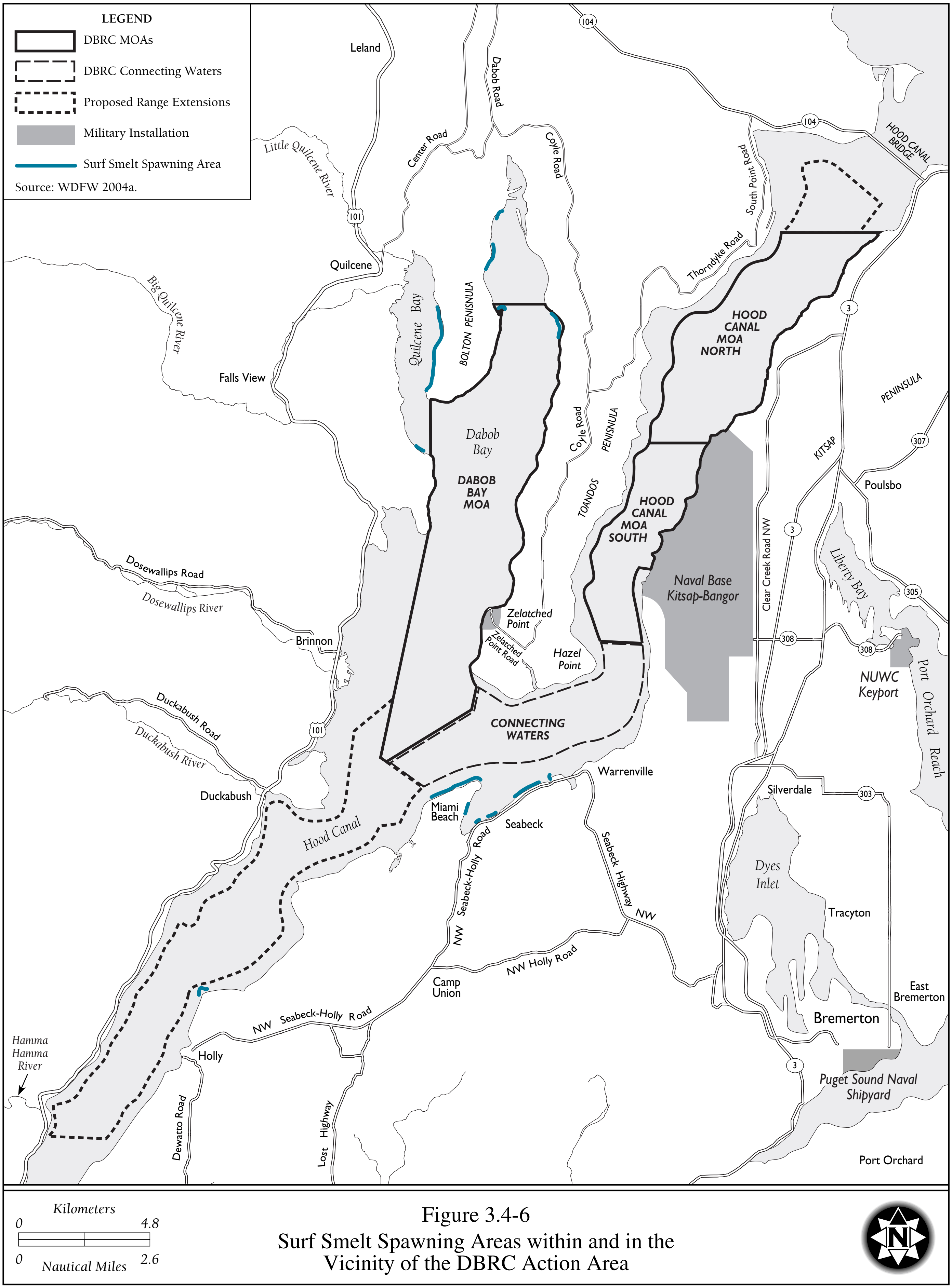


Figure 3.4-6
Surf Smelt Spawning Areas within and in the Vicinity of the DBRC Action Area

Groundfish

Thirty species of groundfish are known to occur within Dabob Bay and Hood Canal (Table 3.4-10).

Table 3.4-10 Groundfish Occurring within or in the Vicinity of Hood Canal

Species	
Arrowtooth flounder	Pacific hake
Big skate	Pacific sanddab
Black rockfish	Petrale sole
Bocaccio	Quillback rockfish
Brown rockfish	Redstripe rockfish
Butter sole	Rex sole
Cabezon	Rock sole
Copper rockfish	Sablefish
Dover sole	Sand sole
English sole	Spiny dogfish
Flathead sole	Splitnose rockfish
Greenstriped rockfish	Spotted ratfish
Lingcod	Starry flounder
Longnose skate	Stripetail rockfish
Pacific cod	Yellowtail rockfish

Sources: Miller and Borton 1980; Navy 2002a.

Essential Fish Habitat

Those fish species with designated EFH within Hood Canal include the same species previously discussed for Puget Sound and the Keyport action area (Section 3.4.2.1 and Table 3.4-4), and the same considerations apply regarding very low habitat suitability for the three rockfish DPSs currently proposed for listing (NMFS 2009b).

Non ESA-Listed Salmonids

Non ESA-listed salmonid species which are known to inhabit streams within Hood Canal include Coho salmon, fall-run chum salmon, pink salmon, and searun cutthroat trout (WDFW 2004b) (Figure 3.4-7). The ESA-listed stocks of Chinook, summer-run chum, and steelhead are discussed below in a separate subsection.

A total of nine stocks of Coho salmon have been identified within Hood Canal and include Coho populations in the Duckabush, Southwest Hood Canal, Skokomish, Southeast Hood Canal, Dewatto, Northeast Hood Canal, Quilcene/Dabob Bays, Dosewallips, and Hamma Hamma systems. Of these nine stocks, six (Duckabush, Southwest Hood Canal, Skokomish, Southeast Hood Canal, Dewatto, and Northeast Hood Canal) are considered healthy, one (Quilcene/Dabob Bays) is considered depressed, and two (Dosewallips and Hamma Hamma) have an unknown status (Table 3.4-11) (WDFW 2002, 2003).

There are 10 stocks of fall-run chum (early and late runs) identified in the DBRC action area including populations from Northeast Hood Canal, Dewatto, Southeast Hood Canal, West Hood Canal, Upper Skokomish, Quilcene, Dosewallips, Duckabush, Hamma Hamma, and Lower Skokomish. Of these 10 stocks, nine have been rated as healthy (Northeast Hood Canal, Dewatto, Southeast Hood Canal, West Hood Canal, Upper Skokomish, Quilcene, Dosewallips, Duckabush, and Hamma Hamma), and one has an unknown status (Lower Skokomish) (Table 3.4-11) (WDFW 2002, 2003).

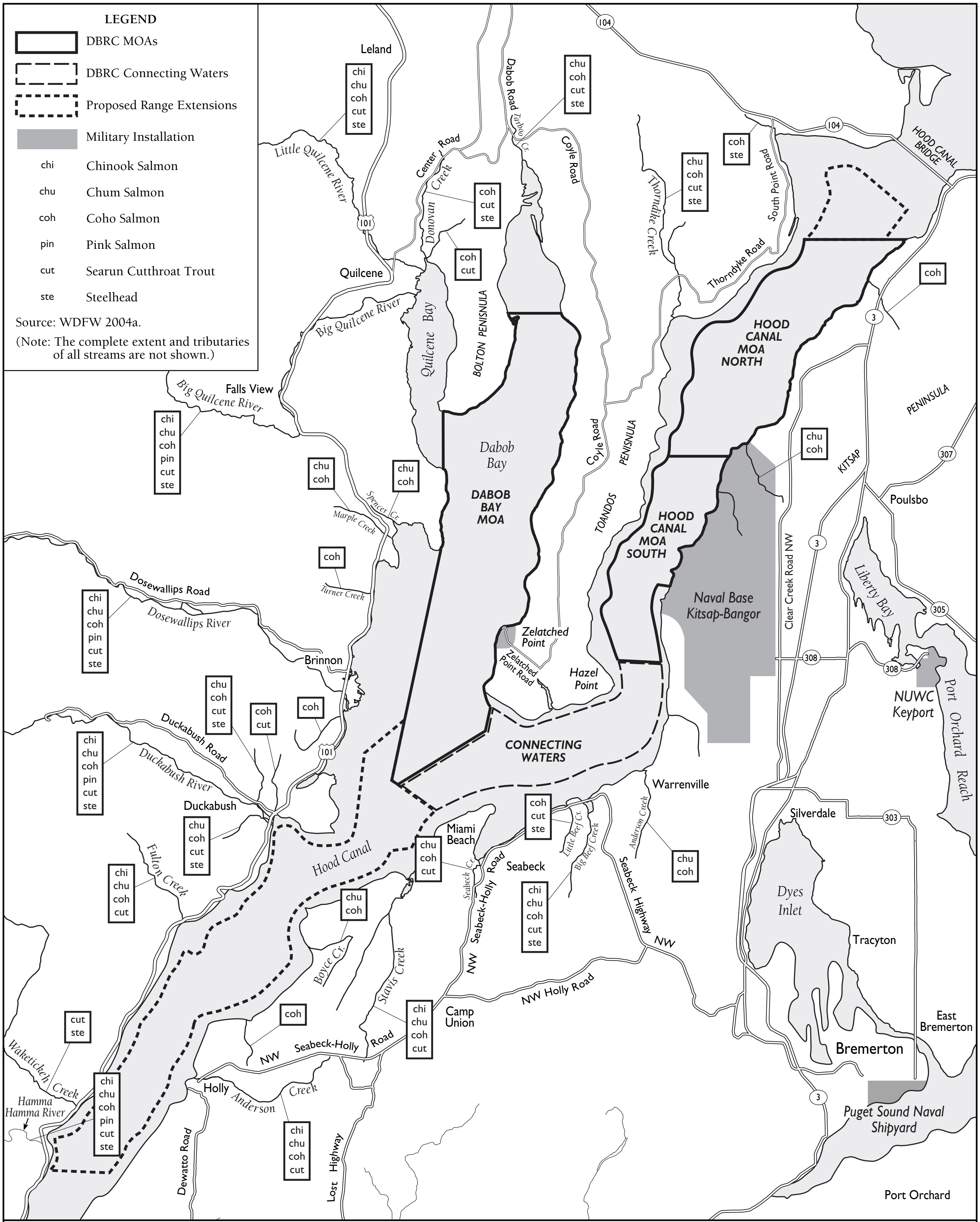


Figure 3.4-7
Salmonid Occurrence in Streams within and in the Vicinity of the DBRC Action Area

Table 3.4-11 2002/2003 Status of Non ESA-listed Salmonid Fish Stocks in Hood Canal

Species (Run type)	*No. stocks*	*Stock Origin*			*Production Types*		*2002 Status*
		Mixed	*Native*	*Non-native*	*Wild*	*Composite*	
Coho (late fall)	9	x	x	x	x	x	6-Healthy; 1-Depressed; 2-Unknown
Chum (fall)	10	x	x		x	x	9-Healthy; 1 Unknown
Pink (fall)	3		x		x		1-Healthy; 2-Depressed
Cutthroat (winter-spring)	2		x		x		2-Unknown

Sources: Williams et al. 1975; Blakley et al. 2000; WDFW 2002, 2003; NMFS 2004a.

Three stocks of pink salmon are present within the action area consisting of populations in the Hamma Hamma, Duckabush, and Dosewallips systems. One stock (Hamma Hamma) is considered healthy and two (Duckabush and Dosewallips) are considered depressed (Table 3.4-11) (WDFW 2002, 2003).

Anadromous cutthroat trout within the action area have been divided into two stock complexes: East Hood Canal and West Hood Canal. The East Hood Canal stock complex is composed of coastal cutthroat trout in drainages flowing from the Kitsap Peninsula into Hood Canal and in independent tributaries to Hood Canal south of the Union River. Drainages include several unnamed tributaries, Jump Off Joe Creek, Little Anderson Creek, Big Beef Creek, Little Beef Creek, Seabeck Creek, Stavis Creek, Boyce Creek, Anderson Creek, Dewatto River, Tahuya River, Shoofly Creek, Stimson Creek, Big and Little Mission Creeks, and the Union River (Blakley et al. 2000).

The West Hood Canal stock complex consists of coastal cutthroat trout in drainages flowing into Hood Canal from the northeastern part of the Olympic Peninsula south to the Skokomish River. Drainages include Skokomish, Hamma Hamma, Duckabush, Dosewallips, Big and Little Quilcene rivers, Shine, Thorndyke, Tarboo, Donovan, McDonald, Fulton, Schaerer, Wacketickeh, Jorsted, Eagle, Lilliwaup, Sund, Miller, Clark, Finch and Hill creeks, as well as numerous independent drainages (Blakley et al. 2000). Both stocks are native in origin and are produced in the wild. Stock status is classified as unknown (Table 3.4-11) (Blakley et al. 2000).Coho and chum adults return from the ocean to spawn in streams and rivers within Hood Canal and can be found in nearshore marine waters from early August to December/January. Spawning occurs from October through January. Juvenile Coho and chum can be found in the nearshore areas of Dabob Bay and Hood Canal from January through July (Williams et al. 1975) (Table 3.4-12).

Returning adult pink salmon can be found in nearshore marine waters of Hood Canal from mid-July through mid-October. Juvenile pink salmon can be found in the nearshore areas of Dabob Bay and Hood Canal from January through mid-June, with the peak generally occurring during March and April. Some populations of Puget Sound pink salmon and possibly some from Hood Canal spend their entire marine phase in the nearshore marine environment (Jewell 1966; Heard 1991). Spawning occurs in September and October (Table 3.4-12).

Coastal cutthroat trout are present in several tributary streams to Hood Canal from January through April. Stock status is unknown (Table 3.4-12) (Blakley et al. 2000). Specific information on juvenile cutthroat trout migration is unknown for the action area. Spawning occurs from January through April (Table 3.4-12).

Table 3.4-12 Probable Migration Timing for Non ESA-listed Salmonid Fish Stocks in Hood Canal

Species	*Lifestage*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Coho	Adults								■	■	■	■	■
	Spawning	■									■	■	■
	Juveniles		■	■	■	■	■	■					
Chum (fall-run)	Adults	■							■	■	■	■	■
	Spawning	■										■	■
	Juveniles	■	■	■	■	■	■	■					
Pink	Adults							■	■	■	■		
	Spawning									■	■		
	Juveniles	■	■	■	■	■	■						
Coastal Cutthroat	Adults	■	■	■	■								
	Spawning	■	■	■	■								
	Juveniles	Data not available											

Sources: Williams et al. 1975; WDFW 1999; Blakley et al. 2000.

ESA-Listed Species and Associated Critical Habitat

As discussed previously, based on little overlap between the Proposed Action areas and the habitats of newly listed species of rockfish (NMFS 2009b, 2010b) and eulachon (NMFS 2010a), the Navy has concluded that the Proposed Action is not likely to adversely affect these species, and the NMFS draft BO reaches the same conclusion. Therefore, they are not discussed further.

Four species of ESA-listed anadromous fish species potentially occur within the DBRC action area: Puget Sound Chinook Salmon ESU, Hood Canal Summer-run Chum Salmon ESU, Puget Sound Steelhead Trout DPS, and Coastal-Puget Sound Bull Trout DPS. The existing DBRC was excluded from previous critical habitat designations and critical habitat has not yet been proposed for steelhead trout (Table 3.4-13). In addition, critical habitat has been designated within the proposed DBRC northern and southern range extensions for the Puget Sound Chinook Salmon ESU, Hood Canal Summer-run Chum Salmon ESU, and Coastal-Puget Sound Bull Trout DPS.

Table 3.4-13 ESA-Listed Anadromous Fish Species and Associated Critical Habitat Potentially Occurring within the DBRC Action Area

Species	*ESA Listing Status*	*Acreage of Critical Habitat within Proposed Range Extensions*
Puget Sound Chinook Salmon ESU	T, CH	915
Hood Canal Summer-run Chum Salmon ESU	T, CH	915
Puget Sound Steelhead Trout DPS	T	na
Coastal-Puget Sound Bull Trout DPS	T, CH	347

Notes: CH = critical habitat, T = threatened.
Sources: NMFS 1999a, 1999b, 2006b, 2007; USFWS 1999a, 2005a.

Puget Sound Chinook Salmon ESU. Approximately 915 acres (370 ha) of critical habitat for the Puget Sound Chinook Salmon ESU has been designated within the nearshore marine/estuarine waters of the proposed DBRC northern and southern range extensions (Table 3.4-13, Figure 3.4-8). The nearshore marine area includes that zone from extreme high water out to a depth of 98 ft (30 m) and adjacent to watersheds occupied by the ESU. Since deeper waters are occupied by subadult and maturing fish, during the designation of critical habitat it was unclear if these areas contain PCEs that required special management considerations or protection (NMFS 2004b). Although a number of watersheds have also been designated as critical habitat (e.g., Hamma Hamma River, Dosewallips River, Duckabush River) (NMFS 2005b), since the proposed range extensions and range activities would only occur within the marine waters of Hood Canal, for the purposes of this EIS these watersheds are not included.

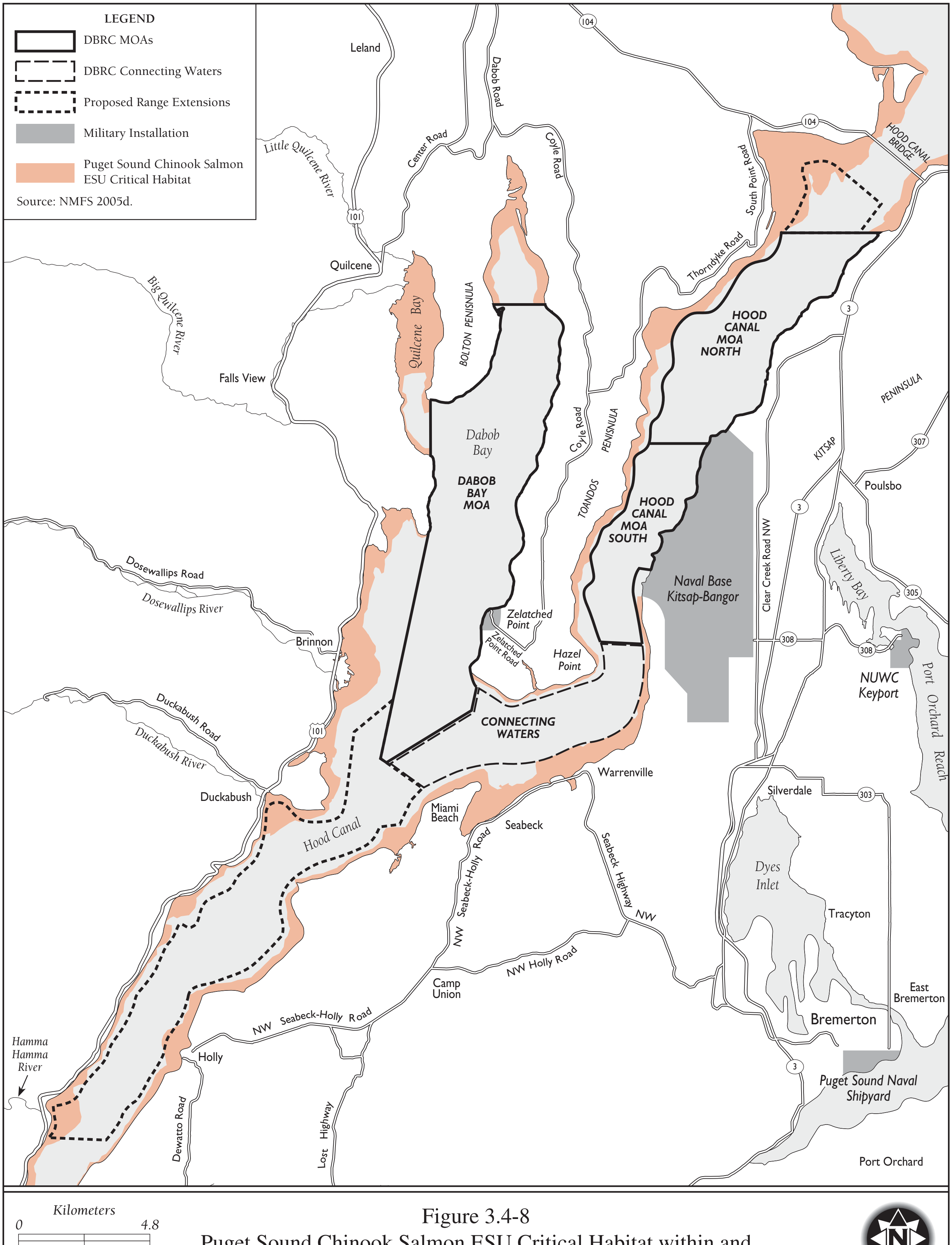


Figure 3.4-8
Puget Sound Chinook Salmon ESU Critical Habitat within and in the Vicinity of the DBRC Action Area

Two stocks from the threatened Puget Sound Chinook Salmon ESU have been identified within Hood Canal. Occurring within the vicinity of the DBRC action area, the Mid-Hood Canal stock encompasses Chinook populations in the Hamma Hamma, Dosewallips, Quilcene, and Duckabush watersheds (NMFS 2004a; WDFW 2004b). The Mid-Hood Canal stock was rated as critical in 2002 (Table 3.4-14). Total escapement estimates based on spawning bed counts and/or live spawner counts in Hamma Hamma, Duckabush and Dosewallips have ranged from 24 in 1996 to 762 in 1999 (WDFW 2002, 2003).

Table 3.4-14 Status of ESA-listed Anadromous Fish Stocks in Hood Canal

Species	*No.*	*Stock Origin*			*Production Types*			
(run type)	*stocks*	*Mixed*	*Native*	*Unk.*	*Wild*	*Composite*	*Unk.*	*2002 Status*
Chinook (summer/fall)	2	x				x		1-Depressed; 1-Critical
Chum (summer)	12		x		x	x		1-Healthy; 4-Depressed; 1-Critical; 6-Extinct
Steelhead (8 winter, 3 summer)	11		x	x	x	x	x	6-Depressed; 5-Unkown
Bull Trout/Dolly Varden (fall/winter)	1*		x		x			1-Unknown

Note: *Bull Trout/Dolly Varden are separated into three distinct stocks but only one stock is considered anadromous.
Sources: Williams et al. 1975; WDFW 2002, 2003; NMFS 2004a.

The Skokomish Chinook stock, south of the proposed southern range extension, encompasses populations in the mainstream Skokomish, in the lower portions of the North and South forks of the Skokomish, and in Purdy, Vance and Hunter creeks. Total escapement estimates (including natural and hatchery produced Chinook) for the Skokomish Chinook stock have ranged from 1,119 in 1992 to 11,159 in 2003. The Skokomish Chinook stock was rated as depressed in 2002 because of chronically low natural escapements (Table 3.4-14) (WDFW 2002, 2003).

Table 3.4-15 provides a general summary of migration timing for adult and juvenile ESA-listed anadromous fish species that potentially occur within the DBRC action area. Juvenile Chinook outmigration studies conducted in Hood Canal from 1976 to 1979 found that smolts migrated through this area from early May through July and were primarily found in nearshore areas on the east side of Hood Canal in the top few meters of water (Schreiner et al. 1977; Bax et al. 1978, 1980).

Table 3.4-15 Probable Migration Timing for ESA-Listed Anadromous Fish Species in Hood Canal

Species	*Lifestage*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Puget Sound Chinook	Adults				▒	▒	▒	▒	▒				
	Spawning	▒							▒	▒	▒	▒	▒
	Juveniles					▒	▒	▒					
Hood Canal Summer-Run chum	Adults								▒	▒	▒		
	Spawning									▒	▒		
	Juveniles		▒	▒	▒								
Puget Sound Steelhead	Adults											▒	▒
	Spawning		▒	▒	▒	▒	▒						
	Juveniles				▒	▒	▒						
Bull Trout	Adults					▒	▒	▒	▒	▒	▒		
	Spawning									▒	▒	▒	▒
	Juveniles			▒	▒	▒	▒	▒					

Sources: WDF 1975; Schreiner et al. 1977; Bax et al. 1978, 1980; Bax 1983; Tynan 1997; WDFW 1999, 2002; NMFS 2004b.

Hood Canal Summer-run Chum Salmon ESU. Approximately 915 acres (370 ha) of critical habitat for the Hood Canal Summer-run Chum Salmon ESU have been designated within the nearshore marine/estuarine waters of the proposed DBRC northern and southern range extensions (Table 3.4-13, Figure 3.4-9). The salmon ESUs share many of the same rivers and estuaries and have similar life history characteristics and, therefore, many of the same PCEs as previously discussed for Puget Sound Chinook Salmon ESU critical habitat (refer to Section 3.4.2.1).

As previously discussed for the Puget Sound Chinook Salmon ESU, the nearshore marine area includes the zone from extreme high water out to a depth of 98 ft (30 m) and adjacent to watersheds occupied by the ESU; it also includes estuarine/marine areas of Hood Canal (NMFS 2004b). Although a number of watersheds have also been designated as critical habitat (e.g., Hamma Hamma River, Dosewallips River, Duckabush River, Big Quilcene River, Little Quilcene River) (NMFS 2005b), since the proposed range extensions and activities would only occur within Hood Canal marine waters, for the purposes of this EIS these watersheds are not included.

Of the 12 stocks of summer-run chum identified within Hood Canal, six are within the vicinity of the DBRC action area. Four are depressed (Hamma Hamma, Duckabush, Dosewallips, and Big/Little Quilcene rivers) and two are extinct (Big Beef Creek and Anderson Creek). The remaining six stocks are associated with watersheds within southern Hood Canal. One is healthy (Union River), one is critical (Lilliwaup River), and four are extinct (Finch Creek and Dewatto, Tahuya, and Skokomish rivers) (Table 3.4-14) (WDFW 2002, 2003).

Returning adult summer-run chum are found in nearshore marine waters from early August to the end of October (Table 3.4-15). Estimated peak emergence timing for Hood Canal summer-run chum populations is between March and April (WDFW and Point No Point Treat Tribes 2000). Following emergence, the summer-run chum fry migrate quickly to estuary areas near the river mouth and generally all outmigration occurs within a period of 30 days (Salo 1991). Juvenile chum tend to frequent areas close to shore and have been observed utilizing nearshore habitats such as eelgrass beds (Schreiner 1977; Bax 1983; Phillips 1984). Juvenile chum salmon can be found in nearshore marine waters from approximately early February to the end of April after which they move to more offshore areas to take advantage of larger, more prevalent prey (Bax 1983).

Puget Sound Steelhead Trout DPS. Recently listed as threatened under the ESA, critical habitat has not been proposed for this DPS (NMFS 2007a). Eleven steelhead stocks have been identified within Hood Canal consisting of three summer-run stocks and eight winter-run stocks (Table 3.4-14). Of these 11 steelhead stocks present in Hood Canal/Dabob Bay, 6 are within the vicinity of the DBRC action area. Three are rated as depressed (Hamma Hamma, Duckabush, and Dosewallips winter-runs) and three have an unknown status (Quilcene/Dabob Bays winter-run and Duckabush and Dosewallips summer-runs). The status of the remaining southern Hood Canal watersheds are either depressed (Dewatto, Tahuya, and Skokomish winter-runs) or unknown (Skokomish summer-run and Union winter-run) (WDFW 2002, 2003).

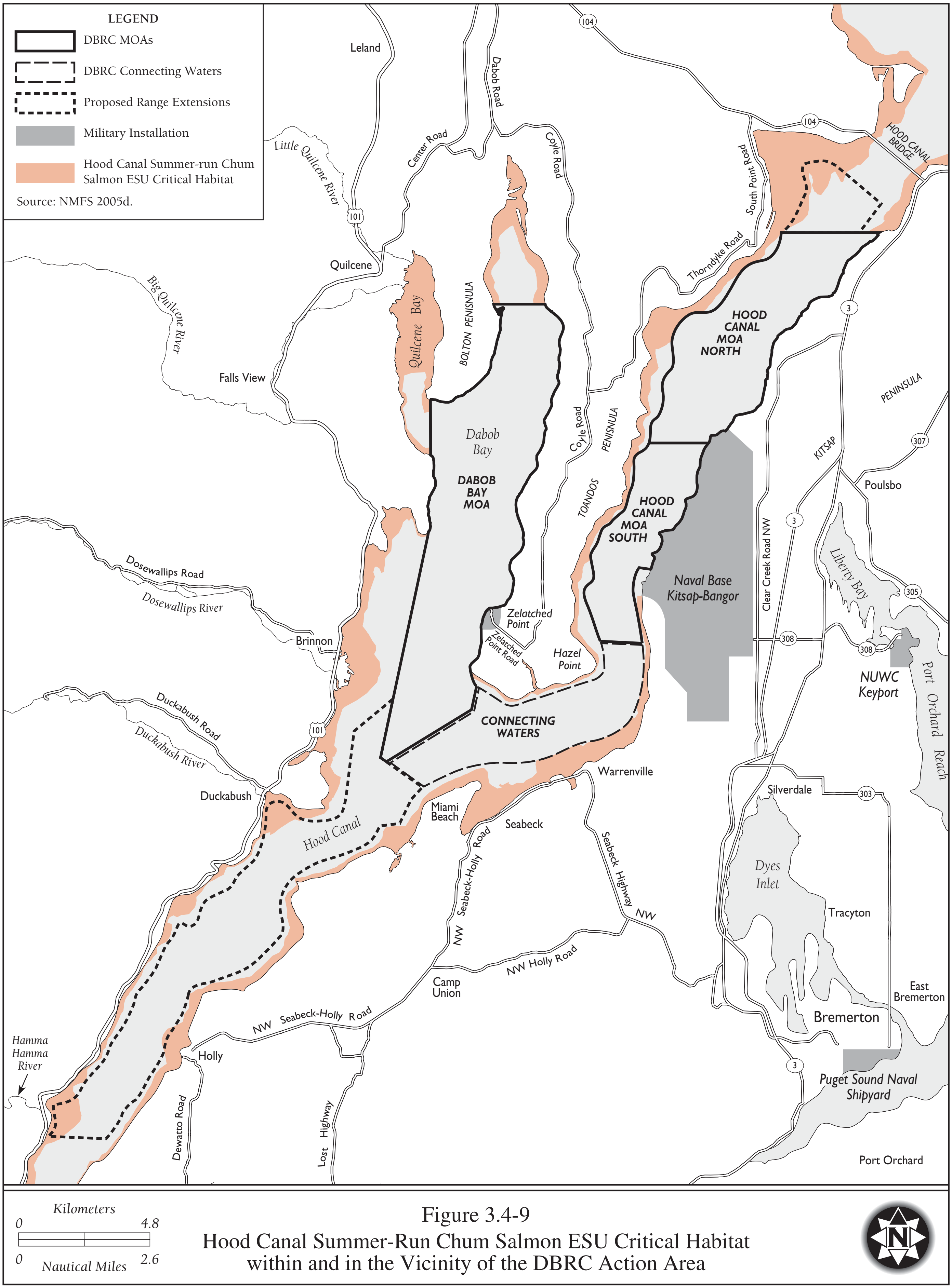


Figure 3.4-9
Hood Canal Summer-Run Chum Salmon ESU Critical Habitat within and in the Vicinity of the DBRC Action Area

Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of activity (Table 3.4-15). In a given river basin there may be one or more peaks in migration activity; these ‘runs’ are usually named for the season in which the peak occurs (e.g., winter, spring, summer, or fall steelhead). Steelhead can be divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry and duration of spawning migration. The summer or ‘stream-maturing’ type enters fresh water in a sexually immature condition between May and October, and requires several months to mature and spawn. The winter or ‘ocean-maturing’ type enters fresh water between November and April with well-developed gonads and spawns shortly thereafter (NMFS 2006b).

Coastal-Puget Sound Bull Trout DPS. Approximately 347 acres (140 ha) of critical habitat for the Coastal-Puget Sound Bull Trout DPS have been designated within the nearshore marine/estuarine waters of proposed DBRC northern and southern range extensions (Table 3.4-13, Figure 3.4-10). The offshore extent of critical habitat for marine nearshore areas extends offshore to the depth of 33 ft (10 m) relative to mean lower low water (MLLW); this equates to the average depth of the photic zone (USFWS 2005a). Although bull trout are not known to occur in any streams within the DBRC action area (Figure 3.4-7), they may occur within the marine waters of Hood Canal and Dabob Bay. Bull trout adults may be present in Hood Canal and Dabob Bay during the summer and fall and juvenile bull trout may be present in nearshore marine areas during the spring and summer (Table 3.4-15).

Although there are anecdotal and historical observations of bull trout in Hood Canal tributaries (e.g., Hamma Hamma River, Dosewallips River, Duckabush River), there are no current records of bull trout in independent tributaries to Hood Canal. As recently as the 1980s, bull trout were observed during snorkeling surveys in tributaries to Hood Canal, including the Quilcene, Dosewallips, Duckabush, and Hamma Hamma Rivers. More recent surveys by Olympic National Park in some of these rivers have not detected bull trout. Historically, bull trout were observed immediately downstream of the Duckabush Fish Hatchery and in the lower reaches of the Hamma Hamma River (USFWS 2004). The only known bull trout population in Hood Canal is located in the Skokomish River.

This river basin has been identified as a core area (an area consisting of one or more local populations of bull trout and their habitat) that is depressed and at risk of extermination due to low numbers and fragmentation. Hood Canal bull trout are currently separated into three geographically separate stocks within the Skokomish River basin, approximately 20 mi (32 km) to the south of the proposed DBRC southern range extension: South Fork Skokomish, Lake Cushman (Cushman Reservoir, on the North Fork Skokomish River), and Upper North Fork Skokomish. The South Fork Skokomish stock is thought to have anadromous and resident life history forms, whereas the Lake Cushman stock is adfluvial (live in lakes and migrate into streams to spawn). The Upper North Fork Skokomish stock is resident. The Olympic Peninsula Recovery Team identified Hood Canal as important bull trout foraging, migration, and overwintering habitat that would likely be used as the Skokomish core area increases in abundance (USFWS 2004).

Of the three stocks of bull trout identified in the action area, one (Lake Cushman) is considered healthy and the South Fork Skokomish and Upper North Fork Skokomish stocks are of unknown status. The South Fork Skokomish is thought to have the only population of anadromous bull trout (WDFW 2002).

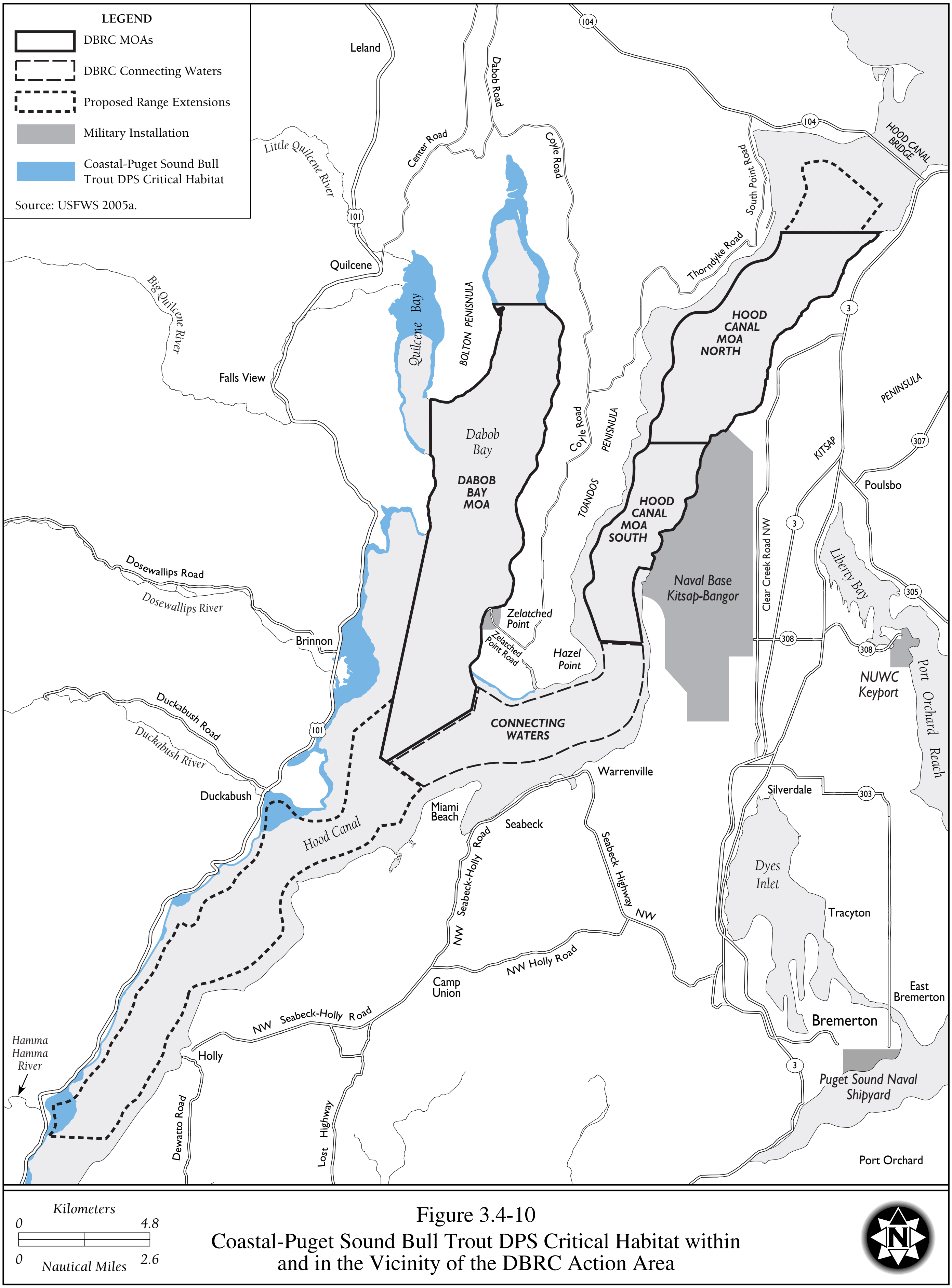


Figure 3.4-10
Coastal-Puget Sound Bull Trout DPS Critical Habitat within and in the Vicinity of the DBRC Action Area

3.4.3.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension Only)

Acoustic Effects. Based on current knowledge (Appendix B), none of the relatively high-frequency acoustic sources proposed for use during Navy activities are expected to have any adverse effects on fish in the DBRC action area. As stated previously, salmonids are exclusively low-frequency hearing generalists and are not sensitive above about 500 Hz. Most acoustic sources proposed for use in the DBRC action area are greater than 1 kHz except for the systems like the target simulator (0.1 – 10 kHz), which has a signal level that is 170 dB re 1 µPa@1 m. While there are no data on effects of this particular sound on fish hearing, recent studies have shown that rainbow trout, a species in the same taxonomic genus as the Pacific salmonids and with a very similar ear structure, exposed to sounds of about 155 dB re 1 µPa (received level) noise for up to nine months had no effect on hearing, growth, or the immune system of this species (Wysocki et al. 2007). In addition, studies on another hearing generalist, the oscar, showed that up to 1 month of exposure to band-limited noise of 170 dB re 1 µPa (received level) had no effect on hearing at all, and 100 percent of the fish survived (Smith et al. 2004a). Based on these data, it is highly likely that the only source in the DBRC action area that is audible to hearing generalists will not have any impact on the fish. Of course, it is recognized that the specific sound from the target simulator may be different from the sounds used in the aforementioned peer-reviewed studies, but considering that the target simulator sound is relatively low intensity, it is likely that extrapolation from the other studies is reasonable to do.

Sources greater than 200 dB re 1 µPa @ 1 m are greater than 2 kHz, which exceeds the hearing sensitivity of most fish. The only exceptions are some of the hearing specialists and, in the case of the DBRC action area, only Pacific herring are likely to be able to detect most of these signals (Mann et al. 2005). Even this species is not able to detect most of the sources in use, with the possible exception of the lower frequency portion of the signal of the dipping sonar. It is not possible to say without experimentation whether the sound emitted by the dipping sonar would be detected, and reacted to, by the Pacific herring. However, since hearing sensitivity of Pacific herring at and above 2 kHz is not great (Mann et al. 2005), the fish would have to be relatively close to the source for the sound to be detectable. Even if the sound was detected, it is expected that the impact on behavior (if any) is likely to be low, and the impact on physiology far lower.

Non-Acoustic Effects. The number of proposed annual activities within the DBRC Site and the proposed southern range extension would not change from the current estimated annual activities occurring within the existing DBRC Site (Table 2-8). Hazardous materials may potentially be released from vessels, submarines, aircraft, sonobuoys, submarine targets, torpedoes, and range targets. Hydrocarbon spills and material released into the marine environment have the potential to impact fish and their habitats. Activities within the proposed southern range extension would take place over a larger area but impacts to marine fish would continue to be the same to those from current activities within the existing DBRC Range Site. A previous EA and BA covering current activities within the existing DBRC Site concluded no significant impacts to marine fish (Navy 2001b, 2002a). In addition, the potential effects from accidental spills of petroleum products and other harmful fluids from UUVs or support craft during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1) (Section 3.6, Sediment and Water Quality). No effects on marine organisms would result from the limited use of magnetic sensors (non-acoustic) since they are passive and do not have a magnetic field associated with them. Magnetic sources used in other range activities do generate a weak EMF that attenuates rapidly.

Evaluations of EMF (Navy 2002a; 2008a) have found that the magnetic sources used in range activities produce a weak EMF, comparable to the earth's at a distance of 4 m from the source, and diminishing further with distance. Most fish apparently cannot detect an EMF, although some fish (sharks, rays, and eels) can, and may even be attracted to the source; however, no adverse effects are known or likely to occur in any case (Navy 2002a; 2008a). Therefore, activities within the proposed DBRC Site southern extension would likely not result in an increase in potential impacts on marine fish over current activities.

Expendable materials and other bottom disturbance would affect a very small fraction of the existing habitat, and such effects would be temporary. The annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 364 losses of expendable materials per year over a 44.0 nm^2 (150.8 km^2), which represents approximately 8 expendables lost per nm^2 or 0.01 per acre. Because activities would occur in different areas of the DBRC site, it is reasonable to assume that the expended materials would be randomly distributed within the range. Therefore, there would be minimal impacts to marine fish with implementation of DBRC Alternative 1 within the DBRC Site and the proposed southern range extension.

ESA-Listed Species and Associated Critical Habitat. The potential effects of NUWC Keyport activities within the DBRC action area on the habitats of the Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout DPS, Hood Canal Summer-run Chum Salmon ESU, and Coastal-Puget Sound Bull Trout DPS were analyzed using an approach developed by NMFS (1996) and USFWS (1998). The analysis developed a matrix of pathways (water quality and physical and biological habitat elements) and indicators (various elements of the pathway categories) for salmonid estuarine habitat present in the action area and then characterized the baseline environmental conditions of salmonid estuarine habitat present in the action area by level of habitat function using the matrix of pathways. Finally, the potential project effects on salmonid estuarine habitat present in the action area were characterized by their potential to restore, maintain, or degrade existing environmental baseline conditions for each habitat indicator within the matrix of pathways.

Based on the indicators for baseline environmental conditions within the action area, all pathway indicators (water quality, physical habitat elements, and biological habitat elements) are properly functioning. Evaluation of the proposed project activities within the DBRC action area found that implementation of DBRC Alternative 1 would not degrade any environmental indicator for salmonid estuarine habitat. The basis for these conclusions is summarized in Table 3.4-16.

Critical habitat for Chinook salmon, chum salmon, and bull trout occurs only along the extreme edges or corners of the proposed southern range extension (Figures 3.4-8, 3.4-9, and 3.4-10). It is expected that proposed NUWC Keyport activities would occur predominantly within the central portion of the proposed southern range extension, and activities within designated critical habitat for any species would be extremely infrequent. The number of proposed annual activities within the DBRC Site and the proposed southern range extension would not change from the current estimated annual activities occurring within the existing DBRC Site (Table 2-8). Activities within the DBRC Range Site and proposed southern range extension would take place over a larger area but impacts to ESA-listed species would continue to be the same to those from current activities within the existing DBRC Site. A previous EA and BA covering current activities within the existing DBRC Site concluded that current activities may affect but would not adversely affect ESA-listed species, findings with which NMFS concurred (Navy 2001b, 2002a). Therefore, the same conclusion of may affect but not likely to adversely affect remains applicable to the implementation of the DBRC Alternative 1 within the DBRC Site and the proposed southern range extension. Any such effects would be temporary and localized to the immediate area of the activity and would be unlikely to cause harm to individuals or have a persistent effect on numbers and distribution of ESA-listed species or their critical habitat.

Table 3.4-16 Summary of Project Effects of Proposed NUWC Activities on Salmonid Habitat Elements within or in the Vicinity of the DBRC Action Area

Pathway	*Indicator*	*Effects of the Action*
Water Quality	Turbidity, Dissolved Oxygen (DO), Water Contamination/Nutrients, Sediment Contamination	With implementation of DBRC Alternative 1, the temporary placement and recovery of test equipment, anchors, targets, or cabling on the bottom including sensors and tracking equipment or the action of crawler UUVs during test activities along the bottom would cause only short-term, temporary increases in turbidity in the localized area. Swimmer UUVs and other test vehicles are not expected to appreciably increase turbidity as they operate in deeper water and higher in the water column, away from the bottom. Proposed activities would not decrease or have any effect on existing DO levels and water or sediment contamination within the action area. Project effects would maintain baseline water quality conditions within the DBRC action area.
Physical Habitat Features	Substrate/Armoring, Depth/Slope, Tideland Conditions, Marsh Prevalence, Refugia, Physical Barriers, Current Patterns, Salt/Fresh Water Mixing Patterns and Locations	No direct physical impacts to intertidal or shallow subtidal substrata or habitats utilized by salmonids would result from proposed activities. Project effects would maintain baseline physical habitat conditions within the DBRC action area.
Biological Habitat Features	Salmon Prey Availability, Forage Fish Community, Aquatic Vegetation, Exotic Species	Proposed NUWC Keyport activities would maintain baseline conditions of demersal prey and forage fish availability within the action area. Although epibenthic invertebrates, preyed upon by juvenile salmonids, could be affected by crawler UUVs as they move along the bottom, and by placement of test equipment, anchors, or cabling on the bottom including sensors and tracking equipment, these effects would be short term and would not result in long-term changes in prey availability or distribution. In addition, implementation of DBRC Alternatives 1 or 2 would have no direct effect on physical habitat elements of salmonid estuarine habitats, including substrata which maintain eelgrass and macroalgae beds in the action area. Proposed NUWC Keyport activities would also have no effect that would increase the number or abundance of exotic species within the action area. Therefore, project effects would maintain baseline biological habitat elements within the DBRC action area.

Additional analysis of potential effects of the proposed DBRC Site extension on critical habitat for Puget Sound Chinook salmon, Hood Canal Summer-run chum salmon, and Coastal-Puget Sound bull trout considers the PCEs that were used by the USFWS and NMFS to designate critical habitat. These PCEs are included in the pathways and indicators of Table 3.4-16. Consideration of project-related impacts on these PCEs and, by extension, on designated critical habitat, indicates no temporary, permanent, direct, or indirect impacts to the PCEs associated with salmonid critical habitat within the DBRC action area. Based upon the conclusions of the analysis of the potential impacts of NUWC range activities on the matrix of pathways and indicators for salmonid estuarine habitat and the analysis of potential effects on the critical habitat PCEs, implementation of DBRC Alternative 1 within the existing DBRC Range Site and proposed southern range extension would not compromise the function or relevance of any habitat indicators or critical habitat PCEs.

Implementation of DBRC Alternative 1 would not increase fragmentation of ESA-listed salmonid populations nor decrease the function of any of the critical habitat PCEs. Therefore, implementation of DBRC Alternative 1 would have minimal impacts on water quality parameters that are important to fish, such as turbidity and metals (Section 3.6.2) and no effects on habitats (including designated critical habitat for the Puget Sound Chinook Salmon ESU, Hood Canal Summer-run Chum Salmon ESU, and

Coastal-Puget Sound Bull Trout DPS) for the marine life stages of Chinook salmon, chum, salmon, steelhead trout, or bull trout within the DBRC action area. In addition, there would be no effects to seasonal distribution or abundance of salmonids within the action area with implementation of DBRC Alternative 1. In its BO the USWFS (2010) concurred with Navy findings on Coastal Puget Sound DPS Bull Trout and its critical habitat.

Essential Fish Habitat. As discussed above (Table 3.4-16), there would be minimal and temporary effects, if any, to water quality and the physical and biological elements of marine or freshwater habitats within the DBRC action area. Activities within the proposed southern range extension would take place over a larger area but impacts to EFH would continue to be the same to those from current activities within the existing DBRC Range Site. A previous EA and BA covering current activities within the existing DBRC Site concluded no adverse effects to EFH (Navy 2001b, 2002a). Therefore, implementation of DBRC Alternative 1 would not adversely affect EFH; any effects would be minimal and temporary and would not reduce the quality or quantity of EFH for any managed species. No harm to individuals or other impacts on species of rockfish that have EFH in the study area and are currently proposed for listing (NMFS 2009b) are likely to occur. Therefore, no further action is required of the Navy.

<u>DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Implementation of DBRC Alternative 2 within the existing DBRC Site and proposed northern and southern range extensions would result in the same effects to marine fish, including threatened and endangered species, critical habitat, and EFH, as previously described under DBRC Alternative 1. The number of activities would not increase and the added area within the northern extension includes the same flora and fauna as that in the rest of the area south of the Hood Canal Bridge. A previous EA and BA covering current activities within the existing DBRC Site concluded that current activities may affect but would not adversely affect ESA-listed species, findings with which NMFS concurred (Navy 2001b, 2002a). Therefore, the same conclusion of may affect but not likely to adversely affect remains applicable to the implementation of the DBRC Alternative 2 within the DBRC Site and the proposed southern and northern range extension. Any such effects would be temporary and localized to the immediate area of the activity and would be unlikely to cause harm to individuals or have a persistent effect on numbers and distribution of ESA-listed species or their critical habitat.

Essential Fish Habitat. There would be minimal and temporary effects, if any, to water quality and the physical and biological elements of marine or freshwater habitats within the DBRC action area. Activities within the proposed southern range extension would take place over a larger area but impacts to EFH would continue to be the same to those from current activities within the existing DBRC Range Site. A previous EA and BA covering current activities within the existing DBRC Site concluded no adverse effects to EFH (Navy 2001b, 2002a). Therefore, implementation of DBRC Alternative 2 would not adversely affect EFH; any effects would be minimal and temporary and would not reduce the quality or quantity of EFH for any managed species. No harm to individuals or other impacts on species of rockfish that have EFH in the study area and were recently listed (NMFS 2009b, 2010b) are likely to occur. Therefore, no further action is required of the Navy.

<u>No-Action Alternative</u>

Under the No-Action Alternative, current activities would continue within the existing boundaries of the DBRC Site. Current NUWC Keyport activities within the existing DBRC Site (i.e., the No-Action Alternative) were previously analyzed in the DBRC EA and found to have only very localized, temporary impacts on water quality (turbidity), no effects on physical habitat features, and only short-term localized effects on prey availability or other biological habitat features (Navy 2002a). The EA found there would be minimal impacts to marine fish, no adverse effects to EFH, and that continuing actions may affect listed species and critical habitat. The same conclusions would apply to implementation of the No-Action Alternative within the existing DBRC Site.

3.4.3.3 Mitigation Measures

Since there would be minimal impacts to marine fish from implementing the DBRC Site Alternative 1, Alternative 2, or the No-Action Alternative, no mitigation measures would be necessary. As a matter of standard practice, to the extent practicable the Navy retrieves expendable materials and avoids and minimizes any loss or discharge of materials incidental to RDT&E and training activities (OPNAVINST 5090.1 series). No further measures are necessary to protect fish and EFH during the proposed activities. Although it is the Navy's conclusion that none of the alternatives would have an adverse effect on Essential Fish Habitat (EFH) that would require mitigation under the Magnuson-Stevens Fishery Conservation and Management Act, the Navy has considered NMFS' EFH conservation recommendations and is in discussion with NMFS regarding appropriate EFH conservation measures that could be implemented (Appendix H).

Neither the final USFWS BO nor the draft NMFS BO identified adverse effects that would be likely to occur for ESA-listed fish species. To the extent practicable, NUWC Keyport will comply with reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

3.4.4 QUTR Site

3.4.4.1 Existing Conditions

Although there is a separate surf-zone access area associated with each QUTR range extension alternative, since they all occur along sandy beaches and within 30 nm (55.6 km) of each other along the Olympic Coast, the existing habitat within each surf-zone area is considered the same across all three sites. Therefore, the following discussion of nearshore marine fish applies to all three surf-zone access areas.

<u>Coastal Pelagic and Forage Fish Species</u>

Pelagic fish species which are known to occur in the QUTR action area are Pacific herring, Pacific sand lance, surf smelt, Pacific sardine, northern anchovy, and eulachon. Herring stocks are defined by spawning grounds and there is only one stock on the outer Washington coast, in central Willapa Bay (WDFW 1997). Pacific sand lance spawning populations on Washington's outer coast and coastal estuaries have not been surveyed, although the occurrence of yolk sac sand lance larvae in those areas in the winter months indicates their presence (Bargmann 1998). Documented areas of surf smelt spawning grounds off the Washington coast are to the north of the Quinault Indian Reservation and at Pt. Grenville south of Taholah (Figure 3.4-11).

The presence of northern anchovy in Washington is sporadic and unpredictable. They are not consistently available in numbers necessary for commercial use. Occasional to rare spawning runs of eulachon may occur in coastal rivers such as the Queets and Quinault (NMFS 2010a), and the Columbia River stock is known to migrate through the action area (Bargmann 1998). The Willapa Bay herring stock has an unknown stock status (Bargmann 1998) as do stocks of Pacific sand lance and surf smelt within the action area. No anchovy stock condition or habitat assessment activities are presently conducted for Washington coastal anchovies. Within Grays Harbor and Willapa Bay, anchovy fishing is open throughout the year with seasonal gear restrictions. Within coastal waters, anchovy harvest is allowed year-round with any lawful gear (WDFW 1997).

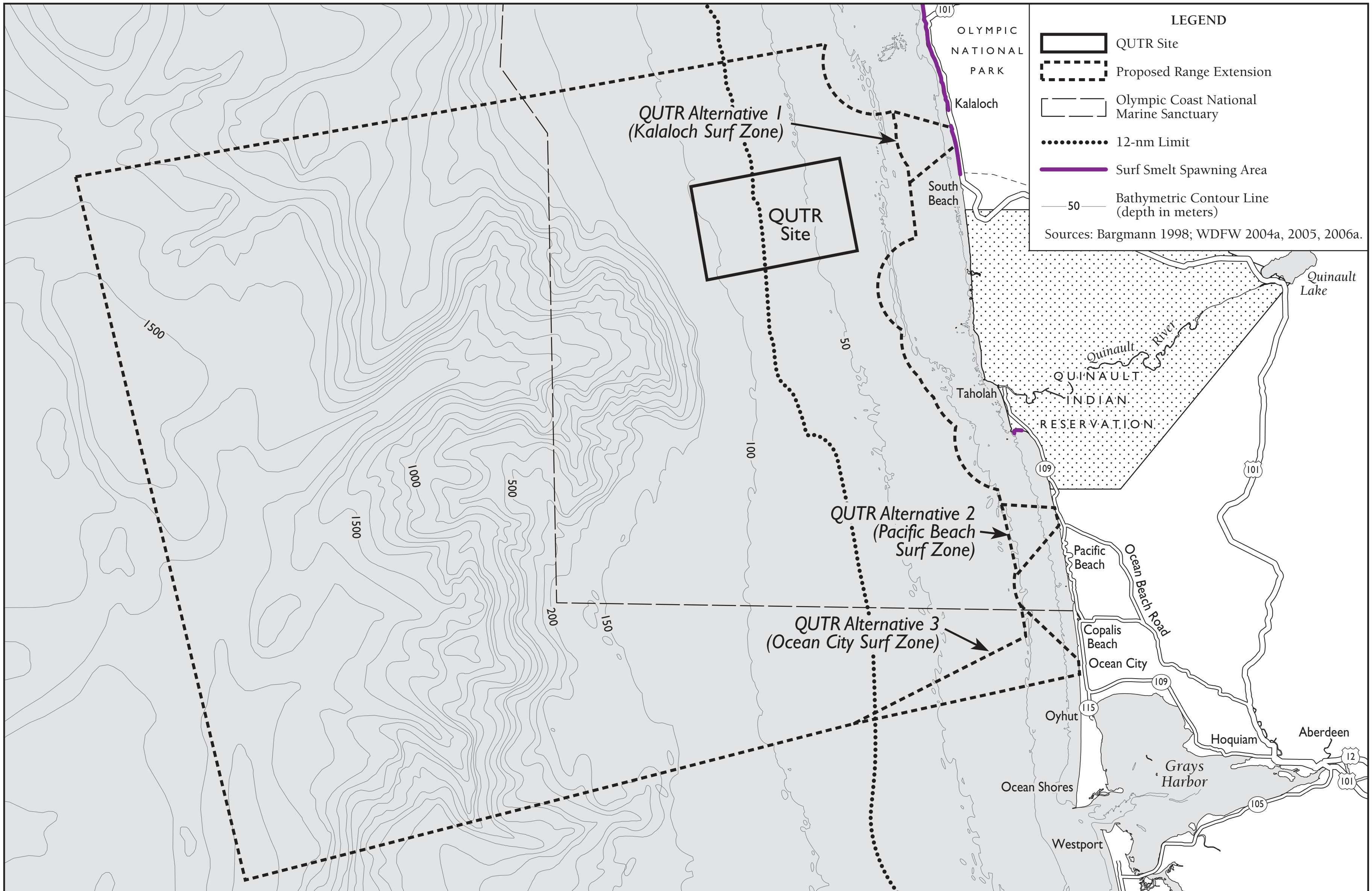


Figure 3.4-11
Surf Smelt Spawning Areas within and in the Vicinity of the QUTR Action Area

Very little documented information is available for pelagic fish species within the action area. General summary information on distribution, seasonal occurrence and habitat use for Pacific herring, Pacific sand lance, and surf smelt was provided previously. Refer to Section 3.4.1, Overview of Existing Conditions Common to All Three Range Sites, which is a description of the information common to all three range sites. Eulachon from the Columbia River, its tributaries, and adjacent systems are generally considered to be one stock (Bargmann 1998).

Groundfish

In 1998 and 1999, the Northwest Fisheries Science Center (NWFSC) conducted trawl surveys of upper continental slope groundfish resources off the coasts of Washington, Oregon and California (Turk et al. 2001; Builder Ramsey et al. 2002). Selected species of bottomfish caught during these trawl surveys that are likely present in the QUTR action area are listed in Table 3.4-17.

Table 3.4-17 Bottomfish species Potentially Occurring within or in the Vicinity of the QUTR Action Area

Species		
Arrowtooth flounder	Northern rockfish	Rougheye rockfish
Aurora rockfish	Pacific cod	Sablefish
Bocaccio	Pacific flatnose	Sharpchin rockfish
Canary rockfish	Pacific hake	Shortspine thornyhead
Darkblotched rockfish	Pacific halibut	Slender sole
Deepsea sole	Pacific ocean perch	Spiny dogfish
Dover sole	Petrale sole	Splitnose rockfish
English sole	Redbanded rockfish	Spotted ratfish
Greenstriped rockfish	Redstripe rockfish	Walleye Pollock
Lingcod	Rex sole	Yellowtail rockfish
Longspine thornyhead	Rosethorn rockfish	

Sources: Turk et al. 2001; Builder Ramsey et al. 2002

There are no site-specific data on distribution, timing, and habitat use for groundfish within the QUTR action area. The recently listed rockfish (NMFS 2009b, 2010b) do not occur on the outer coast. Distribution, timing, and habitat use information for important groundfish species potentially present within the general area of the QUTR action area were previously discussed (Section 3.4.1, *Overview of Existing Conditions Common to All Three Range Sites*).

Highly Migratory Species

As a group, HMS are managed by the PFMC under the supervision of the NMFS-Southwest Region (SWR) (NMFS 2004d). The U.S. west coast HMS are composed of 13 species of which three species occur within the QUTR action area (Table 3.4-18).

Table 3.4-18 Highly Migratory Species Potentially Occurring within or in the Vicinity of the QUTR Action Area

Sharks	
Common thresher shark	
Tunas	
Albacore tuna	Northern bluefin tuna

Source: Navy 2006a

HMS are not correlated with the areas or features that typify most fish habitat (bottom substrate or submerged vegetation), but rather are associated with physiographic and hydrographic features, such as ocean fronts, current boundaries, the continental shelf margin, or seamounts. These characteristics, along with the fact that these fishes generally occur in the open ocean and frequent nearshore waters, complicate the identification process of HMS habitat. These species exhibit both horizontal and vertical movements, as well as traveling great distances inshore, offshore, and for seasonal migrations. The distributions of the various life stages of these highly mobile species are also constrained by temperature, salinity, and oxygen concentrations (PFMC 2003).

Essential Fish Habitat

EFH has been designated along the Washington coast for groundfish, salmon, and CPS. Based on habitat suitability maps developed by NMFS, 59 species managed under the Groundfish FMP are likely to occur in some form of life stage along the Washington coast and within the QUTR action area (Table 3.4-19) (PFMC 2006a, b). Three CPS (jack mackerel, Pacific sardine, and market squid) can be found along the Washington coast within the QUTR action area. Jack mackerel occurs in the adult stage; Pacific sardine occur in the adult, larval, and egg stages both nearshore and offshore; and market squid inhabit the area during the adult and egg stages (PFMC 1998, 2006b). Adult and juvenile Coho, Chinook, and pink salmon can all be found along the Washington coast within the QUTR action area (PFMC 2000, 2006b, 2006c).

Table 3.4-19 Fish Species with Designated EFH within the Vicinity of the QUTR Action Area

Species	*Life Stage Habitat Suitability*	*Habitat Suitability Probability (HSP)*
GROUNDFISH		
Arrowtooth flounder	A, J, L, E	High
Aurora rockfish	A, J, L	Low
Big skate	A, J, E	High
Black rockfish	A, J	Very low
Blue rockfish	A, J, L	Very low
Bocaccio rockfish	A, J, L	Moderate
Brown rockfish	A	Low
Butter sole	A	High
Cabezon	A	Very low
California skate	A, J, E	Moderate
Canary rockfish	A, J	Very low
Chilipepper rockfish	A, J	Low
China rockfish	A, J	Very low
Copper rockfish	A	Very low
Cowcod	A, J	Very low
Curlfin sole	A	Low
Darkblotched rockfish	A, J, L	Moderate
Dover sole	A, J	High
English sole	A, J, L	Moderate
Finescale codling	A	Moderate
Flathead sole	A, J	Moderate
Greenspotted rockfish	A, J	Low
Greenstriped rockfish	A, J	Moderate
Kelp greenling	A, J	Very low
Lingcod	A, J, L, E	Low

Table 3.4-19 Fish Species with Designated EFH within the Vicinity of the QUTR Action Area (Continued)

Species	*Life Stage Habitat Suitability*	*Habitat Suitabiltiy Probability (HSP)*
Longnose skate	A, J, E	High
Longspine thornyhead	A, J	Low
Pacific ocean perch	A, J, L	Low
Pacific cod	A, J, L, E	Low
Pacific rattail	A, J, L, E	Low
Pacific sanddab	A	High
Pacific whiting	A, E	Moderate
Petrale sole	A, J	High
Quillback rockfish	A, J	Very low
Ratfish	A, J, E	High
Redbanded rockfish	A	Low
Redstripe rockfish	A	Very low
Rex sole	A, J	High
Rock sole	A	Moderate
Rosethorn rockfish	A	Very low
Rosy rockfish	A, J	Very low
Rougheye rockfish	A, J	Moderate
Sablefish	A, J, L, E	Moderate
Sand sole	A, J, L	Moderate
Sharpchin rockfish	A, J, L	Low
Shortbelly rockfish	A	Very low
Shortraker rockfish	A	Low
Shortspine thornyhead	A, J	Moderate
Soupfin shark	A, J	Moderate
Spiny dogfish	A, J	High
Splitnose rockfish	A, J, L	Moderate
Starry flounder	A, J, E	Moderate
Stripetail rockfish	A, J	Low
Tiger rockfish	A	Very low
Vermillion rockfish	A	Very low
Widow rockfish	A, J	Low
Yelloweye rockfish	A, J	Very low
Yellowmouth rockfish	A, J	Very low
Yellowtail rockfish	A	Very low
COASTAL PELAGICS		
Jack mackerel	A	Moderate
Pacific sardine	A, L, E	Suitability is dependent on sea surface temperature – Pacific sardine are found south of the 10°C (50°F) isotherm
Market Squid	A, E	Moderate
PACIFIC SALMON		
Chinook	A, J	High
Coho	A, J	High
Pink	A, J	Low

Notes: A = adult, E = eggs. J = juvenile, L = larvae.
HSP scale: very low = <0.01, low = 0.01 - 0.39, moderate = 0.40 - 0.59, high = 0.60 - >0.80

Sources: PFMC 1998, 2000, 2006a, b, c.

All waters and sea bottom in Washington State waters shoreward from the 3-nm (6-km) boundary of the Territorial Waters to mean higher high water (MHHW) has been designated as an HAPC for groundfish. The Washington State waters HAPC encompasses a variety of habitats important to groundfish, including other HAPCs such as rocky reef habitat supporting juvenile rockfish (primarily north of Grays Harbor) and estuary areas supporting numerous economically and ecologically important species, including juvenile lingcod and English sole. Sandy substrates within state waters (primarily south of Grays Harbor) are important habitat for juvenile flatfish (PFMC 2005).

Deep-water areas with high-relief substrate and which are known or likely to contain biogenic habitat, that is, habitat formed by living organisms including sponges and deep-water corals, have been recognized as being especially important to groundfish. The vulnerability of such habitats to the destructive impacts of bottom trawling led NMFS to designate several Groundfish Conservation Areas, which are off limits to bottom trawling, off of the Washington coast (NMFS 2006h). These areas are shown in Figure 3.4-12 and include Biogenic 1 and 2, Grays Harbor, and the generalized area west of the 700 fathom (1280 m) isobath.

Non ESA-Listed Salmonids

Non ESA-listed salmonid species which are known to inhabit streams within the vicinity of the QUTR action area include seven stocks of fall- and spring-run Chinook salmon, nine stocks of Coho salmon, two stocks of fall-run chum salmon, two stocks of pink salmon, one stock of sockeye salmon, three stock complexes of searun cutthroat trout, and 10 stocks of winter- and summer-run steelhead trout (Blakley et al. 2000; WDFW 2002, 2003, 2004a) (Table 3.4-20, Figure 3.4-13). The ESA-listed Coastal-Puget Sound Bull Trout DPS is discussed below in a separate subsection.

Table 3.4-20 Non ESA-listed Salmonid Fish Stocks within the Vicinity of the QUTR Action Area

Species	*Stocks*
Chinook	Queets River fall and spring/summer, Clearwater River fall and spring/summer, Quinault River fall and spring/summer, Cook Creek fall
Coho	Queets River, Clearwater River, Salmon River, Kalaloch Creek, Creek Raft River, Quinault River, Cook Creek, Moclips River, Copalis River, Steamboat Creek
Chum	Queets River fall, Quinault River fall
Sockeye	Queets River, Quinault River
Steelhead	Queets River summer and winter, Clearwater River summer and winter, Quinault River summer and winter, Kalaloch Creek winter, Raft River winter, Moclips River winter, Copalis River winter, Cedar Creek winter, Steamboat Creek winter
Searun Cutthroat	Queets River, Raft/Quinault River, Moclips/Copalis River
Pink	Queets River, Quinault River

Sources: Blakley et al. 2000; WDFW 2002, 2003, 2004a, 2005b, 2006a.

Of the seven stocks of Chinook salmon, three fall runs (Queets, Clearwater, and Quinault) have been rated as healthy, two spring/summer-runs (Queets and Quinault) have been rated as depressed, one spring/summer-run has been rated as critical (Clearwater), and one fall-run (Cook Creek) is of unknown stock status (Table 3.4-21). Of the nine stocks of Coho, three (Queets, Clearwater, and Salmon) have been rated as healthy and six (Kalaloch, Raft, Quinault, Cook, Moclips, and Copalis) have been rated as of unknown stock status. Both of the fall-run chum stocks (Queets and Quinault) have been rated as unknown stock status. The Quinault River sockeye stock has been rated as healthy (WDFW 2002, 2003).

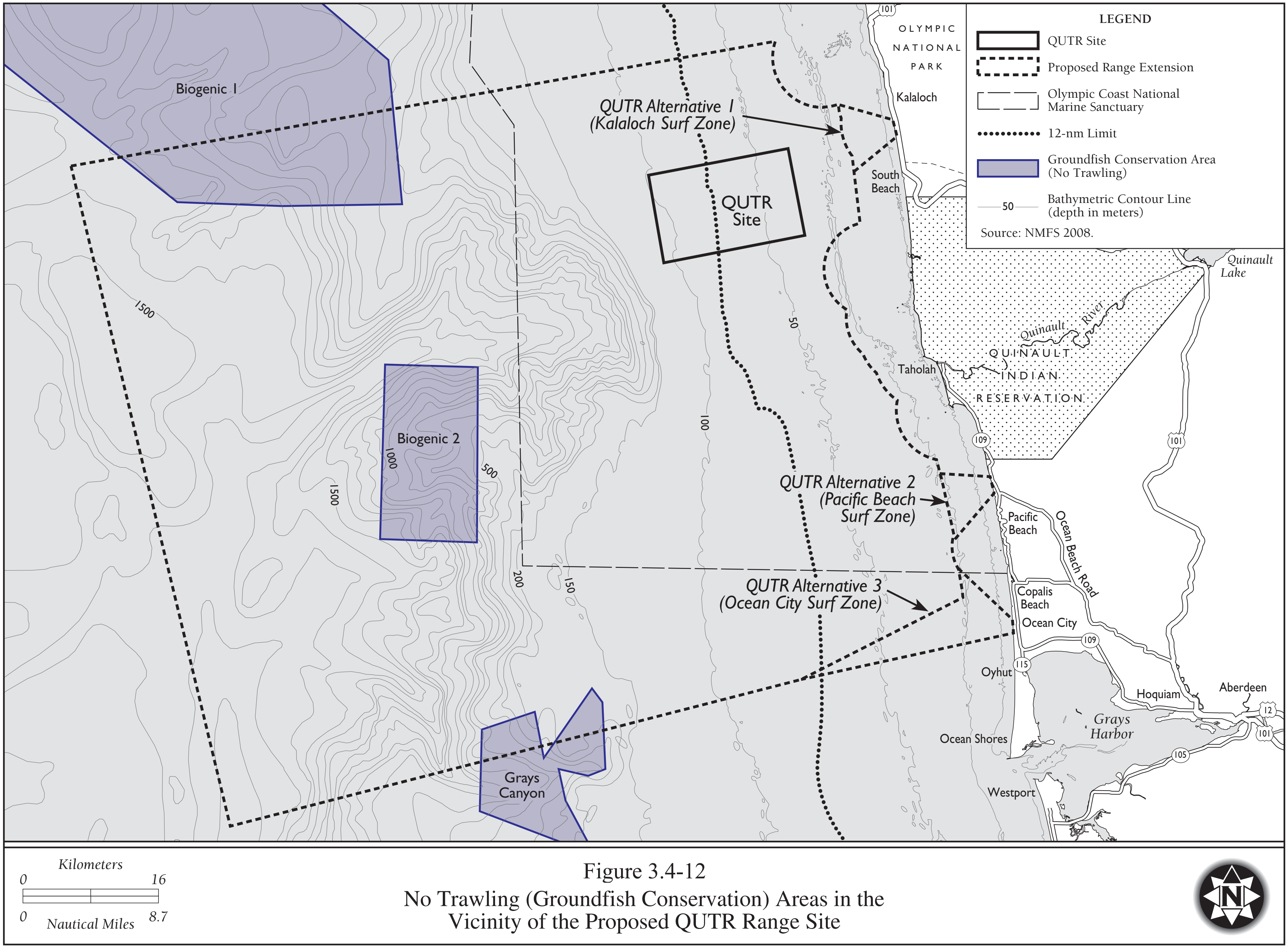


Figure 3.4-12
No Trawling (Groundfish Conservation) Areas in the Vicinity of the Proposed QUTR Range Site

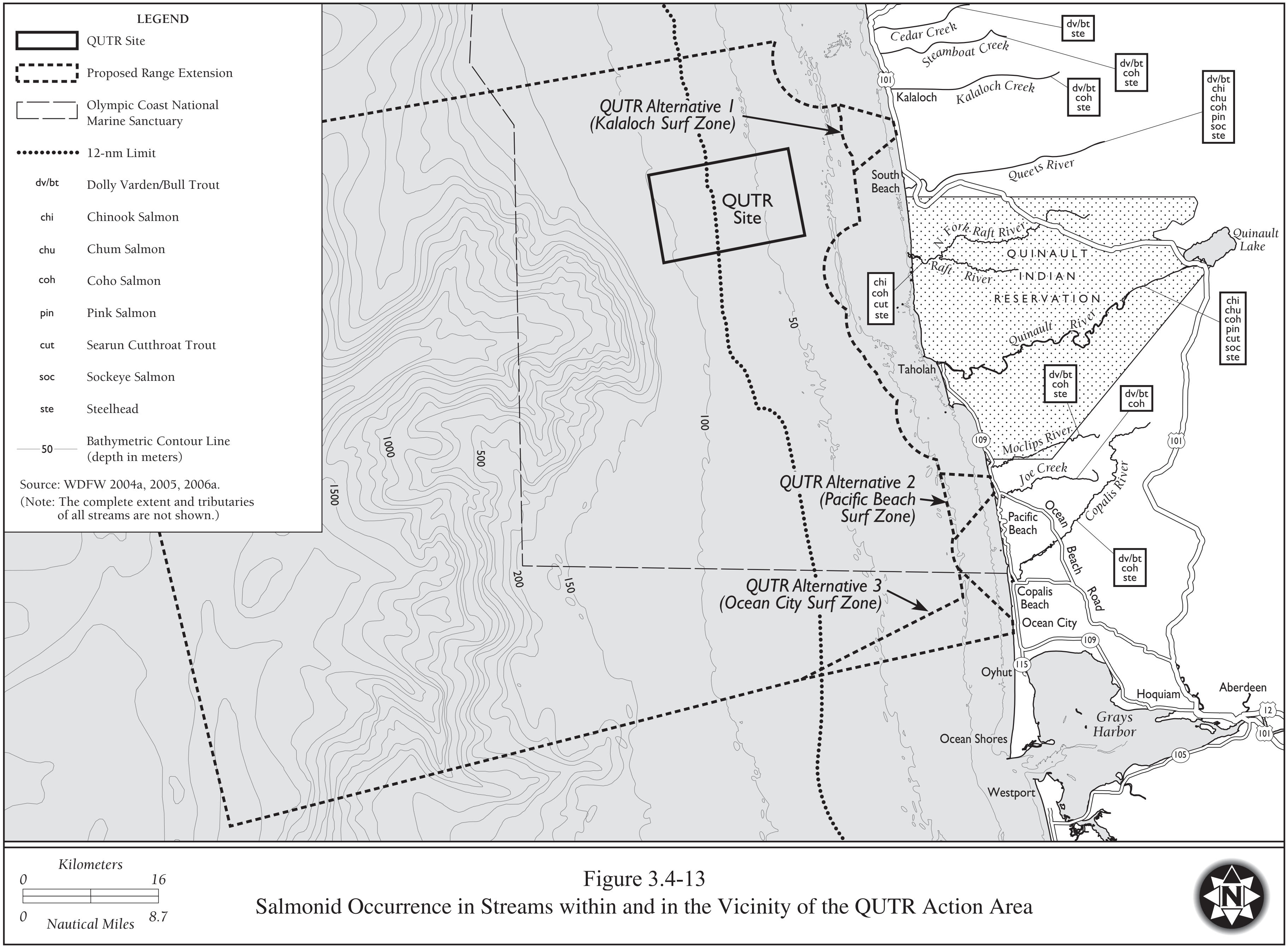


Figure 3.4-13
Salmonid Occurrence in Streams within and in the Vicinity of the QUTR Action Area

Table 3.4-21 Status of Non ESA-listed Salmonid Fish Stocks within the Vicinity of the QUTR Action Area

			Stock Origin			*Production Types*			
Species	*No. stocks*	*Run types*	*Mixed*	*Native*	*Unk.*	*Wild*	*Composite*	*Unk.*	*2002 Status*
Chinook	7	Spr/sum (3), fall (4)	x	x		x	X		3 Healthy; 2 Depressed; 1 Unknown; 1 Critical
Coho	9	Late fall/win	x	x		x	X		3 Healthy; 6 Unknown
Chum	2	Fall	x		x		X	x	2 Unknown
Sockeye	1	Fall/win		x		x			1 Healthy
Steelhead	11	Win (8), sum (3)	x	x		x	X		3 Healthy; 7 Unknown; 1 Depressed
Cutthroat	3	Win/spr		x		x			3 Unknown
Pink	2	No Data Available							

Sources: Williams et al. 1975; Blakley et al. 2000; WDFW 2002, 2003; NMFS 2004a.

Of the 11 stocks of steelhead, three winter-runs (Queets, Clearwater, and Quinault) have been rated as healthy, one winter-run (Quinault Lake) has been rated as depressed, and seven runs (Kalaloch Creek winter-run, Queets summer-run, Clearwater summer-run, Raft winter-run, Quinault summer-run, Moclips winter-run, and Copalis winter-run) have been rated as unknown stock status (WDFW 2002, 2003). The stock status of anadromous cutthroat is unknown for all three stock complexes (Blakley et al. 2000). No data are available on the run type, stock origin, production type, or status for pink salmon within the Queets and Quinault rivers.

A general summary of migration timing for adult and juvenile salmonid fish species within the action area can be found in Table 3.4-22. The Quinault Lake sockeye salmon stock is the most southerly coastal population of this species in North America (Gustafson et al. 1997). Adult sockeye salmon begin entering the lower Quinault River in small numbers in January and continue to the end of July, peaking in late May or early July (WDF et al. 1993). Sockeye salmon have been known to enter the Quinault River as early as December and as late as August (Quinault Indian Nation 1981). Spawning generally takes place from mid-October through the end of February (WDFW 2002, 2003). Juvenile outmigration occurs from April to June (Davidson and Barnaby 1936; Tyler and Wright 1974).

Washington coastal populations of steelhead consist primarily of winter-run fish, although three stocks of summer-run steelhead are present within the QUTR action area. Winter-run adults generally spawn from February to June (WDFW 2002, 2003). Information on summer-run spawn timing and juvenile out-migration timing is not available.

The timing of movement into freshwater by adult coastal or searun cutthroat trout for spawning is highly variable for the three stocks within the action area. River entry for the Queets stock is in December and January, the Raft/Quinault stock moves into rivers during October to April (early and later entry), and the Moclips/Copalis stock is thought to occur in rivers from June through April (WDFW 2002). Juvenile out-migration timing information was not available.

Table 3.4-22 Probable Migration Timing for Non ESA-listed Salmonid Fish Species within the Vicinity of the QUTR Action Area

Species	*Lifestage*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Chinook	Adults				X	X	X	X	X	X	X	X	
	Spawning									X	X	X	X
	Juveniles				X	X	X	X	X	X			
Coho	Adults	X								X	X	X	X
	Spawning	X								X	X	X	X
	Juveniles					X	X						
Fall-run Chum	Adults									X	X	X	X
	Spawning	X									X	X	X
	Juveniles	X	X	X	X	X							
Sockeye	Adults	X	X	X	X	X	X	X					
	Spawning	X	X								X	X	X
	Juveniles				X	X	X						
Steelhead	Adults		X	X	X	X	X						
	Spawning		X	X	X	X	X						
	Juveniles												
Coastal Cutthroat	Adults	X	X	X	X		X	X	X	X	X	X	X
	Spawning	X	X	X	X		X	X	X	X	X	X	X
	Juveniles	Data not available											

Sources: Seiler et al. 1984; WDF et al. 1993; QTNR 1995; Gustafson et al. 1997; Johnson et al. 1997; WDFW 2002, 2003.

ESA-Listed Species and Associated Critical Habitat

The oceanic stages of eight federally listed anadromous fish populations are widely distributed and could occur in the open-ocean waters of the QUTR site and proposed extension: Pacific eulachon southern DPS, Coastal-Puget Sound Bull Trout DPS, Lower Columbia River Coho Salmon ESU, Lower Columbia River Chinook Salmon ESU, Columbia River Chum ESU, Lower Columbia River Steelhead Trout DPS, Ozette Lake Sockeye Salmon ESU, and the Southern DPS of the Green Sturgeon (Table 3.4-23). In contrast to the Columbia River and Ozette Lake salmonids, the southern DPS of the green sturgeon, which is indistinguishable from the unlisted northern DPS, spawns in the Sacramento River, California. The green sturgeon spends most of its life in the ocean, returning to spawn every 2-5 years, and after spawning, the post-juvenile and adult stages range from Mexico to the Bering Sea (NMFS 2005g, 2006c). Only the bull trout is expected to occur as a resident within the action area. All other species, including eulachon and juvenile and adult salmonids from the Columbia River and Ozette Lake stocks, would only occur during their non-breeding marine life stages. As a result, there would be no potential effects on their up- or downstream migration corridors or breeding areas. Data on the occurrence of these species within the QUTR Site or the proposed extension area are not available, so they are considered potentially present. However, the possibility that aircraft, vessels, materials or acoustic transmissions (Section 3.4.1.6) associated with the Proposed Action could harm (through physical contact) individuals or significantly interfere with their behavior in the open ocean is considered discountable. Therefore, for the QUTR Site, only the bull trout is considered further in this EIS/OEIS.

Table 3.4-23 ESA-Listed Salmonid Fish Species and Associated Critical Habitat Potentially Occurring within the QUTR Action Area

Species	*ESA Listing Status**	*Acreage of Critical Habitat within Proposed Surf Zone Access Area**		
		1 – Kalaloch	2- Pacific Beach	3 – Ocean City
Coastal-Puget Sound Bull Trout DPS	T, CH	1,525	2,200	1,400
Lower Columbia R. Chinook Salmon ESU	T	na	na	na
Columbia R. Chum Salmon ESU	T	na	na	na
Lower Columbia R. Coho Salmon ESU	T, CH	0	0	0
Lower Columbia R. Steelhead Trout DPS	T	na	na	na
Ozette Lake Sockeye Salmon ESU	T, CH	0	0	0
Green Sturgeon Southern DPS	T	na	na	na
Pacific Eulachon Southern DPS	T	na	na	na

Notes: CH = critical habitat, T = threatened; *na = not applicable – critical habitat has not been proposed.
Sources: NMFS 1999a, 1999b, 1999c, 2005b, 2006b, 2010a; USFWS 1999a, 2005a, 2005f, 2006g.

Coastal-Puget Sound Bull Trout DPS. Critical habitat for the Coastal-Puget Sound Bull Trout DPS has been designated within the nearshore marine/estuarine waters of coastal Washington. Within the proposed surf-zone access areas, critical habitat is within 1,525 acres (617 ha) of the Kalaloch Option (Alternative 1), 2,200 acres (890 ha) of the Pacific Beach Option (Alternative 2), and 1,400 acres (567 ha) of the Ocean City Option (Alternative 3) (Table 3.4-23, Figure 3.4-14). The offshore extent of critical habitat for marine nearshore areas extends offshore to the depth of 33 ft (10 m) relative to MLLW; this equates to the average depth of the photic zone (USFWS 2005a).

Four stocks of bull trout have been identified within the vicinity of the QUTR action area: Queets River, Quinault River, Moclips River, and Copalis River (Figure 3.4-13) (WDFW 2004c). The Queets River stock is thought to have an anadromous life history form as they have been caught in the anadromous zone. Resident and fluvial forms may also be present. The Quinault River stock has been caught in the anadromous zone of the river, in Quinault Lake, and in the upper river. The Moclips and Copalis rivers stocks are thought to be anadromous as anglers have caught them in the anadromous zone. All four stocks are native and are maintained by wild production. Only one stock (Queets River) is considered healthy and three (Quinault, Moclips and Copalis rivers) are of unknown stock status (Table 3.4-24) (WDFW 2004c).

Table 3.4-24 Status of ESA-listed Anadromous Fish Stocks within the Vicinity of the QUTR Action Area

Species	*No. Stocks*	*Run types*	*Stock Origin*		*Production Types*		*2002 Status*
			Mixed	*Native*	*Wild*	*Composite*	
Bull Trout	4	Fall-Winter		x	x		1-Healthy; 3-Unknown

Source: WDFW 2004c.

No information is available on timing of spawning and presence of juvenile and adult bull trout for the action area (WDFW 2004c).

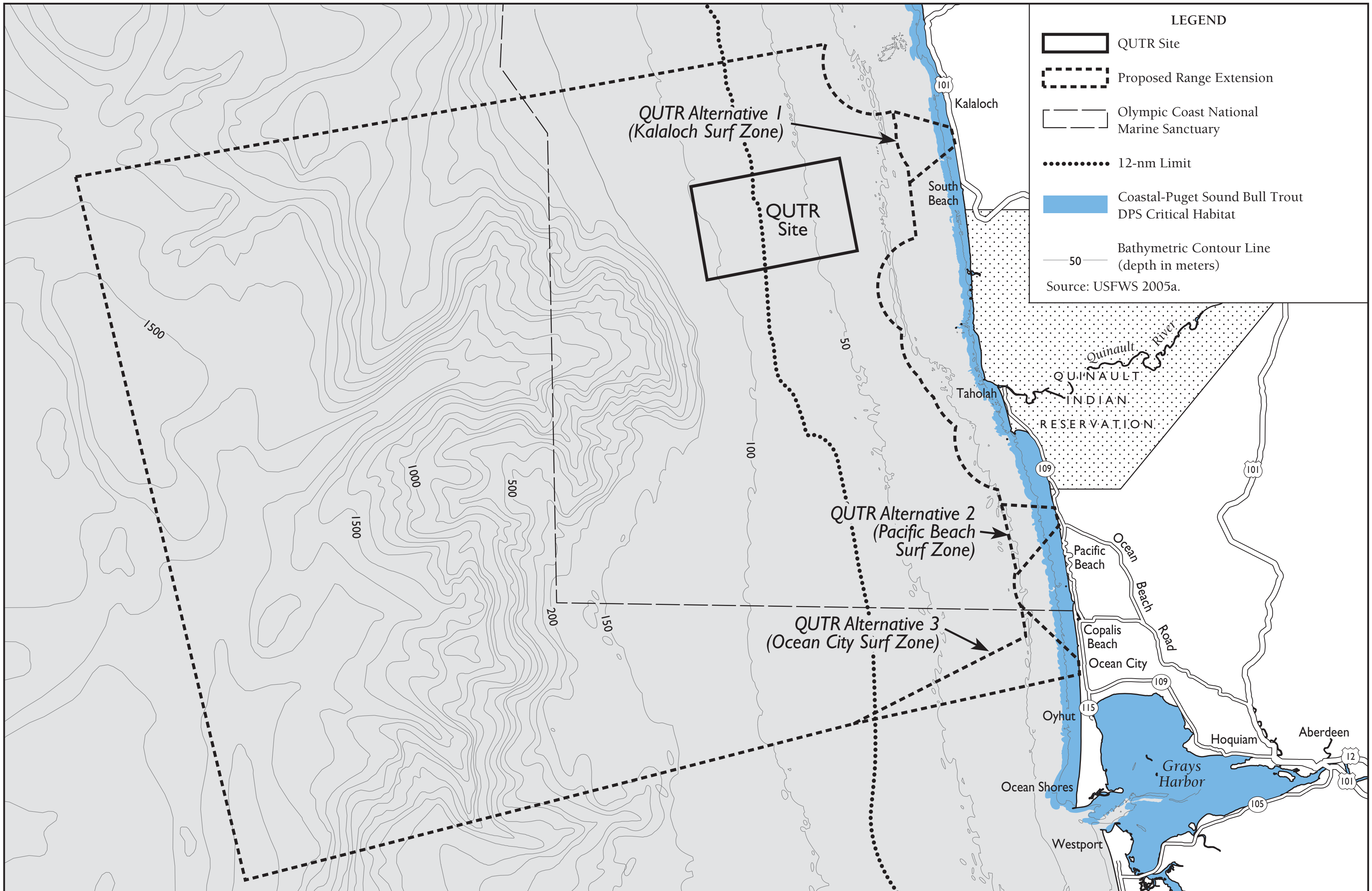


Figure 3.4-14
Coastal-Puget Sound Bull Trout DPS Critical Habitat within and in the Vicinity of the QUTR Action Area

3.4.4.2 Environmental Consequences

QUTR Alternative 1 - Kalaloch

Acoustic Effects. Based on current knowledge, none of the relatively high-frequency acoustic sources proposed for use during Navy activities are expected to have any adverse effects on fish in the QUTR action area. As stated previously, salmonids are exclusively low-frequency hearing generalists and are not sensitive above about 500 Hz. Most acoustic sources proposed for use in the QUTR action area are greater than 1 kHz except for systems like the target simulator (0.1 – 10 kHz), which has a signal level that is 170 dB re 1 µPa@1 m. While there are no data on effects of this particular sound on fish hearing, recent studies have shown that rainbow trout, a species in the same taxonomic genus as the Pacific salmonids and with a very similar ear structure, exposed to sounds of about 155 dB re 1 µPa (received level) noise for up to 9 months had no effect on hearing, growth, or the immune system of this species (Wysocki et al. 2007). In addition, studies on another hearing generalist, the oscar, showed that up to 1 month of exposure to band-limited noise of 170 dB re 1 µPa (received level) had no effect on hearing at all, and 100 percent of the fish survived (Smith et al. 2004a). Based on these data, it is highly likely that the only source in the QUTR action area that is audible to hearing generalists will not have any impact on the fish. Of course, it is recognized that the specific sound from the target simulator may be different from the sounds used in the aforementioned peer-reviewed studies, but considering that the target simulator sound is relatively low intensity, it is likely that extrapolation from the other studies is reasonable to do.

Sources greater than 200 dB re 1 µPa @ 1 m are greater than 2 kHz, which exceeds the hearing sensitivity of most fish. The only exceptions are some of the hearing specialists and, in the case of the QUTR action area, only Pacific herring are likely to be able to detect most of these signals (Mann et al. 2005). Even this species is not able to detect most of the sources in use, with the possible exception of the lower frequency portion of the signal of the dipping sonar. It is not possible to say without experimentation whether the sound emitted by the dipping sonar would be detected, and reacted to, by the Pacific herring. However, since hearing sensitivity of Pacific herring at and above 2 kHz is not great (Mann et al. 2005), the fish would have to be relatively close to the source for the sound to be detectable. Even if the sound was detected, it is expected that the impact on behavior (if any) is likely to be low, and the impact on physiology far lower.

Non-Acoustic Effects. Under QUTR Alternative 1, proposed NUWC Keyport activities within the QUTR site and proposed range extension would increase from 14 to 16 days per year; activities within the Kalaloch surf-zone access area would be conducted 30 days per year (Table 2-2). Activities within the proposed range extension would take place over a larger area but impacts to marine fish and EFH would continue to be the same to those from current activities within the existing QUTR Site. Hazardous materials may potentially be released from vessels, submarines, aircraft, sonobuoys, submarine targets, torpedoes, and range targets. Hydrocarbon spills and material released into the marine environment have the potential to impact fish and their habitats. The potential effects from accidental spills of petroleum products and other harmful fluids from UUVs or support craft during proposed activities would be minimized through implementing shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1) (Section 3.6, Sediment and Water Quality). No effects on marine organisms would result from the limited use of magnetic sensors (non-acoustic) since they are passive and do not have a magnetic field associated with them. Magnetic sources used in other range activities do generate a weak EMF that attenuates rapidly. Evaluations of EMF (Navy 2002a; 2008a) have found that the magnetic sources used in range activities produce a weak EMF, comparable to the earth's at a distance of 4 m from the source, and diminishing further with distance. Most fish apparently cannot detect an EMF, although some fish (sharks, rays, and eels) can, and may even be attracted to the source; however, no adverse effects are known or likely to occur in any case (Navy 2002a; 2008a).

Expendable materials and other bottom disturbance would affect a very small fraction of the existing habitat within the proposed extension area, and such effects would be temporary. The annual number of expended materials is low when compared to the area of the Proposed Action. There would be approximately 617 losses of expendable materials per year over a 1,840.4-nm^2 (6,312.4-km^2) area, which represents approximately 0.34 expendables lost per nm^2 or 0.0004 per acre. Because activities would occur in different areas of the QUTR site, it is reasonable to assume that the expended materials would be randomly distributed within the range. Therefore, there would be no adverse impacts to marine fish within Territorial Waters and non-Territorial Waters with implementation of Alternative 1 within the QUTR Site, proposed range extension, and Kalaloch surf-zone access area.

ESA-Listed Species and Associated Critical Habitat. The potential effects of NUWC Keyport activities within the QUTR action area on the Coastal-Puget Sound Bull Trout DPS and associated critical habitat are analyzed using an approach developed by NMFS (1996) and USFWS (1998). The analysis develops a matrix of pathways (water quality and physical and biological habitat elements) and indicators (various elements of the pathway categories) for salmonid estuarine habitat present in the action area and then characterizes the baseline environmental conditions of salmonid estuarine habitat present in the action area by level of habitat function using the matrix of pathways. Finally, the potential project effects on salmonid estuarine habitat present in the action area are characterized by their potential to restore, maintain, or degrade existing environmental baseline conditions for each habitat indicator within the matrix of pathways.

Critical habitat for bull trout occurs only within the proposed surf-zone access areas (Figure 3.4-14). With implementation of QUTR Alternative 1, systems under test such as sensors or crawler UUVs would conduct activities within the nearshore environment and up onto the beach that would cause short-term, temporary increases in turbidity in the nearshore environment. However, since the surf zone is an active and dynamic environment, this short-term increase in turbidity would be insignificant in relation to the on-going turbidity caused by the surf. Therefore, implementation of QUTR Alternative 1 within QUTR Site, proposed range extension, and Kalaloch surf-zone access area may affect, but is not likely to adversely affect, this ESA-listed marine fish and its designated critical habitat, and any such effects would be very minor.

Additional analysis of potential effects of the proposed QUTR Site extension on critical habitat for Coastal-Puget Sound bull trout considers the PCEs that were used by the USFWS and NMFS to designate critical habitat. These PCEs are included in the pathways and indicators of Table 3.4-25. Consideration of project-related impacts on these PCEs and, by extension, on designated critical habitat, indicates no temporary, permanent, direct, or indirect impacts to the PCEs associated with salmonid critical habitat within the QUTR action area.

Therefore, implementation of QUTR Alternative 1 would have minimal impacts on water quality and no adverse effects on habitats for the marine life stages of Chinook salmon, chum, salmon, steelhead trout, or bull trout within the QUTR action area. In addition, there would be no effects to seasonal distribution or abundance of salmonids within the action area with implementation of QUTR Alternative 1. In its BO, the USFWS concurred with Navy findings on Coastal Puget Sound Bull Trout DPS and its critical habitat.

Table 3.4-25 Summary of Project Effects of Proposed NUWC Activities on Salmonid Habitat Elements within or in the Vicinity of the QUTR Action Area

Pathway	*Indicator*	*Effects of the Action*
Water Quality	Turbidity, Dissolved Oxygen (DO), Water Contamination/Nutrients, Sediment Contamination	With implementation of QUTR Alternative 1, 2, or 3, the temporary placement and recovery of test equipment, anchors, targets, or cabling on the bottom including sensors and tracking equipment or the action of crawler UUVs during test activities along the bottom would cause only short-term, temporary increases in turbidity in the localized area. Swimmer UUVs and other test vehicles are not expected to appreciably increase turbidity as they operate in deeper water and higher in the water column, away from the bottom. Proposed activities would not decrease or have any effect on existing DO levels and water or sediment contamination within the action area. Project effects would maintain baseline water quality conditions within the QUTR action area.
Physical Habitat Features	Substrate/Armoring, Depth/Slope, Tideland Conditions, Marsh Prevalence, Refugia, Physical Barriers, Current Patterns, Salt/Fresh Water Mixing Patterns and Locations	No direct physical impacts to intertidal or shallow subtidal substrata or habitats utilized by salmonids would result from proposed activities. Project effects would maintain baseline physical habitat conditions within the QUTR action area.
Biological Habitat Features	Salmon Prey Availability, Forage Fish Community, Aquatic Vegetation, Exotic Species	Proposed NUWC Keyport activities would maintain baseline conditions of demersal prey and forage fish availability within the action area. Although epibenthic invertebrates, preyed upon by juvenile salmonids, could be affected by crawler UUVs as they move along the bottom, and by placement of test equipment, anchors, or cabling on the bottom including sensors and tracking equipment, these effects would be short term and would not result in long-term changes in prey availability or distribution. In addition, implementation of QUTR Alternative 1, 2, or 3 would have no direct effect on physical habitat elements of salmonid habitats, including substrata which maintain macroalgae beds in the action area. Proposed NUWC Keyport activities would also have no effect that would increase the number or abundance of exotic species within the action area. Therefore, project effects would maintain baseline biological habitat elements within the QUTR action area.

Essential Fish Habitat.

As discussed above (Table 3.4-25), there would be minimal and temporary effects, if any, to water quality parameters that are important to fish, such as turbidity and metals, and the physical and biological elements of marine or freshwater habitats within of the QUTR action area. As described previously (Figure 3.4-12), Groundfish Conservation Areas which are off-limits to trawling have been designated off of the Washington coast (NMFS 2006h). NUWC Keyport RDT&E activities are not similar to trawling – they do not involve dragging heavy nets over extensive areas of the seabed. Potential interactions with the bottom associated with current and proposed activities are described further below.

Expendable Materials

Expended materials include all items that are released during the course of a ranging operation and are expendable. These items are not recovered due to the low value of the materials as well as the impracticality of their recovery. Most expendable materials, such as parts of sonobuoys, parachutes and other accessories, sink to the bottom and come into direct contact with the seafloor. These materials become buried in the sediment. Some other examples of these materials are copper guiding wire as well as mine shapes and clump anchors. For more examples as well as detailed descriptions of each material refer to Chapter 1 (Section 1.3.3.7). The locations of expended materials may be anywhere within the range site. These would be expended as a result of the activity tempo and days of activities described in Section 2.3.

Recovery of Test Systems

Defined as the collection of a test vehicle when it is lying on the bottom or has become buried in bottom sediments and requires some digging for collection, recovery involves equipment that come into direct contact with the seafloor. Although 95 percent of test vehicles are designed to never contact the seafloor, approximately 5 percent sink to the bottom and are recovered by either a ROV or a Submerged Object Recovery Device (SORD). The type of equipment likely to come into contact with the seafloor during recovery would be the test vehicle as well as the recovery vehicle or device. For example a torpedo may sink to the bottom and become buried in sediment, or, a ROV such as SORD may temporarily disturb the seafloor by displacing sediment and increasing turbidity. For more information on Recovery refer to Section 1.3.3.6. When recovery occurs it usually lasts less than a day and is localized within the area where the item being recovered is located. Given that the size of the disturbed area would be small (several yards at most) and placement and recovery activities would be short term and infrequent, impacts would be minimal. Recovery may occur anywhere within the range site and would occur as a result of the activity tempo and days of activities described in Section 2.3.

Temporary Sea-bottom Equipment

The proposed range extension would not result in additional permanent bottom deployed instrumentation. All bottom deployed equipment is temporary and would be recovered. Temporary deployment is defined for this analysis as less than 2 years, which includes planning, funding, and availability to retrieve/recover. Portable range tracking equipment and sensors for tracking using acoustics, magnetics, may be mounted on the bottom or may be suspended from a buoy at the surface and an anchor at the bottom.

Permanent Sea-bottom Equipment

Some bottom sensors are permanently mounted on the sea floor for tracking and are maintained and configured by the Navy. The sensors are connected to the shore via cables, in the case of the QUTR site extend under the beach to the bluffs and end at a Navy trailer and communication tower in Kalaloch (National Park Service [NPS] property).

Test Vehicle Propulsion Activities

During Test Vehicle Propulsion activities the system is likely to be in mid stratum. The test vehicle may expend guidance wire.

Mine Activities

During inert mine detection, classification and localization activities an inert mine shape may be temporarily deployed. This may include one shape or a field of shapes. All mine targets in the proposed range extension areas would be temporary; they would not be permanently mounted on the bottom and could be removed when they were no longer necessary for testing activities, which could be up to 2 years.

Several target shapes may be deployed in the surf-zone test area in water greater than 10 ft (3 m) deep; additional targets would be placed in depths of less than 10 ft (3 m). Inert mine shapes are made of many composite materials and are often put on the bottom or float in the water column above an anchor, often in groups. A series of inert mine fields can be laid to test the detection, classification, and localization capability of the system under test. For example, a concrete clump can be put on the bottom.

Stationary, Bottom-Anchored Targets

Associated with the units being tested, a series of about 20 target shapes are set out in a uniform or random pattern. They can be made of plastic, metal, and concrete. Varying in shape, they measure about 1.8 by 10 ft (0.5 by 3 m) and weigh about 800 lbs (363 kg). Targets either sit on the bottom or are tethered by an anchor to the bottom at various depths. Targets are placed approximately 200 to 300 yards (183 to 274 m) apart using a support craft and remain on the bottom until they need to be replaced. Temporary inert mine shapes would be recovered to the maximum extent practicable. NUWC Keyport routinely recovers all major test components including targets and inert mine shapes. Components either sink into a soft bottom or lie on a hard bottom where they may be recovered or eventually covered by shifting sediments.

UUV Activities

Electric, magnetic, and acoustic sensor measurements of the UUV would be obtained by having the UUV make several passes over a transportable electric and magnetic field measurement system installed at the range site.

One example of a UUV is a bottom-crawling robotic vehicle. It would be tested in the surf-zone area in water depths from 0 to 100 ft (0 to 31 m). The representative crawler would carry a payload of several acoustic emitters, including communication/navigation equipment and sonars. Crawler UUVs are self-powered underwater vehicles designed to operate on land, in the surf zone, and in very shallow water. They can move along the bottom on tracks.

Conclusion

Expendable materials and other bottom disturbance would affect a very small fraction of the existing habitat within the range site, and such effects would be temporary. The temporary placement and recovery of test equipment, anchors, targets, or cabling on the bottom including sensors and tracking equipment or the action of crawler UUVs during test activities along the bottom would cause only short term, temporary increases in turbidity in the localized area. Although marine biota could be affected by the deposition of expendable materials or activities involving placement or movement of items on the bottom (e.g., anchors, targets, crawler UUVs) or recovery activities, these effects would be short term, would affect a very small fraction of the habitat, and would not result in long-term changes in the distribution or abundance of the natural resources.

Therefore, implementation of QUTR Alternative 1 would not reduce the quality or quantity of EFH for any managed species. Therefore, no adverse effect to EFH would occur.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of QUTR Alternative 2 would result in the same impacts to marine fish, including threatened and endangered species, critical habitat, and EFH, as previously described under QUTR Alternative 1. Therefore, implementation of QUTR Alternative 2 within QUTR Site, proposed range extension, and Pacific Beach Surf Zone access area may affect, but is not likely to adversely affect, the ESA-listed bull trout and its designated critical habitat, and any such effects would be very minor. As with Alternative 1, there would be minimal impacts on water quality and no adverse effects on habitats for the marine life stages of Chinook salmon, chum, salmon, steelhead trout, or bull trout within the

QUTR action area. In addition, with implementation of QUTR Alternative 2 there would be no effects to seasonal distribution or abundance of salmonids within the action area and any effects on EFH would be minimal and temporary and would not reduce the quality or quantity of EFH for any managed species within Territorial Waters and non-Territorial Waters. Therefore, no adverse effect to EFH would occur.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of QUTR Alternative 3 would result in the same impacts to marine fish, including threatened and endangered species, critical habitat, and EFH, as previously described under QUTR Alternative 1. Therefore, implementation of QUTR Alternative 3 within QUTR Site, proposed range extension, and Ocean City Surf Zone access area may affect, but is not likely to adversely affect, the ESA-listed bull trout and its designated critical habitat, and any such effects would be very minor. As with Alternative 1, there would be minimal impacts on water quality and no adverse effects on habitats for the marine life stages of Chinook salmon, chum, salmon, steelhead trout, or bull trout within the QUTR action area. In addition, with implementation of QUTR Alternative 3 there would be no effects to seasonal distribution or abundance of salmonids within the action area and any effects on EFH would be minimal and temporary and would not reduce the quality or quantity of EFH for any managed species within Territorial Waters and non-Territorial Waters. Therefore, no adverse effect to EFH would occur.

No-Action Alternative

Under the No-Action Alternative, current activities would continue within the existing boundaries of the QUTR Site. The existing action area of the QUTR Site has been included in the earlier analysis of the alternatives including the maintenance of the shore run of the cables from the Kalaloch ranger station and existing bottom tracking equipment. Implementation of the No-Action Alternative would have no impact on marine fish, would not affect ESA-listed marine fish, and would not adversely affect EFH within Territorial Waters and non-Territorial Waters.

3.4.4.3 Mitigation Measures

Since there would be minimal impacts to marine fish from implementing the QUTR Site Alternative 1, Alternative 2, Alternative 3, or the No-Action Alternative, no mitigation measures would be necessary. As a matter of standard practice, to the extent practicable the Navy retrieves expendable materials and avoids and minimizes any loss or discharge of materials incidental to RDT&E and training activities (OPNAVINST 5090.1 series). No further measures are necessary to protect fish and EFH during the proposed activities. Although it is the Navy's conclusion that none of the alternatives would have an adverse effect on Essential Fish Habitat (EFH) that would require mitigation under the Magnuson-Stevens Fishery Conservation and Management Act, the Navy has considered NMFS' EFH conservation recommendations and is in discussion with NMFS regarding appropriate EFH conservation measures that could be implemented (Appendix H).

Neither the final USFWS BO nor the draft NMFS BO identified adverse effects that would be likely to occur for ESA-listed fish species. To the extent practicable, NUWC Keyport will comply with reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

3.5 MARINE MAMMALS

This section describes the existing conditions and potential environmental consequences for marine mammal species that occur within the three existing ranges and the areas proposed for extension. The "action area" for each range site includes the existing range site and the proposed range extension(s): existing Keyport Range Site and proposed range extension (Keyport action area); existing DBRC Site and proposed northern and southern extension areas (DBRC action area); and existing QUTR Site, proposed range extension, and surf-zone access areas (QUTR action area).

Marine mammals that potentially occur within the action areas belong to four taxonomic groups: *mysticetes* (baleen whales) and *odontocetes* (toothed whales, porpoises and dolphins), which are known collectively as cetaceans; *pinnipeds* (seals and sea lions); and *mustelids* (sea otter). It should be noted that another mustelid, the river otter, occurs in the waters of the Keyport and DBRC sites, but is not considered a marine mammal from the standpoint of regulatory protection under MMPA. The river otter is analyzed in Section 3.1. Pinnipeds are further categorized into otariids (eared seals such as sea lions and fur seals), and phocids (earless seals such as harbor seals and elephant seals).

A total of 24 cetacean species, 5 pinniped species, and 2 mustelids (only one of which, the sea otter, is considered a marine mammal) are known to occur in Washington waters; however, several are seen only rarely. All marine mammals are protected under MMPA and some are also listed as threatened or endangered under the ESA. In accordance with section 7 of ESA, a Biological Evaluation (BE) has been prepared to address potential impacts to ESA-listed species and associated critical habitat in the action area.

This section includes the following: 1) discussion of the relevant regulatory framework for marine mammals; 2) description of the methodology for assessing acoustic effects on marine mammals; 3) description of the acoustic properties of the range sites; 4) review of the acoustic capabilities of marine mammals; 5) summary of sound sources used at the range sites; and 6) for each of the three range sites, the existing conditions and environmental consequences of the Proposed Action and alternatives.

3.5.1 Regulatory Framework

The MMPA prohibits the unauthorized "take" of any marine mammal by harm or harassment (see Glossary for definition), and provides the regulatory process by which such take can be authorized by NMFS. The ESA further protects species of marine mammals that are listed as threatened or endangered and requires the federal action agency to consult with NMFS whenever a proposed action "may affect" through harm or harassment a listed species of marine mammal.

The regulatory framework for estimating potential acoustic effects from training activities on cetacean species makes use of the methodology that was developed in cooperation with NOAA for the Navy's *Undersea Warfare Training Range (USWTR) Draft Overseas Environmental Impact Statement/Environmental Impact Statement (OEIS/EIS),* (Navy 2005b). Via response comment letter to USWTR received from NMFS January 30, 2006, NMFS concurred with the use of EL for the determination of physiological effects to marine mammals. Therefore, this methodology is used to estimate the annual exposure of marine mammals that may be considered Level A harassment or Level B harassment as a result of temporary, recoverable physiological effects.

In addition, the approach for estimating potential acoustic effects from training activities on marine mammals makes use of the comments received on the Navy's USWTR Draft OEIS/EIS(Navy 2005b) and the *2006 Rim of the Pacific Supplemental Overseas Environmental Assessment* (Navy 2006d). NMFS and other commentators recommended the use of an alternate methodology to evaluate when sound exposures might result in behavioral effects without corresponding physiological effects. As a result of these comments, this document uses a risk function approach to evaluate the potential for behavioral effects. A number of Navy actions and NOAA rulings have helped to qualify possible events deemed as "harassment" under the MMPA. As stated previously, "harassment" under the MMPA includes both potential injury (Level A), and disruptions of natural behavioral patterns to a point where they are abandoned or significantly altered (Level B). NMFS also includes mortality as a possible outcome to consider in addition to Level A and Level B harassment. The acoustic effects analysis and exposure calculations are based on the following premises:

- Harassment that may result from Navy operations described in this EIS/OEIS is unintentional and incidental to those operations.

- This EIS/OEIS uses an unambiguous definition of injury as defined in the USWTR Draft OEIS/EIS (Navy 2005b), 2006 Rim of the Pacific Supplemental Overseas Environmental Assessment (Navy 2006d), and in previous rulings (NOAA 2001, 2002a): injury occurs when any biological tissue is destroyed or lost as a result of the action.

- Behavioral disruption might result in subsequent injury and injury may cause a subsequent behavioral disruption, so Level A and Level B (defined below) harassment categories can overlap and are not necessarily mutually exclusive. However, by prior ruling (NOAA 2001, 2006c), this EIS/OEIS analysis assumes that Level A and B do not overlap.

- An individual animal predicted to experience simultaneous multiple injuries, multiple disruptions, or both, is counted as a single take (NOAA 2001, 2006c). An animal whose behavior is disrupted by an injury has already been counted as a Level A harassment and will not also be counted as a Level B harassment. Based on the consideration of two different acoustic modeling methodologies to assess the potential for sound exposures that might result in behavioral disturbance, it is possible that the model would count a Level B TTS exposure and a Level B behavioral exposure for the same animal. This approach overestimates the potential for behavioral disturbance incidents, it is considered conservative because the actual incidents of disturbance are expected to be lower.

- The acoustic effects analysis is based on primary exposures of the action. Secondary, or indirect, effects, such as susceptibility to predation following injury and injury resulting from disrupted behavior, while possible, can only be reliably predicted in circumstances where the responses have been well documented. Consideration of secondary effects would result in Level A exposures being considered Level B exposures, and vice versa, since Level A exposure (assumed to be Level A harassment and injury) has the potential to disrupt behavior resulting in Level B harassment. In like manner, temporary physiological or behavioral disruption (Level B exposures) could be conjectured to have the potential for injury (Level A). Consideration of secondary effects would lead to circular definitions of exposures. For beaked whales, where a connection between behavioral disruption by mid frequency active sonar and injury to beaked whales is considered a possibility (under specific operational and environmental parameters), secondary effects are considered in the discussion for each species.

3.5.2 Assessing Marine Mammal Acoustic Effects

This section describes the approach or "modeling" used to predict the numbers and types of harassment to marine mammals from acoustic source activities conducted at the NAVSEA NUWC Keyport Range Complex. The methods applied herein were originally developed for mid-frequency (1-10 kHz) active

(MFA) sonars (e.g., surface-ship hull-mounted sonars, which are not used in the NAVSEA NUWC Keyport Range Complex). Nevertheless, the methods and thresholds are agreed upon by the U.S. Navy and NMFS as the best available science with which to determine the extent of physiological or behavioral effects on marine mammals that would result from the use of mid-frequency active (MFA) and high-frequency active (HFA) acoustic sources under the Proposed Action and alternatives. Detailed descriptions of the modeling process and results are provided in Appendix C.

Of the high frequency sources modeled for this analysis, three are near or above the functional hearing ranges of many marine mammal species. For example, the upper hearing limit of baleen whales (mysticetes) is considered to be approximately 22 kHz (Southall et al. 2007). Sounds at frequencies above the hearing limits, by definition, cannot be a source of harm or harassment to marine mammals. For many of the Odontocetes, and for pinnipeds in water, only one of the modeled sources is near or above the upper limit of hearing (S4 at 150 kHz). This upper limit of hearing for pinnipeds in water is approximately 75 kHz (Southall et al. 2007), while many dolphins, larger toothed whales, beaked and bottlenose whales have an upper limit of hearing extending to 160 kHz (Southall et al. 2007). For true porpoises and a few other species the upper limit of hearing extends to 180 kHz (Southall et al. 2007). Another consideration is that hearing sensitivity generally declines with increasing frequency as the upper limits are approached (NRC 2003).

NMFS and Navy made the decision to apply the MFA methodology to HFA sources due to lack of available and complete information regarding HFA sources. As more specific and applicable data become available for MFA/HFA sources, NMFS can use these data to modify the outputs generated by the risk function to make them more realistic. Ultimately, data may exist to justify the use of additional, alternate, or multi-variate functions.

3.5.2.1 Defining Marine Mammal Harassment from Acoustic Sources

Laws, regulations, and policies have identified and established what constitutes harassment of marine mammals as a result of sound in water. The legal definitions express the nature of the harassment and are considered "qualitative" or distinctions based on qualities only. Further interpretation of the acts or regulations provides the defined metrics (or measurements), establishes thresholds based on these metrics and requires "quantitative" estimates of the effects of sound on marine mammals. Quantitative estimates are determinations expressed numerically. Based on the definitions of harassment and policies associated with the quantification of potential effects, a scientific model was developed based on source characteristics and animal density. The model takes into account many variables and predicts the expected or average harassment of marine mammals from representative acoustical activity at each of the associated range sites and the proposed extensions.

The interpretation by NMFS distinguishes among three types of harassment:

- Level A (permanent threshold shift (PTS)) - includes any act that injures or directly harms a marine mammal from destruction or loss of biological tissue and physiological functions. PTS harassment is evaluated by calculating total received energy level (EL) as described in Section 3.5.2.4 and in Appendix C;
- Level B (temporary threshold shift (TTS)) - includes any act that results in a temporary, non-injurious distortion of hearing-related tissues. TTS harassment is evaluated by calculating total received EL as described in Section 3.5.2.4 and in Appendix C; and

- Level B (behavioral reaction without a threshold shift (sub-TTS)) - includes actions that disturb a marine mammal through the disruption of natural behavioral patterns, such as migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to directly injure the animal. Sub-TTS harassment is evaluated by calculating a risk function, as described in Section 3.5.2.5 and in Appendix C.

Marine mammals rely heavily on the use of underwater sounds to communicate and to gain information about their surroundings. Experiments also show that they hear and react to many anthropogenic sounds (i.e., sounds caused or produced by humans) (see review in Richardson et al. 1995), but the reactions differ among the marine mammals. Navy RDT&E activities conducted at the NAVSEA NUWC Keyport Range Complex occur both on land and over/within/on the water. Since seals and sea lions are likely to spend significant time out of the water, discussion of potential acoustic effects from over water activities is limited to these pinnipeds.

Marine mammals are adapted to an acoustically variable and often noisy environment. The marine environment is filled with non-biological sounds (e.g., wind, waves, earthquakes, and thunderstorms) and biological sounds (e.g., whales, fish, and crustaceans). Even if a sound is audible to a marine mammal, it may not react in an obvious manner. Marine mammals may tolerate noise if their need for being in a particular area outweighs the disturbance effect of the sound source. In some cases, marine mammals may become accustomed (or habituate) to a noise source where no threat is perceived and there is no negative reinforcement. It is generally expected that the response threshold of a marine mammal is higher for brief transient sounds than for longer sound bursts or continuous sounds.

However, noise in the marine environment does have the potential to interfere with a marine mammal's ability to communicate (by masking biologically important sounds), which in turn has the potential to affect their distribution, abundance, behavior, and general well-being. Since masking (without a resulting threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect for this assessment but rather a potential behavioral effect. Potential behavior modifications that may be displayed by marine mammals that are, or have been, exposed to noise include: (1) changes in general behavior patterns; (2) changes in orientation, breathing, movement (swimming) patterns, and speed of movement; (3) interruption of feeding; and (4) avoidance of an area previously occupied (Richardson et al. 1995; Moore and Clarke 2002).

The range of possible effects can include: 1) minor changes in behavior of individual animals (that may only be discernible through statistical analysis of observational data) and that are unlikely to result in biologically significant impacts; 2) acute disturbance that results in behavioral changes that are clearly observable in the field, such as alteration of migration routes, or displacement from feeding and haulout areas that could result in biologically significant impacts at the individual and/or population level; 3) physiological impacts such as temporary or permanent hearing impairment; and 4) other noise-induced physical effects that can result in biologically significant impacts to individuals and populations (see Table 3.5-1). Physiological impacts may be among the most difficult to evaluate, except through acoustic modeling, due to the inability to assess those impacts on individuals, unless the impact is so severe that stranding and mortality results. Two other recently proposed hypotheses that are largely unstudied are effects caused by acoustic resonance, such as gas-bubble lesions and tissue damage.

Table 3.5-1 Potential Impacts of Noise on Marine Mammals

Impact	*Potential Result*
Physical - non auditory	• Damage to tissue • Gas bubble lesions
Physical - auditory	• Damage to ears • Permanent hearing threshold shift • Temporary hearing threshold shift
Perceptual	• Masking of communication • Masking of other biologically important sounds • Interference with ability to acoustically interpret environment • Adaptive shifting of vocalization
Behavioral	• Interruption of behavior • Modification of behavior • Displacement from area
Chronic/Stress	• Decreased viability of individual • Increased vulnerability to disease • Increased potential of impacts from negative cumulative effects • Sensitization to noise • Habituation to noise (animals remain near noise source in spite of negative effects) • Reduced reproductive success
Indirect effects	• Reduced availability of prey

Source: Simmonds and Dolman 1999.

3.5.2.2 General Analytical Framework for Estimating Acoustic Effects

Marine mammals respond to various types of man-made sounds introduced in the ocean environment. Responses are typically subtle and can include shorter surfacings, shorter dives, fewer blows per surfacing, longer intervals between blows (breaths), ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (NRC 2005). However, it is not known how these responses relate to significant effects (for example, long-term effects or population consequences) (NRC 2005). Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those marine mammals.

In estimating the potential for marine mammals to be exposed to sound levels that would constitute a take, the following actions were completed:

- Evaluated potential effects within the context of existing and current regulations, thresholds, and criteria.
- Identified representative acoustic sources that will be used during active sonar activities.
- Identified the location, season, and duration of the action to determine which marine mammal species are likely to be present.

- Estimated the number of marine mammals (i.e., density) of each species that will likely be present during active sonar activities.
- Applied the applicable acoustic threshold criteria to the predicted sound exposures from the proposed activity. The results were then evaluated to determine whether the predicted sound exposures from the acoustic model might be considered harassment.

Figure 3.5-1 shows the general analytical framework used to apply the specific thresholds discussed in this section. The framework is organized from left to right and addresses the physics of sound propagation (Physics), the potential physiological processes associated with sound exposure (Physiology), the potential behavioral processes that might be affected as a function of sound exposure (Behavior), and the immediate effects these changes may have on functions the animal is engaged in at the time of exposure (Life Function – Proximate). These compartmentalized effects are extended to longer-term life functions (Life Function – Ultimate) and into population and species effects. Throughout the framework, dotted and solid lines are used to connect related events. Solid lines designate those effects that will happen; dotted lines designate those that might happen but must be considered (including those hypothesized to occur but for which there is no direct evidence).

Some boxes are colored according to how they relate to the definitions of harassment under the MMPA. Red boxes correspond to events that are injurious. By prior ruling and usage, these events would be considered as Level A harassment under the MMPA. Yellow boxes correspond to events that have the potential to qualify as Level B harassment under the MMPA. Based on prior ruling, the specific instance of TTS is considered as Level B harassment. Boxes that are shaded from red to yellow have the potential for injury and behavioral disturbance.

Physics

Sound emitted from a source immediately begins to attenuate due to propagation loss. Animals were assumed to have a uniform statistical distribution, i.e. equal probability of occurrence anywhere within the calculated sound fields, to assess the numbers of animals that would experience exposure to a given sound level. If the animal was determined to be affected, two possible scenarios were considered with respect to the animal's physiology– effects on the auditory system and effects on non-auditory system tissues. These are not independent pathways and both were considered since the same sound could affect both auditory and non-auditory tissues. Note that the model did not account for any animal response; rather the animals were considered stationary, accumulating energy until the threshold was tripped.

Physiology

Potential impacts to the auditory system were assessed by considering the characteristics of the received sound (that is the amplitude, frequency, and duration) and the sensitivity of the exposed animals. Some of these assessments were numerically based (e.g., TTS, PTS, perception). Others were qualitative, due to lack of information, or were extrapolated from other species for which information exists. Potential physiological responses to the sound exposure were ranked in descending order, with the most severe impact (auditory trauma) occurring at the top and the least severe impact occurring at the bottom (the sound is not perceived).

- Auditory trauma represents direct mechanical injury to hearing related structures, including tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as the organ of Corti and the associated hair cells. Auditory trauma is always injurious but could be temporary and not result in PTS. Auditory trauma is always assumed to result in a stress response.

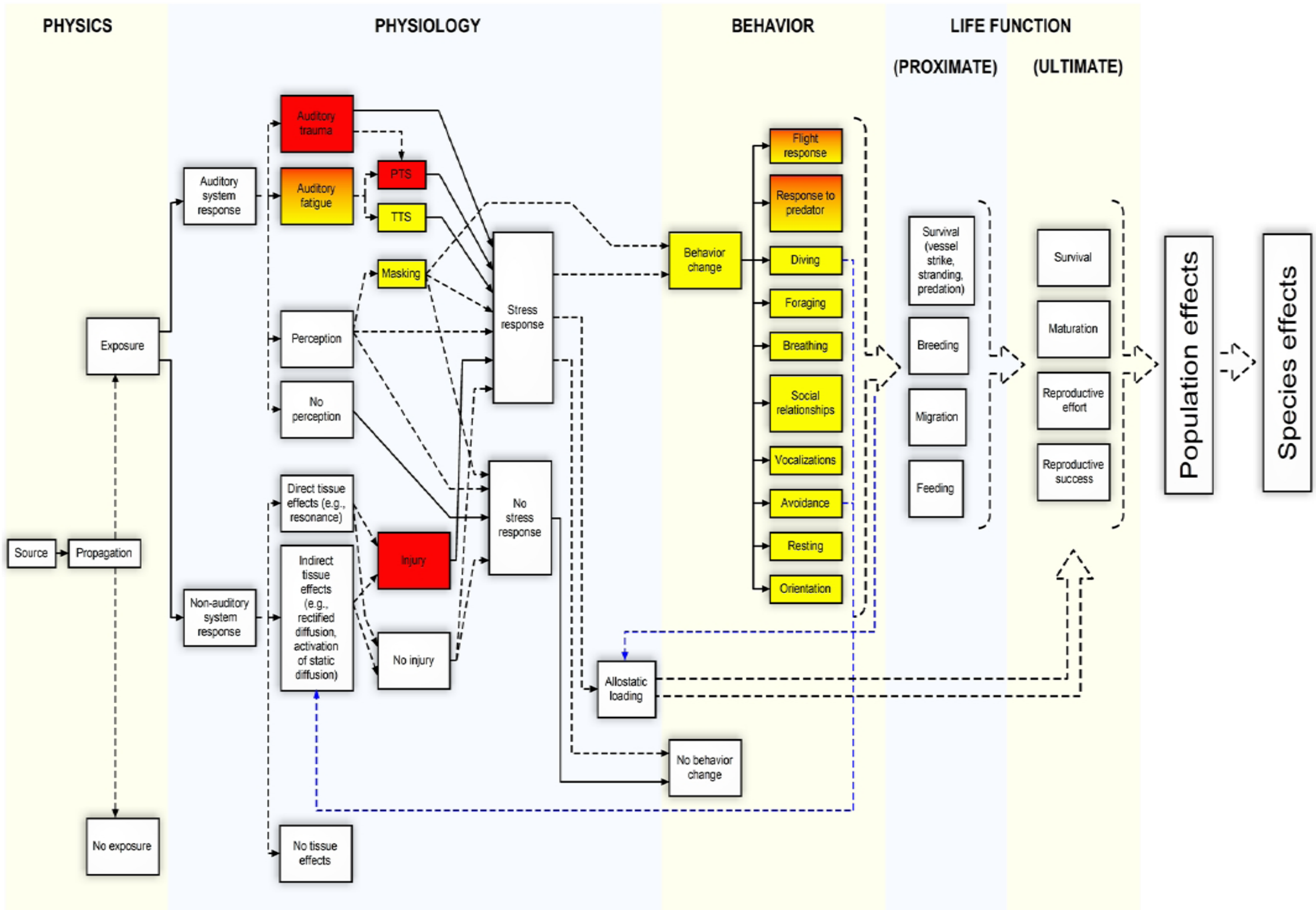


Figure 3.5-1 Analytical Framework for Evaluating Acoustic Effects to Marine Mammals

- Auditory fatigue refers to a loss of hearing sensitivity after sound stimulation. The loss of sensitivity persists after the cessation of the sound. The mechanisms responsible for auditory fatigue differ from auditory trauma and would primarily consist of metabolic exhaustion of the hair cells and cochlear tissues. The features of the exposure (e.g., amplitude, frequency, duration, temporal pattern) and the individual animal's susceptibility would determine the severity of fatigue and whether the effects were temporary (TTS) or permanent (PTS). Auditory fatigue (PTS or TTS) is always assumed to result in a stress response.
- Perception refers to an animal's ability to differentiate a sound from background ambient noise. Sounds with sufficient amplitude and duration to be detected among the background ambient noise are considered to be perceived. This category includes sounds from the threshold of audibility through the normal dynamic range of hearing (i.e., not capable of producing fatigue). To determine whether an animal perceives the sound, the received level, frequency, and duration of the sound are compared to what is known of the species' hearing sensitivity.
- Masking may occur when a perceived sound interferes with an animal's ability to detect other sounds at the same time. Unlike auditory fatigue, which always results in a stress response because the sensory tissues are being stimulated beyond their normal physiological range, masking may or may not result in a stress response, depending on the degree and duration of the masking effect. Masking may also result in a unique circumstance where an animal's ability to detect other sounds is compromised without the animal's knowledge. This could conceivably result in sensory impairment and subsequent behavior change; in this case, the change in behavior is the lack of a response that would normally be made if sensory impairment did not occur. For this reason, masking also may lead directly to behavior change without first causing a stress response.
- Depending upon the features of perceived sounds, the sound exposure may or may not produce a stress response in an animal. Factors to consider in this determination include the probability of the animal being naïve or experienced with the sound.
- No stress response would be produced if the received sound level lacks sufficient amplitude, frequency, and duration to be perceptible by the animal.

Potential impacts to tissues other than those related to the auditory system are assessed by considering the characteristics of the sound and the known or estimated response characteristics of nonauditory tissues. Some of these assessments can be numerically based (e.g., exposure required for rectified diffusion). Others will be necessarily qualitative, due to lack of information. Each of the potential responses may or may not result in a stress response.

- Direct tissue effects – Direct tissue responses to sound stimulation may range from tissue shearing (injury) to mechanical vibration with no resulting injury. Any tissue injury would produce a stress response, whereas noninjurious stimulation may or may not.
- Indirect tissue effects – Based on the amplitude, frequency, and duration of the sound, it must be assessed whether exposure is sufficient to indirectly affect tissues. For example, the hypothesis that rectified diffusion occurs is based on the idea that bubbles that naturally exist in biological tissues can be stimulated to grow by an acoustic field. Under this hypothesis, one of three things could happen: (1) bubbles grow to the extent that tissue hemorrhage occurs (injury); (2) bubbles develop to the extent that a complement immune response is triggered or nervous tissue is subjected to enough localized pressure that pain or dysfunction occurs (a stress response without injury); or (3) the bubbles are cleared by the lung without negative consequence to the animal. The probability of rectified diffusion, or any other indirect tissue effect, will necessarily be based on what is known about the specific process involved.

- No tissue effects – The received sound is insufficient to cause either direct (mechanical) or indirect effects to tissues. No stress response occurs.

The Stress Response

The acoustic source is considered a potential stressor if, by its action on the animal, via auditory or nonauditory means, it may produce a stress response in the animal. The term "stress" has taken on an ambiguous meaning in the scientific literature, but with respect to Figure 3.5-1 and the later discussions of allostasis and allostatic loading, the stress response will refer to an increase in energetic expenditure that results from exposure to the stressor and which is predominantly characterized by either the stimulation of the sympathetic nervous system (SNS) or the hypothalamic-pituitary-adrenal (HPA) axis (Reeder and Kramer, 2005).

The presence and magnitude of a stress response in an animal depends on a number of factors. These include the animal's life history stage, the environmental conditions, reproductive or developmental state, and experience with the stressor.

The stress response may or may not result in a behavioral change, depending on the characteristics of the exposed animal. However, provided a stress response occurs, it was assumed that some contribution is made to the animal's total stress load that could affect its life functions.

If the acoustic source did not produce tissue effects, was not perceived by the animal, or did not produce a stress response by any other means, it was assumed the exposure did not contribute to its stress load. Additionally, without a stress response or auditory masking, it was assumed that there would be no behavioral change. Conversely, any immediate effect of exposure that produced an injury was assumed to also produce a stress response and contribute to total stress load.

Behavior

Acute stress responses may or may not cause a behavioral reaction. However, all changes in behavior were expected to result from an acute stress response. This expectation was based on the idea that some sort of physiological trigger must exist to change any behavior. The exception to this rule is the case of masking. The presence of a masking sound may not produce a stress response, but may interfere with the animal's ability to detect and discriminate biologically relevant signals. The inability to detect and discriminate biologically relevant signals hinders the potential for normal behavioral responses to auditory cues and was thus considered a behavioral change.

Numerous behavioral changes could occur as a result of stress response. For each potential behavioral change, the magnitude in the change and the severity of the response were estimated. Certain conditions, such as stampeding (i.e., flight response) or a response to a predator, might have a probability of resulting in injury. For example, a flight response, if significant enough, could produce a stranding event. Under the MMPA, such an event would be considered a Level A harassment. Each altered behavior may also have the potential to disrupt biologically significant events (e.g., breeding or nursing) and may need to be qualified as Level B harassment. All behavioral disruptions have the potential to contribute to the total stress load.

Special considerations were given to the potential for avoidance and disrupted diving patterns. Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths were provided between avoidance and diving and indirect tissue effects. This feedback accounted for the hypothesis that variations in diving behavior and/or avoidance responses could result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation.

Life Functions

Two types of life functions were considered in the assessment of acoustic exposure effects. These were proximate and ultimate life functions.

Proximate life history functions are the functions that the animal is engaged in at the time of acoustic exposure. The disruption of these functions, and the magnitude of the disruption, is something that must be considered in determining how the ultimate life history functions are affected.

The ultimate life functions are those that enable an animal to contribute to the population's (or stock, or species) long-term maintenance. The impact to ultimate life functions will depend on the nature and magnitude of the perturbation to proximate life history functions.

Application of the Framework

For each species in the region of a Proposed Action, the density and occurrence of the species relative to the timing of the Proposed Action was determined. The probability of exposing an individual was based on the density of the animals at the time of the action and the acoustic propagation loss. Based upon the calculated exposure levels for the individuals, or proportions of the population, an assessment for auditory and nonauditory responses was made. Based on the available literature on the bioacoustics, physiology, dive behavior, and ecology of the species, the process outlined in Figure 3.5-1 was used to assess the potential impact of the exposure to the population and species.

Physiological and Behavioral Effects

Sound exposure may affect multiple biological traits of a marine animal; however, the MMPA as amended directs which traits should be used when determining effects. Effects that address injury are considered Level A harassment. Effects that address behavioral disruption are considered Level B harassment.

The biological framework was structured according to potential physiological and behavioral effects resulting from sound exposure. The range of effects were then assessed to determine which qualify as injury or behavioral disturbance under MMPA regulations. Physiology and behavior are chosen over other biological traits because:

- They are consistent with regulatory statements defining harassment by injury and harassment by disturbance.
- They are components of other biological traits that may be relevant.
- They are a more sensitive and immediate indicator of effect.

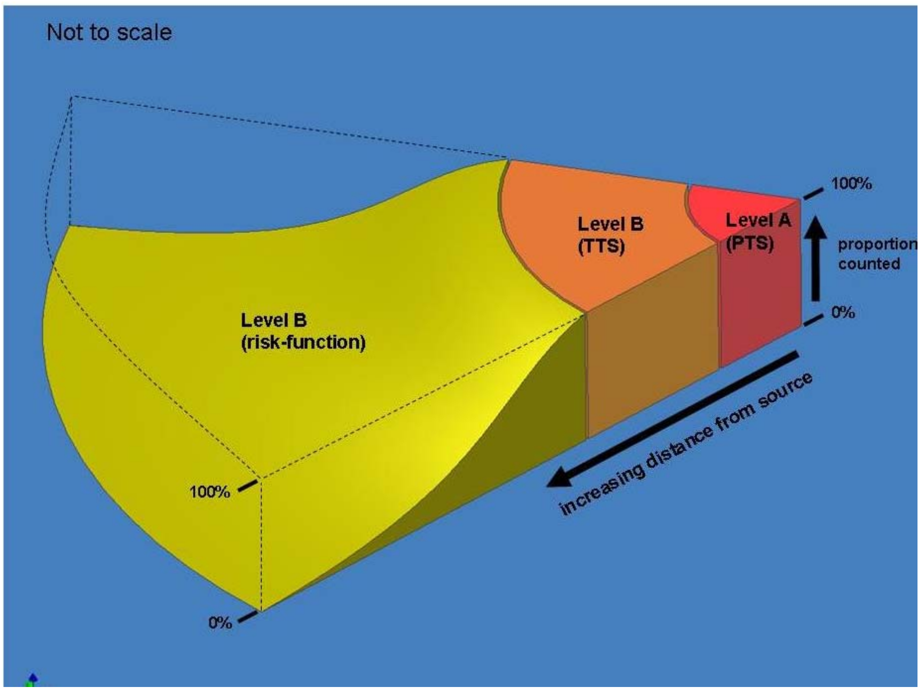
A "physiological effect" was defined as one in which the "normal" physiological function of the animal was altered in response to sound exposure. Physiological function was any of a collection of processes ranging from biochemical reactions to mechanical interaction and operation of organs and tissues within an animal. Physiological effects ranged from the most significant of effects (i.e., mortality and serious injury) to lesser effects that defined the lower end of the physiological effects range, such as the noninjurious distortion of auditory tissues. This latter physiological effect was important to the integration of the biological and regulatory frameworks.

A "behavioral effect" is one in which the "normal" behavior or patterns of behavior of an animal were overtly disrupted in response to an acoustic exposure. Examples of behaviors of concern were derived from the harassment definitions in the MMPA and the ESA.

3.5.2.3 MMPA Exposure Zones

Two acoustic modeling approaches were used to account for both physiological and behavioral effects to marine mammals. The exposure zone modeled total energy. When using a threshold of accumulated energy, the areas of ocean in which Level A and Level B harassment would occur are called "exposure zones." As a conservative estimate, all marine mammals predicted to be in an exposure zone were considered exposed to accumulated sound levels within the applicable Level A or Level B harassment categories. Figure 3.5-2 illustrates exposure zones extending from a hypothetical, directional sound source.

Figure 3.5-2 Relationships of Physiological and Behavioral Effects to Level A and Level B Harassment Categories



The Level A exposure zone extended from the source out to the distance and exposure at which the slightest amount of injury is predicted to occur. The acoustic exposure that produced the slightest degree of injury is therefore the threshold of the Level A exposure zone. Use of the threshold associated with the onset of slight injury as the most distant point and least injurious exposure took into account all more serious injuries by inclusion within the Level A exposure zone. The Level B exposure zone began just beyond the point of slightest injury and extended outward from that point to include all animals that may possibly experience Level B harassment. Physiological effects extended beyond the range of slightest injury to a point where slight temporary distortion of the most sensitive tissue occurred but without destruction or loss of that tissue. The animals predicted to be in this exposure zone were assumed to experience Level B harassment due to temporary impairment of sensory function (i.e., altered physiological function) that could disrupt behavior.

Very high sound levels may rupture the eardrum or damage the small bones in the middle ear (Yost, 1994). Lower level exposures of sufficient duration may cause permanent or temporary hearing loss; such an effect is called a noise-induced threshold shift, or simply a threshold shift (TS) (Miller, 1974). A TS may be either temporary (TTS) or permanent (PTS). PTS does not equal permanent hearing loss;

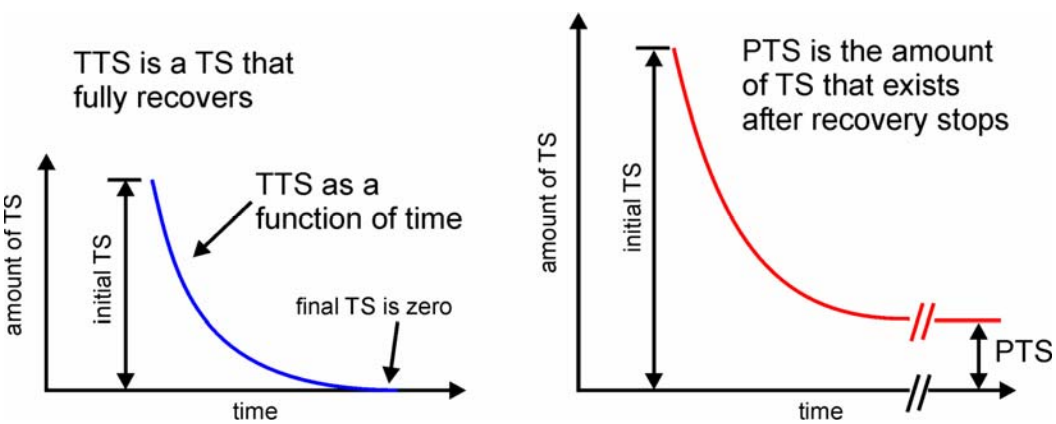
more correctly, it is a permanent loss of hearing sensitivity, usually over a subset of the animal's hearing range. Similarly, TTS is a temporary hearing sensitivity loss, usually over a subset of the animal's hearing range. Still lower levels of sound may result in auditory masking, which may interfere with an animal's ability to hear other concurrent sounds.

Noise-Induced Threshold Shifts

The amount of TS depends on the amplitude, duration, frequency, and temporal pattern of the sound exposure. Threshold shifts generally increase with the amplitude and duration of sound exposure. For continuous sounds, exposures of equal energy lead to approximately equal effects (Ward, 1997). For intermittent sounds, less TS occurs than from a continuous exposure with the same energy because some recovery will occur between exposures (Kryter et al., 1966; Ward, 1997).

The magnitude of a TS normally decreases with the amount of time post-exposure (Miller, 1974). The amount of TS just after exposure is called the "initial TS." If the TS activity returns to zero (the threshold returns to the pre-exposure value), the TS is a TTS. Since the amount of TTS depends on the time postexposure, it is common to use a subscript to indicate the time in minutes after exposure (Quaranta et al., 1998). For example, TTS_2 means a TTS measured 2 minutes after exposure. If the TS does not return to zero but leaves some finite amount of TS, then that remaining TS is a PTS. The distinction between PTS and TTS is based on whether there is a complete recovery of a TS following a sound exposure. Figure 3.5-3 shows two hypothetical TSs: one that completely recovers (i.e., a TTS) and one that does not completely recover, leaving some PTS.

Figure 3.5-3 Relationship of TTS and PTS Recovery Characteristics



PTS, TTS, and Exposure Zones

PTS is nonrecoverable and, therefore, qualifies as an injury and is classified as Level A harassment under the MMPA. The smallest amount of PTS (onset-PTS) is taken to be the indicator for the smallest degree of injury that can be measured. The acoustic exposure associated with onset-PTS is used to define the outer limit of the Level A exposure zone.

TTS is recoverable and, as in recent rulings (NOAA, 2001; 2002a), is considered to result from the temporary, noninjurious distortion of hearing-related tissues. In the study area, the smallest measurable amount of TTS (onset-TTS) was taken as the best indicator for slight temporary sensory impairment. Because it is considered noninjurious, the acoustic exposure associated with onset-TTS was used to define the outer limit of the portion of the Level B exposure zone attributable to physiological effects. This follows from the concept that hearing loss potentially affects an animal's ability to react normally to the sounds around it. Therefore, in this EIS/OEIS, the potential for TTS was considered as a Level B harassment that is mediated by physiological effects upon the auditory system.

3.5.2.4 Criteria and Thresholds for Physiological Effects

The most appropriate information from which to develop PTS/TTS criteria for marine mammals is experimental measurements of PTS and TTS from marine mammal species of interest. TTS data exist for several marine mammal species and may be used to develop meaningful TTS criteria and thresholds. PTS data do not exist for marine mammals and are unlikely to be obtained. Therefore, PTS criteria must be developed from TTS criteria and estimates of the relationship between TTS and PTS.

<u>TTS in Marine Mammals</u>

A number of investigators measured TTS in marine mammals. These studies measured hearing thresholds in trained marine mammals before and after exposure to intense sounds. Some of the more important data obtained from these studies are onset TTS levels - exposure levels sufficient to cause a just-measurable amount of TTS, often defined as 6 dB of TTS (e.g., Schlundt et al., 2000). The existing marine mammal TTS data are summarized below.

Schlundt et al. (2000) reported the results of TTS experiments conducted with bottlenose dolphins and beluga whales exposed to one second tones. This paper included a re-analysis of preliminary TTS data released in a technical report by Ridgway et al. (1997a). At frequencies of 3, 10, and 20 kHz sound pressure level (SPL) necessary to induce measurable amounts (6 dB or more) of TTS were between 192 and 201 dB re 1 μPa (energy level (EL) = 192 to 201 dB re 1 μPa^2-s). EL is a measure of the sound energy flow per unit area expressed in dB. EL is stated in decibels (dB) referenced to 1 micro Pascal squared second (dB re 1 μPa^2-s) for underwater sound.

The mean exposure SPL and EL for onset-TTS were 195 dB re 1 μPa and 195 dB re 1 μPa^2-s, respectively. The sound exposure stimuli (tones) and relatively large number of test subjects (five dolphins and two beluga whales) make the Schlundt et al. (2000) data the most directly relevant TTS information for cetaceans for the scenarios described in this EIS/OEIS.

Finneran et al. (2001, 2003, 2005) described TTS experiments conducted with bottlenose dolphins exposed to 3-kHz tones for durations of 1, 2, 4, and 8 seconds. Small amounts of TTS (3 to 6 dB) were observed in one dolphin after exposure to ELs between 190 and 204 dB re 1 μPa^2-s. These results were consistent with the data of Schlundt et al. (2000) and showed that the Schlundt et al. (2000) data were not significantly affected by the masking sound used. These results also confirmed that, for tones with different durations, the amount of TTS is best correlated with the exposure EL rather than the exposure SPL.

Nachtigall et al. (2003, 2004) measured TTS in a bottlenose dolphin exposed to octave-band sound centered at 7.5 kHz. Nachtigall et al. (2003) reported TTSs of about 11 dB measured 10 to 15 minutes after exposure to 30 to 50 minutes of sound with SPL 179 dB re 1 μPa (EL about 213 dB re μPa^2-s). No TTS was observed after exposure to the same sound at 165 and 171 dB re 1 μPa. Nachtigall et al. (2004) reported TTSs of around 4 to 8 dB 5 minutes after exposure to 30 to 50 minutes of sound with SPL 160 dB re 1 μPa (EL about 193 to 195 dB re 1 μPa^2-s). The difference in results was attributed to faster post-exposure threshold measurement - TTS may have recovered before being detected by Nachtigall et al. (2003). These studies showed that, for long-duration exposures, lower sound pressures are required to induce TTS than are required for short-duration tones. These data also confirmed that, for the cetaceans studied, EL is the most appropriate predictor for onset-TTS.

Finneran et al. (2000, 2002) conducted TTS experiments with dolphins and beluga whales exposed to impulsive sounds similar to those produced by distant underwater explosions and seismic waterguns. These studies showed that, for very short-duration impulsive sounds, higher sound pressures were required to induce TTS than for longer-duration tones.

Kastak et al. (1999a,b; 2005) conducted TTS experiments with three species of pinnipeds, California sea lion, northern elephant seal, and a Pacific harbor seal exposed to continuous underwater sounds at levels of 80 and 95 dB at 2.5 and 3.5 kHz for up to 50 minutes. Mean TTS shifts of up to 12.2 dB occurred, with the harbor seals showing the largest shift of 28.1 dB. Increasing the sound duration had a greater effect on TTS than increasing the sound level from 80 to 95 dB.

Finneran et al. (2007) conducted TTS experiments with a bottlenose dolphin, using auditory steady-state responses as well as behavioral methods to measure TTS after exposures (203-206 dB re 1μPa^2-s) to a 20 kHz tone. Hearing loss was frequency-dependent, with the largest TTS occurring (from largest to smallest TTS) at 30, 40, and 20 kHz; the largest TTS occurred at higher frequencies than the exposure. No TTS was observed at 10, 50, 60, or 70 kHz. Auditory steady-state responses in all cases indicated greater threshold shifts than were detected by behavioral methods alone.

The existing marine mammal TTS data have indicated that the growth and recovery of TTS in response to underwater noise are comparable to those observed in mammalian responses to airborne noise (e.g., Kastak et al. 2007). This means that, as in land mammals, cetacean TSs depend on the amplitude, duration, frequency content, and temporal pattern of the sound exposure. Threshold shifts will generally increase with the amplitude and duration of sound exposure. For continuous sounds, exposures of equal energy will lead to approximately equal effects (Ward, 1997). For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur between exposures) (Ward, 1997).

Human non-impulsive noise exposure guidelines are based on exposures of equal energy (the same SEL) producing equal amounts of hearing impairment regardless of how the sound energy is distributed in time (Ward et al. 1958, 1959; NIOSH 1998). Until recently, previous marine mammal TTS studies have also generally supported this equal energy relationship (Southall et al. 2007). Three recent studies, two by Mooney et al. (2009a, 2009b) on a single bottlenose dolphin either exposed to playbacks of Navy MFAS or octave-band noise (4-8 kHz) and one by Kastak et al. (2007) on a single California sea lion exposed to airborne octave-band noise (centered at 2.5 kHz), concluded that for all noise exposure situations the equal energy relationship may not be the best indicator to predict TTS levels. All three of these studies highlight the inherent complexity of TTS in marine mammals, as well the importance of considering exposure duration when assessing impacts. With exposures of equal energy, quieter, longer duration exposures were found to induce greater levels TTS than those of exposures that were louder and of shorter duration (more similar to MFAS).

Research to date has indicated that SPL by itself is not a good predictor of onset-TTS, since the amount of TTS depends on both SPL and duration. Exposure EL is correlated with the amount of TTS and is considered (Southall et al. 2007) a good predictor for onset-TTS for single, continuous exposures with variable durations. This agrees with human TTS data presented by Ward et al. (1958, 1959).

Relationship Between TTS and PTS

Since marine mammal PTS data do not exist, onset-PTS levels for these animals were estimated using TTS data and relationships between TTS and PTS. Based on technical investigations the following key relationships were defined and used in the analysis:

- In the absence of marine mammal PTS data, onset-PTS exposure levels may be estimated from marine mammal TTS data and PTS/TTS relationships observed in terrestrial mammals. This involves:
  - Estimating the largest amount of TTS that may be induced without PTS. Exposures causing a TS greater than this value are assumed to cause PTS.
  - Estimating the growth rate of TTS (i.e., determining how much additional TTS is produced by an increase in exposure level).
- A variety of terrestrial mammal data sources point toward 40 dB as a reasonable estimate of the largest amount of TS that may be induced without PTS. A conservative estimate is that continuous-type exposures producing TSs of 40 dB or more always result in some amount of PTS.
- Data from Ward et al. (1958 and 1959) reveal a linear relationship between TTS2 and exposure EL. A 1.6 dB TTS2 per dB increase in EL is a conservative estimate of how much additional TTS is produced by an increase in exposure level for continuous-type sounds.
- There is a 34 dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). The additional exposure above onset-TTS that is required to reach PTS is therefore 34 dB divided by 1.6 dB/dB, or approximately 21 dB.
- Exposures with ELs 20 dB above those producing TTS may be assumed to produce a PTS. This number is used as a conservative simplification of the 21 dB number derived above.

Use of EL for Physiological Effect Thresholds

Effect thresholds are expressed in terms of total received EL. Energy flux density is a measure of the flow of sound energy through an area. Marine and terrestrial mammal data show that, for continuous sounds of interest, TTS and PTS are more closely related to the energy in the sound exposure than to the exposure SPL. The EL for each individual ping was calculated using the following equation:

$$EL = SPL + 10\log_{10}(\text{duration})$$

The EL includes both the ping SPL and duration. Longer-duration pings and/or higher-SPL pings will have a higher EL. If an animal is exposed to multiple pings, the energy flux density in each individual ping was summed to calculate the total EL. Since mammalian TS data show less effect from intermittent exposures compared to continuous exposures with the same energy (Ward, 1997), basing the effect thresholds on the total received EL was a conservative approach for treating multiple pings; in reality, some recovery will occur between pings and lessen the effect of a particular exposure. Therefore, estimates were conservative because recovery was not taken into account - intermittent exposures were considered comparable to continuous exposures.

The total EL depends on the SPL, duration, and number of pings received. The TTS and PTS thresholds do not imply any specific SPL, duration, or number of pings. The SPL and duration of each received ping were used to calculate the total EL and determined whether the received EL met or exceeded the effect thresholds. For example, the TTS threshold would be reached through any of the following exposures:

A single ping with SPL = 195 dB re 1 μPa and duration = 1 second.

A single ping with SPL = 192 dB re 1 µPa and duration = 2 seconds.

Two pings with SPL = 192 dB re 1 µPa and duration = 1 second.

Two pings with SPL = 189 dB re 1 µPa and duration = 2 seconds.

Threshold Levels for Harassment From Physiological Effects

PTS and TTS were determined to be the most appropriate biological indicators of physiological effects that equate to the onset of injury (Level A harassment) and behavioral disturbance (Level B harassment), respectively. Therefore, this section is focused on criteria and thresholds to predict PTS and TTS in marine mammals.

For cetaceans, the harassment thresholds for physiological effects are:

- Level B (onset TTS) = 195 dB re 1 $\mu Pa^2 \cdot s$
- Level A (onset PTS) = onset TTS + 20 dB = 215 dB re 1 $\mu Pa^2 \cdot s$

A cetacean predicted to receive a sound exposure with an energy flux density level (EFDL) of 215 dB re 1 $\mu Pa^2 \cdot s$ or greater is assumed to experience PTS and is counted as subject to Level A harassment. A cetacean predicted to receive a sound exposure with EFDL greater than or equal to 195 dB re 1 $\mu Pa^2 \cdot s$ but less than 215 dB re 1 $\mu Pa^2 \cdot s$ is assumed to experience TTS and is counted as subject to Level B harassment. The only exception to this approach is for beaked whales, the species identified as the most sensitive to Mid-frequency Active (MFA) sonar, for which this EIS/OEIS takes a conservative approach by treating all cases of behavioral disruption of beaked whales as a potential for injury. All predicted cases of Level B harassment of beaked whales are therefore counted as Level A harassment.

The TTS threshold is primarily based on the cetacean TTS data from Schlundt et al. (2000). Since these tests used short-duration tones similar to sonar pings, they are the most directly relevant data. The mean exposure EL required to produce onset-TTS in these tests was 195 dB re 1 μPa^2-s. This result was corroborated by the short-duration tone data of Finneran et al. (2000, and 2003) and the long-duration sound data from Nachtigall et al. (2003, 2004). Together, these data demonstrated that TTS in cetaceans is correlated with the received EL and that onset- TTS exposures fit well by an equal-energy line passing through 195 dB re 1 μPa^2-s.

For pinnipeds, the harassment thresholds for physiological effects are grouped by species indicated below.

California Sea Lions, Steller Sea Lions, and Northern Fur Seals:

- Level B (onset TTS) = 206 dB re 1 $\mu Pa^2 \cdot s$.
- Level A (onset PTS) = 226 dB re 1 $\mu Pa^2 \cdot s$.

Harbor Seals:

- Level B (onset TTS) = 183 dB re 1 $\mu Pa^2 \cdot s$.
- Level A (onset PTS) = 203 dB re 1 $\mu Pa^2 \cdot s$.

Northern Elephant Seals:

- Level B (onset TTS) = 204 dB re 1 $\mu Pa^2 \cdot s$.
- Level A (onset PTS) = 224 dB re 1 $\mu Pa^2 \cdot s$.

The thresholds for pinnipeds are based on the analysis conducted by Kastak et al (1999a,b; 2005), which determined TTS criteria for three different species: California sea lion, harbor seal and northern elephant seal. Based on similarities in anatomy and physiology related to hearing, the thresholds for the California sea lion were deemed applicable to the Steller sea lion and northern fur seal. The rationale for the 20-dB offset between onset-TTS and assumed onset-PTS is the same as for cetaceans.

3.5.2.5 Summary of Existing Credible Scientific Evidence Relevant to Assessing Behavioral Effects

Background

Based on available evidence, marine animals are likely to exhibit any of a suite of potential behavioral responses or combinations of behavioral responses upon exposure to sonar transmissions. Potential behavioral responses include, but are not limited to: avoiding exposure or continued exposure; behavioral disturbance (including distress or disruption of social or foraging activity); habituation to the sound; becoming sensitized to the sound; or not responding to the sound.

Existing studies of behavioral effects of human-made sounds in marine environments remain inconclusive, partly because many of those studies have lacked adequate controls, applied only to certain kinds of exposures (which are often different from the exposures being analyzed in the study), and had limited ability to detect behavioral changes that may be significant to the biology of the animals that were being observed. These studies are further complicated by the wide variety of behavioral responses marine mammals exhibit and the fact that those responses can vary substantially by species, individuals, and the context of an exposure. In some circumstances, some individuals will continue normal behavioral activities in the presence of high levels of human-made noise. In other circumstances, the same individual or other individuals may avoid an acoustic source at much lower received levels (Richardson et al. 1995, Wartzok et al. 2003, Southall et al. 2007). These differences within and between individuals appear to result from a complex interaction of experience, motivation, and learning that are difficult to quantify and predict.

It is possible that some marine mammal behavioral reactions to anthropogenic sound may result in strandings. Several "mass stranding" events—strandings that involve two or more individuals of the same species (excluding a single cow–calf pair)—that have occurred over the past two decades have been associated with naval operations, seismic surveys, and other anthropogenic activities that introduced sound into the marine environment. Sonar exposure has been identified as a contributing cause or factor in five specific mass stranding events: Greece in 1996; the Bahamas in March 2000; Madeira, Portugal in 2000; the Canary Islands in 2002, and Spain in 2006 (Advisory Committee Report on Acoustic Impacts on Marine Mammals, 2006).

In these circumstances, exposure to acoustic energy has been considered a potential indirect cause of the death of marine mammals (Cox et al. 2006). A popular hypothesis regarding a potential cause of the strandings is that tissue damage results from a "gas and fat embolic syndrome" (Fernandez et al. 2005, Jepson et al. 2003, 2005). Models of nitrogen saturation in diving marine mammals have been used to suggest that altered dive behavior might result in the accumulation of nitrogen gas such that the potential for nitrogen bubble formation is increased (Houser et al. 2001a, Zimmer and Tyack 2007). If so, this mechanism might explain the findings of gas and bubble emboli in stranded beaked whales. It is also possible that stranding is a behavioral response to a sound under certain contextual conditions and that the subsequently observed physiological effects of the strandings (e.g., overheating, decomposition, or internal hemorrhaging from being on shore) were the result of the stranding and not the direct result of exposure to sonar (Cox et al. 2006).

Risk Function Adapted from Feller (1968)

The particular acoustic risk function developed by the Navy and NMFS estimates the probability of behavioral responses that NMFS would classify as harassment for the purposes of the MMPA given exposure to specific received levels of MFA sonar. The mathematical function is derived from a solution in Feller (1968) for the probability as defined in the SURTASS LFA Sonar Final OEIS/EIS (Navy 2001c), and relied on in the Supplemental SURTASS LFA Sonar EIS (Navy 2007b) for the probability of MFA sonar risk for MMPA Level B behavioral harassment with input parameters modified by NMFS for MFA sonar for mysticetes, odontocetes, and pinnipeds.

In order to represent a probability of risk, the function should have a value near zero at very low exposures, and a value near one for very high exposures. One class of functions that satisfies this criterion is cumulative probability distributions, a type of cumulative distribution function. In selecting a particular functional expression for risk, several criteria were identified:

- The function must use parameters to focus discussion on areas of uncertainty;
- The function should contain a limited number of parameters;
- The function should be capable of accurately fitting experimental data; and
- The function should be reasonably convenient for algebraic manipulations.

As described in Navy (2001c), the mathematical function below is adapted from a solution in Feller (1968).

$$R = \frac{1 - \left(\frac{L-B}{K}\right)^{-A}}{1 - \left(\frac{L-B}{K}\right)^{-2A}}$$

Where: R = risk (0 – 1.0);

L = received Level (RL) in dB;

B = basement RL in dB; (120 dB);

K = the RL increment above basement in dB at which there is 50 percent risk;

A = risk transition sharpness parameter (A=10 odontocetes (except harbor porpoises)/pinnipeds; A=8 mysticetes).

In order to use this function, the values of the three parameters (B, K, and A) need to be established. As explained in detail later in this section, the values used in this analysis are based on three sources of data: TTS experiments conducted at SSC and documented in Finneran, et al. (2001, 2003, and 2005); Finneran and Schlundt, (2004); reconstruction of sound fields produced by the USS SHOUP associated with the behavioral responses of killer whales observed in Haro Strait and documented in NMFS (2005c); Navy (2004); and Fromm (2004a, 2004b); and observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components documented in Nowacek et al. (2004). The input parameters, as defined by NMFS, are based on very limited data that represent the best available science at this time.

Data Sources Used for Risk Function

There is widespread consensus that cetacean response to MFA sound signals needs to be better defined using controlled experiments (Cox et al. 2006, Southall et al. 2007). The Navy is contributing to an ongoing behavioral response study in the Bahamas that is anticipated to provide some initial information on beaked whales, the species identified as the most sensitive to MFA sonar. NMFS is leading this international effort with scientists from various academic institutions and research organizations to conduct studies on how marine mammals respond to underwater sound exposures.

Until additional data is available, NMFS and the Navy have determined that the following three data sets are most applicable for the direct use in developing risk function parameters for MFA sonar. These data sets represent the only known data that specifically relate altered behavioral responses to exposure to MFA sound sources. Until applicable data sets are evaluated to better qualify harassment from HFA sources, the risk function derived for MFA sources will apply to HFA.

Data from SSC's Controlled Experiments

Most of the observations of the behavioral responses of toothed whales resulted from a series of controlled experiments on bottlenose dolphins and beluga whales conducted by researchers at SSC's facility in San Diego, California (Finneran et al. 2001, 2003, 2005; Finneran and Schlundt 2004; Schlundt et al. 2000). In experimental trials with marine mammals trained to perform tasks when prompted, scientists evaluated whether the marine mammals performed these tasks when exposed to mid-frequency tones. Altered behavior during experimental trials usually involved refusal of animals to return to the site of the sound stimulus. This refusal included what appeared to be deliberate attempts to avoid a sound exposure or to avoid the location of the exposure site during subsequent tests. (Schlundt et al. 2000, Finneran et al. 2002) Bottlenose dolphins exposed to 1-second (sec) intense tones exhibited short-term changes in behavior above received sound levels of 178 to 193 dB re 1 µPa root mean square (rms), and beluga whales did so at received levels of 180 to 196 dB and above. Test animals sometimes vocalized after an exposure to impulsive sound from a seismic watergun (Finneran et al. 2002). In some instances, animals exhibited aggressive behavior toward the test apparatus (Ridgway et al. 1997b; Schlundt et al., 2000).

Finneran and Schlundt (2004) examined behavioral observations recorded by the trainers or test coordinators during the Schlundt et al. (2000) and Finneran et al. (2001, 2003, 2005) experiments featuring 1-sec tones. These included observations from 193 exposure sessions (fatiguing stimulus level > 141 dB re 1µPa) conducted by Schlundt et al. (2000) and 21 exposure sessions conducted by Finneran et al. (2001, 2003, 2005). The observations were made during exposures to sound sources at 0.4 kHz, 3 kHz, 10 kHz, 20 kHz, and 75 kHz. The TTS experiments that supported Finneran and Schlundt (2004) are further explained below:

- Schlundt et al. (2000) provided a detailed summary of the behavioral responses of trained marine mammals during TTS tests conducted at SSC San Diego with 1-sec tones. Schlundt et al. (2000) reported eight individual TTS experiments. Fatiguing stimuli durations were 1-sec; exposure frequencies were 0.4 kHz, 3 kHz, 10 kHz, 20 kHz and 75 kHz. The experiments were conducted in San Diego Bay. Because of the variable ambient noise in the bay, low-level broadband masking noise was used to keep hearing thresholds consistent despite fluctuations in the ambient noise. Schlundt et al. (2000) reported that "behavioral alterations," or deviations from the behaviors the animals being tested had been trained to exhibit, occurred as the animals were exposed to increasing fatiguing stimulus levels.

- Finneran et al. (2001, 2003, 2005) conducted TTS experiments using tones at 3 kHz. The test method was similar to that of Schlundt et al. (2000) except the tests were conducted in a pool with very low ambient noise level (below 50 dB re 1 μPa^2/hertz [Hz]), and no masking noise was used. Two separate experiments were conducted using 1-sec tones. In the first, fatiguing sound levels were increased from 160 to 201 dB SPL. In the second experiment, fatiguing sound levels between 180 and 200 dB SPL were randomly presented.

Data from Studies of Baleen (Mysticetes) Whale Responses

The only mysticete data available resulted from a field experiments in which baleen whales (mysticetes) were exposed to sounds ranging in frequency from 50 Hz (ship noise playback) to 4500 Hz (alert stimulus) (Nowacek et al. 2004). Behavioral reactions to an alert stimulus, consisting of a combination of tones and frequency and amplitude modulated signals ranging in frequency from 500 Hz to 4500 Hz, was the only portion of the study used to support the risk function input parameters.

Nowacek et al. (2004, 2007) documented observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components. To assess risk factors involved in ship strikes, a multi-sensor acoustic tag was used to measure the responses of whales to passing ships and experimentally tested their responses to controlled sound exposures, which included recordings of ship noise, the social sounds of conspecifics and a signal designed to alert the whales. The alert signal was 18 minutes of exposure consisting of three 2-minute signals played sequentially three times over. The three signals had a 60 percent duty cycle and consisted of: (1) alternating 1-sec pure tones at 500 Hz and 850 Hz; (2) a 2-sec logarithmic down-sweep from 4,500 Hz to 500 Hz; and (3) a pair of low (1,500 Hz)-high (2,000 Hz) sine wave tones amplitude modulated at 120 Hz and each 1-sec long. The purposes of the alert signal were (a) to provoke an action from the whales via the auditory system with disharmonic signals that cover the whales' estimated hearing range; (b) to maximize the signal to noise ratio (obtain the largest difference between background noise) and (c) to provide localization cues for the whale. Five out of six whales reacted to the signal designed to elicit such behavior. Maximum received levels as reported ranged from 133 to 148 dB re 1μPa/√Hz (sic).

Observations of Killer Whales in Haro Strait in the Wild

In May 2003, killer whales (*Orcinus orca*) were observed exhibiting behavioral responses while USS SHOUP was engaged in MFA sonar operations in the Haro Strait in the vicinity of Puget Sound, Washington. Although these observations were made in an uncontrolled environment, the sound field associated with the sonar operations had to be estimated, and the behavioral observations were reported for groups of whales, not individual whales, the observations associated with the USS SHOUP provide the only data set available of the behavioral responses of wild, non-captive animal upon exposure to the AN/SQS-53 MFA sonar.

U.S. Department of Commerce (NMFS 2005c); Navy (2004); Fromm (2004a, 2004b) documented reconstruction of sound fields produced by USS SHOUP associated with the behavioral response of killer whales observed in Haro Strait. Observations from this reconstruction included an estimate of 169.3 dB SPL which represents the mean received level at a point of closest approach within a 500 m wide area in which the animals were exposed. Within that area, the estimated received levels varied from approximately 150 to 180 dB SPL.

Limitations of the Risk Function Data Sources

There are substantial limitations and challenges to any risk function derived to estimate the probability of marine mammal behavioral responses; these are largely attributable to sparse data. Ultimately there should be multiple functions for different marine mammal taxonomic groups, but the current data are insufficient to support them. The goal is unquestionably that risk functions be based on empirical measurement.

The risk function presented here is based on three data sets that NMFS and Navy have determined are the best available science at this time. The Navy and NMFS acknowledge each of these data sets has limitations.

While NMFS considers all data sets as being weighted equally in the development of the risk function, the Navy believes the SSC San Diego data is the most rigorous and applicable for the following reasons:

- The data represents the only source of information where the researchers had complete control over and ability to quantify the noise exposure conditions.
- The altered behaviors were identifiable due to long-term observations of the animals.
- The fatiguing noise consisted of tonal exposures with limited frequencies contained in the MFA sonar bandwidth.

However, the Navy and NMFS do agree that the following are limitations associated with the three data sets used as the basis of the risk function:

- The three data sets represent the responses of only four species: trained bottlenose dolphins and beluga whales, North Atlantic right whales in the wild, and killer whales in the wild.
- None of the three data sets represent experiments designed for behavioral observations of animals exposed to MFA sonar.
- The behavioral responses of marine mammals that were observed in the wild are based primarily on an estimated received level of sound exposure; they do not take into consideration (due to minimal or no supporting data):
  - Potential relationships between acoustic exposures and specific behavioral activities (e.g., feeding, reproduction, changes in diving behavior, etc.), variables such as bathymetry, or acoustic waveguides; or
  - Differences in individuals, populations, or species, or the prior experiences, reproductive state, hearing sensitivity, or age of the marine mammal.

SSC San Diego Trained Bottlenose Dolphins and Beluga Data Set:

- The animals were trained animals in captivity; therefore, they may be more or less sensitive than cetaceans found in the wild (Domjan 1998).
- The tests were designed to measure TTS, not behavior.
- Because the tests were designed to measure TTS, the animals were exposed to much higher levels of sound than the baseline risk function (only two of the total 193 observations were at levels below 160 dB re 1 μPa^2-s).
- The animals were not exposed in the open ocean but in a shallow bay or pool.
- The tones used in the tests were 1-second pure tones similar to MFA sonar.

North Atlantic Right Whales in the Wild Data Set:

- The observations of behavioral response were from exposure to alert stimuli that contained mid-frequency components but was not similar to an MFA sonar ping. The alert signal was 18 minutes of exposure consisting of three 2-minute signals played sequentially three times over. The three signals had a 60 percent duty cycle and consisted of: (1) alternating 1-sec pure tones at 500 Hz and 850 Hz; (2) a 2-sec logarithmic down-sweep from 4,500 Hz to 500 Hz; and (3) a pair of low (1,500 Hz)-high (2,000 Hz) sine wave tones amplitude modulated at 120 Hz and each 1-sec long. This 18-minute alert stimuli is in contrast to the average 1-sec ping every 30 sec in a comparatively very narrow frequency band used by military sonar.
- The purpose of the alert signal was, in part, to provoke an action from the whales through an auditory stimulus.

Killer Whales in the Wild Data Set:

- The observations of behavioral harassment were complicated by the fact that there were other sources of harassment in the vicinity (other vessels and their interaction with the animals during the observation).
- The observations were anecdotal and inconsistent. There were no controls during the observation period, with no way to assess the relative magnitude of the observed response as opposed to baseline conditions.

<u>Input Parameters for the Feller-Adapted Risk Function</u>

The values of <u>B</u>, <u>K</u>, and <u>A</u> need to be specified in order to utilize the risk function defined previously. The risk continuum function approximates the dose-response function in a manner analogous to pharmacological risk assessment (Navy 2001c, Appendix A). In this case, the risk function is combined with the distribution of sound exposure levels to estimate aggregate impact on an exposed population.

Basement Value for Risk—The <u>B</u> Parameter

The <u>B</u> parameter defines the basement value for risk, below which the risk is so low that calculations are impractical. This 120 dB level is taken as the estimate received level (RL) below which the risk of significant change in a biologically important behavior approaches zero for the MFA sonar risk assessment. This level is based on a broad overview of the levels at which multiple species have been reported responding to a variety of sound sources, both mid-frequency and other, was recommended by the scientists, and has been used in other publications. The Navy recognizes that for actual risk of changes in behavior to be zero, the signal-to-noise ratio of the animal must also be zero.

The <u>K</u> Parameter

NMFS and the Navy used the mean of the following values to define the midpoint of the function: (1) the mean of the lowest received levels (185.3 dB) at which individuals responded with altered behavior to 3 kHz tones in the SSC data set; (2) the estimated mean received level value of 169.3 dB produced by the reconstruction of the USS SHOUP incident in which killer whales exposed to MFA sonar (range modeled possible received levels: 150 to 180 dB); and (3) the mean of the 5 maximum received levels at which Nowacek et al. (2004) observed significantly altered responses of right whales to the alert stimuli than to the control (no input signal) is 139.2 dB SPL. The arithmetic mean of these three mean values is 165 dB SPL. The value of <u>K</u> is the difference between the value of <u>B</u> (120 dB SPL) and the 50 percent value of 165 dB SPL; therefore, <u>K</u>=45.

Risk Transition—The A Parameter

The A parameter controls how rapidly risk transitions from low to high values with increasing receive level. As A increases, the slope of the risk function increases. For very large values of A, the risk function can approximate a threshold response or step function. NMFS has recommended that Navy use A=10 as the value for odontocetes (except harbor porpoises), and pinnipeds, and A=8 for mysticetes, (Figures 3.5-4 and 3.5-5) (NMFS 2008).

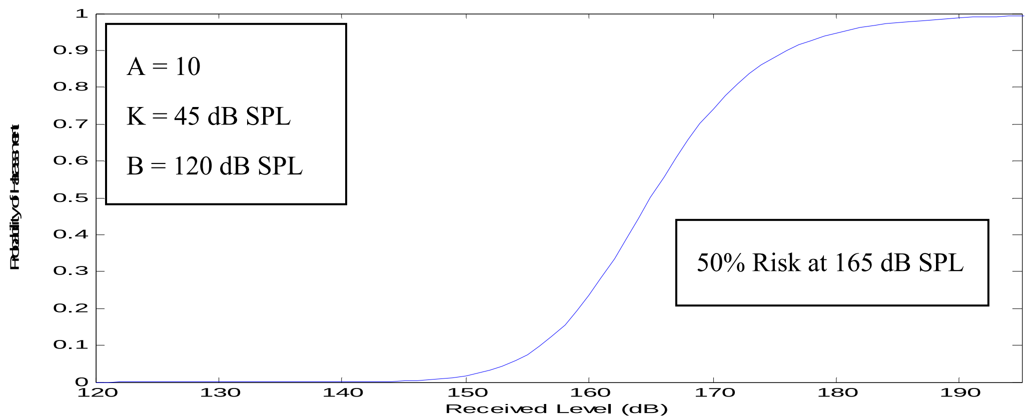


Figure 3.5-4. Risk Function Curve for Odontocetes (except harbor porpoises) (Toothed Whales) and Pinnipeds

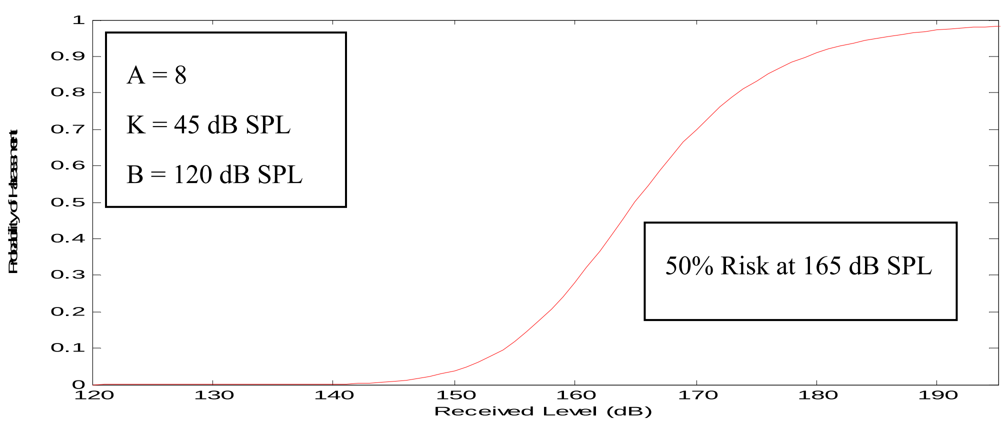


Figure 3.5-5. Risk Function Curve for Mysticetes (Baleen Whales)

Justification for the Steepness Parameter of A=10 for the Odontocete Curve

The NMFS independent review process (described in Section 4.1.2.4.9 of Navy 2008b) provided the impetus for the selection of the parameters for the risk function curves. One scientist recommended staying close to the risk continuum concept as used in the SURTASS LFA sonar EIS. This scientist opined that both the basement and slope values; B=120 dB and A=10 respectively, from the SURTASS

LFA sonar risk continuum concept are logical solutions in the absence of compelling data to select alternate values supporting the Feller-adapted risk function for MFA sonar. Another scientist indicated a steepness parameter needed to be selected, but did not recommend a value. Four scientists did not specifically address selection of a slope value. After reviewing the six scientists' recommendations, the two NMFS scientists recommended selection of A=10. Direction was provided by NMFS to use the A=10 curve for odontocetes based on the scientific review of potential risk functions (explained in Section 4.1.2.4.9.2 of Navy 2008b).

As background, a sensitivity analysis of the A=10 parameter was undertaken and presented in Appendix D of the SURTASS/LFA FEIS (Navy 2001c). The analysis was performed to support the A=10 parameter for mysticete whales responding to a low-frequency sound source, a frequency range to which the mysticete whales are believed to be most sensitive to. The sensitivity analysis results confirmed the increased risk estimate for animals exposed to sound levels below 165 dB. Results from the Low Frequency Sound Scientific Research Program (LFS SRP) phase II research showed that whales (specifically gray whales in their case) did scale their responses with received level as supported by the A=10 parameter (Buck and Tyack 2000). In the second phase of the LFS SRP research, migrating gray whales showed responses similar to those observed in earlier research (Malme et al. 1983, 1984) when the LF source was moored in the migration corridor (2 km [1.1 nm] from shore). The study extended those results with confirmation that a louder SL elicited a larger scale avoidance response. However, when the source was placed offshore (4 km [2.2 nm] from shore) of the migration corridor, the avoidance response was not evident. This implies that the inshore avoidance model – in which 50 percent of the whales avoid exposure to levels of 141 $\pm$ 3 dB – may not be valid for whales in proximity to an offshore source (Navy 2001c). As concluded in the SURTASS LFA Sonar Final OEIS/EIS (Navy 2001c), the value of A=10 produces a curve that has a more gradual transition than the curves developed by the analyses of migratory gray whale studies (Malme et al. 1984; Buck and Tyack 2000; and Navy 2001c, Subchapters 1.43, 4.2.4.3 and Appendix D; and NMFS 2008).

Justification for the steepness parameter of A=8 for the Mysticete Curve

The Nowacek et al. (2004) study provides the only available data source for a mysticete species behaviorally responding to a sound source (*i.e*., alert stimuli) with frequencies in the range of tactical mid-frequency sonar (1-10 kHz), including empirical measurements of received levels (RLs). While there are fundamental differences in the stimulus used by Nowacek et al. (2004) and tactical mid-frequency sonar (*e.g.*, source level, waveform, duration, directionality, likely range from source to receiver), they are generally similar in frequency band and the presence of modulation patterns. Thus, while they must be considered with caution in interpreting behavioral responses of mysticetes to mid-frequency sonar, they seemingly cannot be excluded from this consideration given the overwhelming lack of other information. The Nowacek et al. (2004) data indicate that five out the six North Atlantic right whales exposed to an alert stimuli "significantly altered their regular behavior and did so in identical fashion" (*i.e*., ceasing feeding and swimming to just under the surface). For these five whales, maximum RLs associated with this response ranged from root- mean-square sound (rms) pressure levels of 133-148 dB (re: 1 μPa).

When six scientists (one of them being Nowacek) were asked to independently evaluate available data for constructing a dose response curve based on a solution adapted from Feller (1968), the majority of them (4 out of 6; one being Nowacek) indicated that the Nowacek et al. (2004) data were not only appropriate but also necessary to consider in the analysis. While other parameters associated with the solution adapted from Feller (1968) were provided by many of the scientists (*i.e.*, basement parameter [B], increment above basement where there is 50% risk [K]), only one scientist provided a suggestion for the risk transition parameter, A.

A single curve may provide the simplest quantitative solution to estimating behavioral harassment. However, the policy decision, by NMFS-OPR, to adjust the risk transition parameter from A=10 to A=8 for mysticetes and create a separate curve was based on the fact the use of this shallower slope better reflected the increased risk of behavioral response at relatively low RLs suggested by the Nowacek et al. (2004) data. In other words, by reducing the risk transition parameter from 10 to 8, the slope of the curve for mysticetes is reduced. This results in an increase the proportion of the population being classified as behaviorally harassed at lower RLs. It also slightly reduces the estimate of behavioral response probability at quite high RLs, though this is expected to have quite little practical result owing to the very limited probability of exposures well above the mid-point of the function. This adjustment allows for a slightly more conservative approach in estimating behavioral harassment at relatively low RLs for mysticetes compared to the odontocete curve and is supported by the only dataset currently available. It should be noted that the current approach (with A=8) still yields an extremely low probability for behavioral responses at RLs between 133-148 dB, where the Nowacek data indicated significant responses in a majority of whales studied. (Note: Creating an entire curve based strictly on the Nowacek et al. [2004] data alone for mysticetes was advocated by several of the reviewers and considered inappropriate, by NMFS-OPR, since the sound source used in this study was not identical to tactical mid-frequency sonar, and there were only 5 data points available). The policy adjustment made by NMFS-OPR was also intended to capture some of the additional recommendations and considerations provided by the scientific panel (*i.e.*, the curve should be more data driven and that a greater probability of risk at lower RLs be associated with direct application of the Nowacek et al. 2004 data).

Basic Application of the Risk Function and Relation to the Current Regulatory Scheme

The risk function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors that would qualify as harassment (as that term is defined by the MMPA applicable to military readiness activities, such as the Navy's testing and training with MFA sonar) at a given received level of sound. For example, at 165 dB SPL (dB re: 1µPa rms), the risk (or probability) of harassment is defined according to this function as 50 percent, and Navy/NMFS applies that by estimating that 50 percent of the individuals exposed at that received level are likely to respond by exhibiting behavior that NMFS would classify as behavioral harassment. The risk function is not applied to individual animals, only to exposed populations.

The data used to produce the risk function were compiled from four species that had been exposed to sound sources in a variety of different circumstances. As a result, the risk function represents a general relationship between acoustic exposures and behavioral responses that is then applied to specific circumstances. That is, the risk function represents a relationship that is deemed to be generally true, based on the limited, best-available science, but may not be true in specific circumstances. In particular, the risk function, as currently derived, treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, we know that many other variables—the marine mammal's gender, age, and prior experience; the activity it is engaged in during an exposure event, its distance from a sound source, the number of sound sources, and whether the sound sources are approaching or moving away from the animal—can be critically important in determining whether and how a marine mammal will respond to a sound source (Southall et al. 2007). The data that are currently available do not allow for incorporation of these other variables in the current risk functions; however, the risk function represents the best use of the data that are available.

NMFS and Navy made the decision to apply the MFA risk function curve to HFA sources due to lack of available and complete information regarding HFA sources. As more specific and applicable data become available for MFA/HFA sources, NMFS can use these data to modify the outputs generated by the risk function to make them more realistic. Ultimately, data may exist to justify the use of additional, alternate, or multi-variate functions. As mentioned above, it is known that the distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok et al. 2003). Those distances would influence whether those animals might perceive the sound source as a potential threat, and their behavioral responses to that threat. Though there are data showing marine mammal responses to sound sources at that received level, NMFS does not currently have any data that describe the response of marine mammals to sounds at that distance (or to other contextual aspects of the exposure, such as the presence of higher frequency harmonics), much less data that compare responses to similar sound levels at varying distances. However, if data were to become available that suggested animals were less likely to respond (in a manner NMFS would classify as harassment) to certain levels beyond certain distances, or that they were more likely to respond at certain closer distances, the Navy will re-evaluate the risk function to try to incorporate any additional variables into the "take" estimates.

Last, pursuant to the MMPA, an applicant is required to estimate the number of animals that will be "taken" by their activities. This estimate informs the analysis that NMFS must perform to determine whether the activity will have a "negligible impact" on the species or stock. Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects. Alternately, a negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes, alone, is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS must consider other factors, such as the nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), or any of the other variables mentioned in the first paragraph (if known), as well as the number and nature of estimated Level A takes, the number of estimated mortalities, and effects on habitat. Generally speaking, the Navy and NMFS anticipate more severe effects from takes resulting from exposure to higher received levels (though this is in no way a strictly linear relationship throughout species, individuals, or circumstances) and less severe effects from takes resulting from exposure to lower received levels. For example, Table 3.5-2 and Figure 3.5-6 portray a mathematical extrapolation of the distances and levels at which behavioral harassments occur at each received level band from Test Vehicle 1, with average propagation. The results from Test Vehicle 1 (Source S6) are not intended as a worst case but illustrate a general pattern which is that the largest number of takes tends to occur at intermediate distances and SPLs.

Table 3.5-2. Behavioral Harassments at each Received Level Band from Test Vehicle 1

Received Level (dB SPL)	Distance at which Levels Occur in Range Site	Percent of Harassments Occurring at Given Levels
Below 150	4 km - 12 km	< 1 %
150>Level>160	2.3 km – 4 km	10 %
160>Level>170	1.0 km – 2.3 km	35 %
170>Level>180	400 m – 1000 m	33 %
180>Level>190	140 m – 400 m	15 %
190>Level>200	45 m – 140 m	6 %
Above 200	0 m – 45 m	<1 %

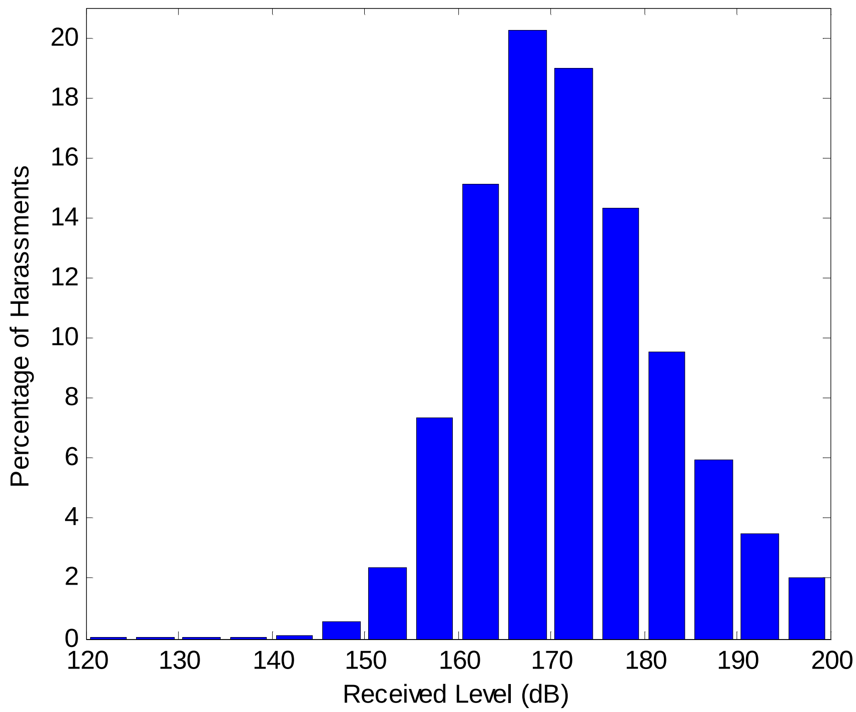


Figure 3.5-6 The Percentage of Behavioral Harassments Resulting from the Risk Function for Every 5 dB of Received Level from Acoustic Source Test Vehicle 1

Specific Consideration for Harbor Porpoises

The information currently available regarding these inshore species that inhabit shallow and coastal waters suggests a very low threshold level of response for both captive and wild animals. Threshold levels at which both captive (e.g. Kastelein et al. 2000, 2005a, 2006) and wild harbor porpoises (e.g. Johnston 2002) responded to sound (e.g. acoustic harassment devices (ADHs), acoustic deterrent devices (ADDs), or other non-pulsed sound sources) is very low (e.g. ~120 dB SPL), although the biological significance of the disturbance is uncertain. Therefore, Navy will not use the risk function curve as presented but will apply a step function threshold of 120 dB SPL estimate take of harbor porpoises (i.e., assumes that all harbor porpoises exposed to 120 dB or higher MFAS/HFAS will respond in a way NMFS considers behavioral harassment).

Navy Post Acoustic Modeling Analysis

The quantification of the acoustic modeling results includes additional analysis to increase the accuracy of the number of marine mammals affected. Table 3.5-3 provides a summary of the modeling protocols used in this analysis. Post modeling analysis includes reducing acoustic footprints where they encounter land masses to better account for the maximum number of individuals of a species that could potentially be exposed to sonar within the course of one day or a discreet continuous sonar event.

Table 3.5-3 Navy Protocols Providing for Accurate Modeling Quantification of Marine Mammal Exposures

Historical Data	Range Log	Annual active sonar usage data is based on historical range logs. These provide results and constitute representative sources and activities for each range site.
Acoustic Parameters	Representative Acoustic Sources	Representative acoustical aources for marine mammal acoustic effects analysis are described in Chapter 3. These active acoustic sources separately parameterize differences in source level, frequency, and exposure effects of RDT&E acoustic sources.
Post Modeling Analysis	Land Shadow	For sound sources within inland waters and the acoustic footprint of land (approximately 65 nautical miles [nm] for the QUTR action area), land shadow effects were taken into account when determining acoustic propagation and are described in detail for each site in Appendix C.
	Multiple Sources	The number of animals predicted to be subject to harassment are calculated on a per run basis for each of the following: • Range site alternatives • Representative sources and • Species Results are accumulated over a year based on the number of runs expected for each representative source.
	Multiple Exposures	Accurate accounting for NAVSEA NUWC Keyport Range Complex activities within the course of one day or a discrete event.

It is worth noting that many of the animals that are likely to be "taken" in the NAVSEA NUWC Keyport Range Complex would experience received levels in the middle range of the risk function response curve, where responses are less likely to be severe in terms of effects on longevity, survival, and reproductive success (Southall et al. 2007). Many such exposures would occur at considerable distance from the source and in the absence of contextual variables that would suggest a threat. NMFS will consider all available information (other variables, etc.), but all else being equal, takes that result from exposure to lower received levels and at greater distances from the exercises would be less likely to contribute to population level effects.

3.5.2.6 Protocol for Acoustic Modeling Analysis of Marine Mammal Exposures

For this DEIS/OEIS, the acoustic modeling results include additional analysis to account for the model's overestimation of potential effects. Specifically, the initial application of the model overestimates effects because a) acoustic footprints for sonar sources near land are not reduced to account for land masses where marine mammals would not occur ("land shadow effect"); and b) the modeling does not account for multiple exposures affecting the same individuals, which means that the number of exposures can exceed the number of animals in the population. As discussed in Appendix C, post-modeling analysis incorporates the effects of land shadowing and multiple exposures into the protocol for quantifying marine mammal exposures. Appendix C provides additional detailed information about the methods used to estimate acoustic effects of Navy activities in the Keyport Range Complex on marine mammals.

3.5.2.7 Stranding Events Associated with Navy Acoustic Sources

Appendix E, Marine Mammal Stranding Report, provides information on the history of stranding, a description of documented stranding events, a review of the many different possible reasons for stranding, and the stranding investigation findings and conclusions. As documented in Appendix E, relatively few of the total stranding events that have been recorded occurred spatially or temporally with Navy sonar activities. While sonar may be a contributing factor under certain rare conditions, the presence of sonar is not a necessary condition for stranding events to occur. A review of past stranding events associated with sonar suggest that the potential factors that may contribute to a stranding event are steep bathymetry changes, narrow channels, multiple sonar ships, surface ducting and the presence of beaked whales that may be more susceptible to sonar exposures. Among the most important factors appears to be the presence of a narrow channel that may prevent animals from avoiding sonar exposure and multiple sonar ships within that channel. These factors are not present during RDT&E activities in the NAVSEA NUWC Keyport Range Complex. In addition, beaked whales may not be more susceptible to sonar but may favor habitats that are more conducive to sonar effects.

There have been no mass strandings in the Pacific Northwest waters that are attributed to Navy sonar. Given the military presence and private and commercial vessel traffic in the Pacific Northwest, it is likely that if a mass stranding event had occurred, it would have been detected. Therefore, it is unlikely that Navy sonar has caused mass strandings in the Pacific Northwest.

3.5.3 Overview of Underwater Acoustics and Acoustic Properties of Range Sites

3.5.3.1 Acoustic Signal Measurement Background

In the underwater environment, sound can be used for detecting and locating underwater objects as well as for communication. For example, dolphins use acoustic echo location to hunt prey and many whales use songs, whistles, buzzes and other sounds for communication. All acoustic signals whether they are generated by the underwater environment, underwater animals or through artificial means, propagate through the water using the same physical mechanisms.

Essentially, these mechanisms can be illustrated as vibrations moving through the water. As the acoustic wave moves, it can be detected and measured through the difference in pressure caused by the vibration. The pressure change is converted to electrical signals through devices like the hydrophone. Then the amplitude, duration and frequencies of the acoustic waveform can be determined from these signals. Often the information intrinsic to an acoustic signal is further condensed into basic quantities for subsequent analysis. For example, the amplitude of the measured acoustic wave is often used to determine the SPL; the higher the amplitude, the greater the SPL. This pressure level can then be used to determine if the sound is too loud for the local ocean environment.

Where SPLs are used in this document, some are taken from literature, while others come from measurements conducted on the equipment being discussed. For example, the SPLs that can be tolerated by certain species of marine mammal are usually taken from literature, whereas the SPL that represents the output of a particular sonar projector may have been measured. Because sound waves potentially have a very large range in amplitudes over a particular frequency bandwidth as they propagate through the water, the units for SPL are usually converted to a logarithmic scale known as the dB. The following equation defines dBv:

$$(SPL\ in\ dBv) = 20 * \log_{10}(SPL\ in\ volts), \qquad (1)$$

where the SPL in volts is measured directly from the hydrophone. If the hydrophone has been calibrated, then the calibration information can be used to convert the dBv into dB re 1µPa, the standard unit for SPL in underwater acoustics. Finally, if the range between the emitter of the sound and the hydrophone is known, then it can be used along with other information relevant to the sound's path. The subsequent SPL (dB re 1µPa) can be referenced to a known distance from the emitting object (usually 1 m).

However, while this information is useful, to be rigorous one must also state certain other quantities about the sound measured that is used to give the subsequent SPL. These quantities are the center frequency of the sound and the bandwidth of the measurement. The frequency tells observers how quickly the vibrations are oscillating back and forth. The frequency combined with the velocity of acoustic propagation can be used to determine the acoustic wavelength. The bandwidth tells observers how many different frequencies are present in the measured sound. These quantities are important for making comparisons between different SPLs. In particular, the bandwidth is very important because comparing levels at different bandwidths can lead to erroneous conclusions. This happens because a large bandwidth will contain more noise and signal than a very narrow bandwidth given the same center frequency.

3.5.3.2 Acoustic Signals Typically Generated during Range Activities

The NAVSEA NUWC Keyport Range Complex is made up of three separate range sites located in the inland and coastal waters of the Pacific Northwest. The Keyport Range Site is located in Port Orchard Reach on the eastern edge of the Kitsap Peninsula within Puget Sound. The DBRC Site encompasses Dabob Bay and portions of Hood Canal along the western edge of the Kitsap Peninsula. The QUTR Site lies off the western coast of Washington in the Pacific Ocean. Each of these areas will be discussed separately after a general discussion on the propagation of sound in the underwater environment.

In the underwater environments of these range sites, acoustic energy comes from 2 sources associated with proposed range activities: acoustic energy radiated directly from the equipment (e.g., vessel, engine noise) and acoustic energy directly generated by the equipment (e.g., active sonar sounds). Radiated noise is usually low frequency and relatively low amplitude compared to the generated active acoustic signals. Consequently, as previously discussed in Chapter 1, radiated noise is not addressed for the purposes of this discussion. The other source of acoustics is from signals generated by the systems under test and the equipment used to track, monitor, and stimulate the systems or vehicles being tested. Table 3.5-4 shows a range of frequencies and typical and maximum source levels that are or would be used on the NAVSEA NUWC Keyport Range Complex.

Table 3.5-4 List of Frequency Ranges and Typical and Maximum Source Levels for Acoustic Sources Used or Tested at the Range Sites

Frequency Range (kHz)	*Typical Source Level (dB re 1uPa @ 1m)*	*Maximum Source Level(dB re l µPa @ 1 m)*		
		Keyport Range Site	*DBRC Site*	*QUTR Site*
0.050–1	170	170	170	170
1–10	186	195	238	238
10–100	186	233	233	233
> 100	200	235	235	235

The generated acoustic signals come from a variety of projectors. Sometimes these projectors are modeled as point sources with spherical spreading of the wave. In reality the projectors are usually directional sources due to the position of the projector on the vehicle and/or the construction of the projector itself. This means that the sound projected from the source does not go in every direction (as the use of a spherical spreading analysis would portray) but is limited to a path (based on the projector's position, construction, and orientation) that must be reflected by the bottom or the surface or both in order to travel (propagate) any significant distance. Some discussions of acoustic propagation assume a point source and use spherical spreading to determine the range of propagation. This leads to a "worst-case" or conservative scenario in that the sound will fill the largest possible volume. The acoustical analysis performed for this EIS/OEIS considered the directivity of the projector involved, whether associated with its position on the vehicle or the construction of the projector itself. In addition, cylindrical spreading may be the appropriate analysis for some activities in certain locations. Using a cylindrical spreading analysis, the range of propagation will increase but the sound is limited to a specific layer of water due to ducting. In general, directional acoustic pulses associated with RDT&E and other NUWC Keyport managed activities within the NAVSEA NUWC Keyport Range Complex will not propagate through as large a volume of the underwater environment as the point sources with spherical spreading described above.

Underwater acoustic propagation has several mechanisms for loss in the amplitude of the signal. First, the water itself acts as an absorber of the acoustic wave. As the frequency of the wave increases the absorption also increases, resulting in high frequency sound not propagating as far as low frequency sound. Second, since the sound source is limited to a very small point in space relative to the large volume of the underwater environment, the sound that emanates from the source spreads out as it travels underwater. Even if there was no absorption by the water, the spherical spreading of the sound decreases the sound amplitude by a factor of the radius squared. This drastically reduces the received levels of the acoustic pulses at any significant distances from the sound source. Finally, the underwater environment of the ocean itself is not a simple environment. Stratification of the water leads to a phenomenon known as ray-bending, which means that the sound does not propagate on a straight path due to variations in sound velocity from the surface of the ocean to the bottom. The sound velocity also varies as a function of temperature, pressure, and composition of the water (e.g., salinity). Consequently, as the water depth increases, the velocity of the acoustic signal changes. Ray-bending often causes sound to bend towards the bottom, which further limits the propagation distance of the sound. Also, the ocean environment is capped by a surface which usually contains waves. As discussed below, this surface causes reflections of the sound. However, the action of the waves on the surface produces noise that increases as the sea state increases. "Sea state" refers to the degree of turbulence at sea, generally measured on a scale of 0 to 9 according to average wave height. A sea state of 6, for example, refers to very rough seas with wave heights of 4 to 6 m (13 to 20 ft). Due to the potential problems caused by elevated sea states and safety issues, test activities are not generally conducted in sea states greater than 3 (wave heights of 0.5 to 1.25 m [1.6 to 4 ft]). For all 3 sites (Keyport, DBRC, and QUTR), average wind speed was used to estimate a corresponding sea state (Summer: 8 knots [sea state of 1.6], Winter: 14 knots [sea state of 2.8]).

Table 3.5-5 shows the distance of sound propagation for a number of frequencies taking into account absorption loss, spreading loss, and other factors like sea state (Urick 1983). In this table, the distance of propagation is considered how far the sound can travel and still be detected above the ambient noise of the ocean with no obstructions to sound propagation (e.g., land). The signals used in this example are typical of what is currently used on the range. This table is often used to aid in the design and placement of a portable tracking range.

Table 3.5-5 Detection Distance of a 190 dB Source as Related to Frequency and Sea State

Source Frequency (kHz)	*Sea State (Noise level)*	*Detection Distance (nm)*
12[1]	1 (68.8 dB)[1]	16.8
12[1]	2 (73.8 dB)[1]	14.7
12[1]	3 (78.8 dB)[1]	12.6
35[2]	1 (60.0 dB)[2]	4.6
35[2]	2 (65.0 dB)[2]	4.2
35[2]	3 (70.0 dB)[2]	3.8
75[3]	1 (65.0 dB)[3]	1.4
75[3]	2 (70.0 dB)[3]	1.3
75[3]	3 (75.0 dB)[3]	1.2

[1] Bandwidth is 3 kHz, [2] Bandwidth is 1.6 kHz, [3] Bandwidth is 20 kHz

As sound propagates it interacts with both the ocean bottom and surface of the water. Consequently, the bottom composition and profile become important in determining how far sound will propagate. If the bottom is smooth, sound can reflect off the bottom and continue to propagate beyond the immediate area of the source. However, when the bottom or surface is rough, then the reflected sound will be scattered over a range of angles, increasing the loss of sound and decreasing the distance it is propagated. One consequence of this is that it is rare for sound to propagate around points of land or past islands. If the bottom is muddy, then instead of sound reflecting off of it, it is absorbed into the mud and consequently these surfaces do not typically produce echoes.

Keyport Range Site

The current and proposed Keyport Range Site is a shallow-water area with depths no greater than 100 ft (30 m) with a generally muddy bottom and gently sloping sides. It is effectively land-locked within Port Orchard Reach by the Kitsap Peninsula to the west and Bainbridge Island to the east (Figure 2-4a). The only water channels from the Keyport Range Site to the greater Puget Sound region involve narrow passages and a curve. Consequently, there is no direct path for sound to get from the Keyport Range Site to anywhere else in Puget Sound. Since the bottom is muddy, sound reflections are absorbed and the gently sloping sides also cause reflections from the shore to be absorbed through multiple bounces between the surface and the bottom. Therefore, the distance of propagation as given in Table 3.5-5 is not valid since the sound would completely attenuate due to interactions with all of the adjacent land. Since the proposed Keyport Range Site extension also lies entirely within the same body of water, any sound in the existing Keyport Range Site would also propagate throughout the proposed extended area with none of it getting beyond this immediate region. Consequently, acoustically speaking, there is no difference between the existing Keyport Range Site and the proposed extended area.

DBRC Site

The current and proposed extended DBRC Site can be described as a large, relatively deep bathtub with steep sides. The bottom is very muddy and soft, which absorbs sound very readily. However, the sides are relatively smooth and often produce strong reflections. Sound originating within Dabob Bay generally reflects off the sides once or twice and can easily propagate throughout the entire Bay. However, due to the way that Dabob Bay joins with the rest of Hood Canal, sound rarely propagates very far outside Dabob Bay into Hood Canal because it cannot propagate around the corners without being absorbed through interactions with land (Figure 2-5a).

The proposed extensions to the DBRC Site encompass an area from approximately 1 mile (2 km) south of the Hood Canal Bridge to the Hamma Hamma River. Unlike Dabob Bay, most of Hood Canal is only about half as deep, with muddy and rocky bottoms. However, where the bottom is rocky, there tends to be a variation in depth which causes reflections to scatter in multiple directions. Since the Hood Canal does not follow a straight path, sound originating within Hood Canal would tend to stay limited to the Canal. The only place that may prove to be an exception is near the Hood Canal Bridge. There the sound could propagate into Admiralty Inlet. Even here, the sound would still encounter land which would effectively block its propagation into the greater Puget Sound region.

Since Dabob Bay and Hood Canal are considerably larger than Port Orchard Reach, the distances given in Table 3.5-5 represent the detectable range of the sound. As the table shows, the sound has more than 100 dB of loss over these distances. This loss increases as a function of the distance from the source. However, after propagation across 1 nm (2 km) the sound amplitude decreases at least 60 dB at low frequencies and even more at higher frequencies.

QUTR Site

Due to its location, the QUTR Site is not contained within a land mass like the Keyport Range and DBRC sites (Figure 2-6a). Consequently, propagation of sound in this action area will not be limited by interactions with the shore. The proposed extension around the QUTR Site can be divided into two different regions. Nearshore, where there is a sandy bottom with a gentle slope, is an ideal situation for causing multiple reflections of sound throughout the water column. Offshore, the action area has a large variation in depths, with generally deeper water. Sound propagation within this region will be unobstructed, meaning that the propagation distances given in Table 3.5-5 are applicable.

Since the QUTR nearshore area is a highly reflective environment, sound spreading will follow a cylindrical instead of a spherical model. Consequently, the propagation distance increases as long as the sound remains within the shallow zone. As the sound moves towards the shore, interaction with the shore tends to absorb all the reflections as they bounce rapidly between the surface and the bottom. As the sound moves directly away from the shore it begins to spread in a spherical manner after a couple of nautical miles. Consequently, the greatest propagation distances are parallel to the shore. In this instance, the propagation distances given in Table 3.5-5 should be doubled to estimate the total distance where the sound would still be detected. The sound would decrease by 60 dB within a couple of nautical miles of the source for low frequencies and even more for high frequencies parallel to the shore.

3.5.4 Representative Acoustic Sources from NUWC Keyport Test and Training Activities in the NAVSEA NUWC Keyport Range Complex

Sonar and other acoustic sources are used by the military for many purposes including underwater communication, mapping the seabed, torpedoes, countermeasures, and obstacle detection. As previously discussed, passive acoustic devices simply listen to sounds and do not produce any noise, and active acoustic devices produce sounds that are intended to bounce off objects (e.g., ships, the seabed) back to receivers at the source. Differences in received sounds, whether from a response from an active source or from a passive acoustic sensor (hydrophone), can be used to detect, classify and localize an object as well as to determine bottom contour and subbottom characteristics. Sonar can be designed to use frequencies from very low (<1 kHz) to very high (2,000 kHz). Different frequencies have different abilities for detection with the lowest frequencies best for long distances.

Behavioral reactions of free-ranging marine mammals to military and other sonars appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins et al. 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon 1999), and the previously mentioned strandings by beaked whales. During exposure to a 21–25 kHz whale-finding sonar with a source level of 215 dB re 1 µPa@1 m, gray whales showed only slight avoidance behavior (approximately 656 ft [200 m]) (Frankel 2005).

Potential acoustic sources for the NAVSEA NUWC Keyport Range Complex and proposed extensions were examined with regard to their operational characteristics. Generally, systems with an operating frequency greater than 150 kHz were not individually modeled. Likewise, systems with acoustic source levels below 186 dB re 1 µPa @ 1 m were not individually modeled. In both cases, the results from these sources would be conservatively represented by the sources shown in Table 3.5-6 because higher frequencies attenuate more rapidly and lower source levels will not propagate as far. Therefore, eight commonly used acoustic sources were selected for use in marine mammal acoustic effects analysis in this EIS/OEIS (Table 3.5-6).

Table 3.5-6 Representative Acoustic Sources for Marine Mammal Acoustic Effects Analysis

Acoustic Source	*Frequency (kHz)*	*Source Level (dB re 1 µPa @ 1 m)*
Subbottom Profiler	4.5	207
UUV 1	15	205
UUV Acoustic Modem	10	186
UUV 2	150	220
Range Target	5	233
Test Vehicle 1	20	233
Test Vehicle 2	25	230
Test Vehicle 3	30	233

These eight acoustic sources are a subset of the types of acoustic sources that would be used on the NAVSEA NUWC Keyport Range Complex. To ensure that any new range systems can be evaluated when applying this EIS/OEIS analysis, a set of parameters was established based on frequencies and output levels to ensure there was a range of acoustic source types to consider. These EIS/OEIS results will be used to determine which systems can be tested by NUWC Keyport on the NAVSEA NUWC Keyport Range Complex sites without further NEPA analysis. The NUWC Keyport mission to test active acoustic systems is limited to those acoustic sources described in this EIS/OEIS. Further, NUWC Keyport proactively monitors and subsequently limits acoustic devices and sensors that have operational capacities outside the acoustic ranges specified herein.

Because the metric for impact is accumulated energy over time, the drivers of impacts are source energy, pulse repetition rate, and ensonified volume. Frequency can be important, but is not the key for short-duration impacts such as those analyzed in this EIS/OEIS (unless the frequency is judged to be out of the hearing range of the animal). The other parameter that drives this risk assessment is the total operation time for the systems over a year. For the proposed active acoustic operations examined in this EIS/OEIS, the operations occur for a very limited amount of time in any one location.

Both moving and non-moving (or slow-moving) sources are addressed. In the former case, animals are treated as non-moving over the times that energy is accumulated toward the threshold. Moving acoustic sources considered in this EIS/OEIS are assumed to be moving at speeds significantly greater than average animal speeds. In that case, it is assumed that animals do not move over the time for which energy is accumulated to threshold level. For most acoustic sources, this accumulation time is a few minutes or less. For slow or fixed sources, it is considered a similar mathematical exercise if the source is moving and the animal is stationary or if the source is stationary and the animal is moving. This is referred to in mathematical terms as a duality argument. This is applied to the acoustic energy summation. Either the animal can be considered stationary or the source can be stationary and the animal assumed to be moving. A 'random walk' approach is used for extended durations. Refer to Appendix C for more detailed information on the acoustic modeling and acoustic sources.

It is reasonable to expect that the number of potential exposures from multiple acoustic sources would be greater than the potential number for one source. For source separations greater than the exposure range for a single source, it can be shown that the total exposure count is approximated by the sum of exposure counts for the individual sources. The reason is that, again emphasizing that the exposure count is an expected value (and not a probability or worst case), the maximum energy contribution from any one source cannot be increased significantly by the contributions from a second source unless the animal approaches as closely to the second source.

The potential for exposures of marine mammals under the MMPA were only calculated for potential problematic acoustic sources as indicated in the acoustic model (see Appendix C). Other potential sources of noise were determined to not have the potential to impact marine mammals either because the frequency was too high (i.e., marine mammals would not be able to hear the source) or the initial source level was lower than the Level B harassment acoustic threshold. Acoustic modeling did not predict any Level A harassment; therefore, the following discussion of the calculation of exposures is in reference to Level B harassment only.

The acoustic model generated exposure volumes for a wide variety of acoustic source parameters. The modeled parameters or interpolation of modeled parameters were associated with the types of acoustic sources typically used in the NAVSEA NUWC Keyport Range Complex. The predicted exposure (based on the results of the model) for each type of source used was calculated as the product of the exposure volume (or ensonified area) and species-specific marine mammal density (per unit area). This represents the expected value. Since animal densities are almost always given as densities per unit area, rather than per unit volume, the area approach is commonly used. In this case, the density data give no information on the distribution of animals with depth, so it must be assumed that animals are uniformly distributed in depth, at least over the depths that are ensonified by the acoustic source. For shallow water and the ranges of interest here, this is generally a reasonable assumption, though it may slightly overestimate or underestimate the number of exposures.

Again, the 'ensonified area' approach is sufficiently accurate for many cases (e.g., those for which the ensonified area extends from surface to maximum animal depth, and for which average sound propagation is weakly depth dependent). On the other hand, there are cases when accounting for the vertical component is important. Among the more obvious examples are ones for which the sound field is omni-directional and the exposure range very small (e.g., high-frequency tracking source), or cases where sound sources have vertical directivity (e.g., side-scan sonar). In these cases, the area approach may overestimate the risk. For the acoustic sources in this analysis, the impact ranges are generally small and highly directional.

Because the exposure volumes were measured in cubic kilometers (km^3), area-based densities were converted to volumetric densities by first converting the area based densities into expected number of animals (i.e., multiplying the density times the area of each range) and then dividing the product by the volume of water in each range to a maximum depth of 656 ft (200 m). This resulted in a modeled estimate of the number of individuals of each species potentially impacted at the Level B harassment threshold for each kilometer of use of each of the acoustic sources. Because the resulting numbers are small (i.e., less than 1), it is more realistic to think of the results as the probability of an animal being affected and those probabilities are additive by distance traveled by the source (or animals if the source is fixed). In order to calculate the estimated number of exposures predicted by the acoustic model, the probabilities (or animals affected per km that the acoustic source traveled) need to be multiplied by the distance traveled.

It was assumed, based on the hearing range of mysticete whales, that the probability of exposures from acoustic sources in excess of 30 kHz would be 0; this number was used to calculate exposures for the appropriate sources for all mysticete whales. Once an animal is counted as an exposure, the same animal is not counted again later in the same day as an exposure. Since an animal can be counted as two separate exposures on two different days, the number of exposures can exceed the local animal population.

Because the densities of animals, the sound velocity profile, transmission loss, and therefore the exposure volume of the acoustic sources vary seasonally, calculations were conducted both for the warm (May-October) and the cold (November-April) seasons. The results for each season were then added together to generate the estimated exposures per year. Because the density of marine mammals along the Washington coast varied substantially within Territorial (≤12 nm [22 km]) and beyond Territorial (>12 nm [22 km]) waters, the estimates for the QUTR action area were potentially more complicated. However, since it was not possible to determine acoustic source use within or outside 12 nm (22 km), exposure calculations were based on all sources being used within the zone in which the species densities were highest in order to obtain the most conservative exposure estimates.

Finally, as noted previously, the effects of land shadowing and multiple exposures have been incorporated into the modeling protocols as described in Appendix C. Land shadow effects are particularly important in Puget Sound because of the complex and irregular boundaries between the land and the sea.

3.5.5 Acoustic Capabilities of Marine Mammals

Marine mammal hearing has been reviewed by Kastelein et al. (1995), Richardson et al. (1995), Kastak and Schusterman (1998), Ketten (1998, 2000), Au et al. (2000), Nachtigall et al. (2000), and Nedwell et al. (2004). Fay (1988) tabulated and graphed most pre-1988 data and compared them with audiometric (measured sensitivity of hearing) data from other vertebrates. Ketten (2000) categorized cetaceans into functional groupings based on their auditory anatomy.

For many marine mammal species, no direct behavioral or physiologic audiometric data exist, especially mysticete whales. Hearing ranges for species with no audiograms are estimated with mathematical models based on ear anatomy, inferred from the range of vocalizations, or by a variety of experimental techniques (Ketten 1997; Houser et al. 2007). The hearing ability of mammals is a complex of biotic (e.g., structure of inner ear) and abiotic factors (e.g., water temperature, depth, weather). For instance, the "absolute threshold" is the level of sound at a specific frequency that is barely audible in the absence of significant ambient noise. Data on hearing are available for a few odontocetes and pinnipeds, but not for mysticetes. Various authors have speculated about hearing abilities of mysticetes based on the anatomy of their ears, the frequencies of their own calls, and their known reactions to sounds of certain frequencies and levels.

For most marine mammal species tested for hearing abilities, only one or two individuals have been studied. The most extensive data on individual variation are from odontocetes such as the bottlenose dolphin and beluga (see Richardson et al. 1995). There is evidence of intra- and interspecific differences in hearing abilities. However, data show reasonably consistent patterns of hearing sensitivity within each of three groups: small odontocetes (although river dolphins and porpoises may be somewhat different), medium-sized odontocetes, and phocinid seals. Hearing abilities of larger odontocetes are estimated mostly based on extrapolation from studies of smaller odontocetes.

Marine mammals as a group have functional hearing ranges of 10 Hz to 180 kHz with lowest auditory thresholds best sensitivity thresholds near 40 dB re 1 μPa (Ketten 1998; Gentry et al. 2004; Kastak et al. 2005). They can be divided into groups based on their probable functional ranges: (a) species with a probable range of 15 Hz to 20 kHz, (b) species with a probable range of 100 Hz to 100 kHz, and (c) species with a probable range of 500 Hz to 180 kHz. The larger species of whales and pinnipeds (e.g., blue whale, elephant seal) have best hearing sensitivity in the lower frequency ranges (i.e., less than 1 kHz).

3.5.5.1 Mysticetes (Baleen Whales)

The known hearing and sound production characteristics of mysticetes are summarized in Table 3.5-7. Although the hearing abilities of mysticetes have not been studied directly, they can be inferred, to a degree, from the vocalizations that they produce, the sounds to which they do and do not respond, and their auditory anatomy. Optimum hearing is likely within the frequency range of vocalizations emitted, and hearing may extend beyond this frequency range since other environmental sounds may also be important (Ketten 2004). The anatomy of the baleen whale inner ear seems to be well adapted for detection of low-frequency sounds (Ketten 1991, 1992, 1994, 2000).

Overall, current information suggests that mysticete hearing includes frequencies of 10-15 Hz (or lower) at the lower end and up to 20-30 kHz (Frisk et al. 2003). Behavioral and anatomical evidence indicates that they hear well at frequencies below 1 kHz (Richardson et al. 1995, Ketten 2000). Functional hearing for mysticetes as a group extends from 7 Hz to 22 kHz, though the hearing range of individual species may not be as wide (Miller et al. 2005). The auditory threshold for mysticetes is unknown, but is speculated to be approx 60-80 dB re 1 μPa within the frequency range of best hearing (Ketten 2004). However, the absolute sound levels that they can detect below 1 kHz are probably limited by increasing levels of natural ambient noise at decreasing frequencies. At frequencies below 1 kHz, natural ambient levels tend to increase with decreasing frequency (Hildebrand 2004).

Based on field and anatomical evidence, it is assumed that mysticete whale hearing is similar at frequencies less than 1 kHz, then deteriorates with increasing frequency. At frequencies in the 1 to 8 kHz range, ambient noise levels occurring under the quietest natural conditions (and in the absence of man-made sound) are rarely less than 60 dB re 1 μPa (Richardson et al. 1995). Therefore, the minimum hearing sensitivity for mysticetes is likely about 50 dB re 1 μPa at their best frequencies.

Mysticetes are more sensitive to low-frequency sounds than are the small odontocetes. For example, baleen whales are likely to hear airgun pulses farther away than can small toothed whales and, at closer distances, airgun sounds may seem more prominent to baleen than to toothed whales. In addition, mysticetes are known to detect the low-frequency sound pulses emitted by seismic airguns and change their direction of movement (Richardson et al. 1986; Miller et al. 1999; McCauley et al. 2000), or change their calling behavior (Greene et al. 1999). However, mysticetes have commonly been observed well within the distances where seismic or sonar sounds would be detectable, and yet show no overt reaction to those sounds. Behavioral responses by mysticetes to seismic pulses have been documented, but received levels of pulsed sounds necessary to elicit behavioral reactions are typically well above the minimum detectable levels (Malme et al. 1984, 1988; Richardson et al. 1986, 1995, 1999; McCauley et al 2000; Johnson 2002). Mysticetes also reacted to sonar sounds at 3.1 kHz and other sources centered at 4 kHz (see Richardson et al. 1995 for a review). Some mysticetes react to pinger sounds up to 28 kHz, but not to pingers or sonars emitting at or above 36 kHz (Watkins 1986).

Table 3.5-7 Summary of Underwater Hearing and Sound Production Characteristics of Mysticetes

Species	Sound Production: Frequency Range (Hz)	Sound Production: Source Level (dB re 1 µPa @ 1 m)	Hearing Range (Hz)[a]
N Atlantic right whale	70–600	137–192	Functional range: 15–18,000[b] Maximum range: 10–22,000[b]
N Pacific right whale	<400	-	-
S right whale	30–2,200	172–187	-
Bowhead whale	20–3,500	128–189	-
Pygmy right whale	60–300	153–179	-
E gray whale	20–20,000	167–188	800–1,500 [c]
Humpback whale	10[d]–>24,000[e]	Male song: 144–174 Social sounds: 190	700–10,000, Max. sensitivity 2,000–24,000[e, f]
Minke whale	60–20,000	151–175	-
Bryde's whale	70–950	152–174	-
Sei whale	100-150[g] – 3,500[h]	147–156[g, i]	-
Fin whale	10–750	155–190	-
Blue whale	10–400	180–190	-

Sources: Richardson et al. 1995; Navy 2007b; also see footnotes below.

Notes: [a] For some species, the frequency range of hearing has been suggested (e.g., footnote b, footnote d) based on indirect evidence, but there are no specific data for any mysticete. Some mysticetes are believed to have at least limited hearing capabilities at frequencies as low as 7 Hz or as high as 22 kHz (Miller et al. 2005), given their auditory anatomy, the frequencies of their calls, and their responsiveness (or lack thereof) to sounds at particular frequencies.
[b] Parks et al. 2004.
[c] As suggested by Dahlheim and Ljungblad (1990) in Navy (2005a).
[d] Zoidis et al. 2005, 2006.
[e] Au et al. 2006.
[f] Estimated using mathematical function developed by Houser et al. (2001b) in Navy (2005a).
[g] Miller et al. 2005.
[h] Thompson et al. 1979; Knowlton et al. 1991.
[i] (rms) re 1 µPa-m.

Most mysticetes produce sounds in the range of 10-500 Hz, with the larger species (blue and fin whales) producing the lowest frequency vocalizations (Richardson et al. 1995). Most studies of baleen whales have used equipment designed to detect and record only low-frequency sound. Studies of humpback whale songs by Au et al. (2001, 2006) used equipment that detected higher frequencies. Houser et al. (2001b) constructed a humpback audiogram using a mathematical model based on the internal structure of the ear and estimated sensitivity to frequencies from 700 Hz to 10 kHz, with maximum relative sensitivity between 2 and 6 kHz. It was found that humpback whales use higher frequency sound much more than had previously been known, although the higher frequency components of the songs were at a lower energy level than those at low frequencies. Overall, the auditory system of mysticete whales appears to be more sensitive to low-frequency sounds than is the auditory system of the small- to moderate-sized odontocetes.

Hearing data for minke whales are not available, although it is known that minke whales produce many types of sounds that range from 80 Hz to 5 kHz, with pings and clicks from 3.3 to 20 kHz (Beamish and Mitchell 1973; Winn and Perkins 1976). The same data on hearing for humpback whales are also not available. In general, humpback whales produce sounds in the 10 Hz to 24 kHz range (Au et al. 2006). Despite a significant amount of research on gray whales, data on hearing are limited. The structure of the gray whale ear is evolved for low-frequency hearing (Ketten 1992). The ability of gray whales to hear frequencies below 2 kHz has been demonstrated in playback studies (Cummings and Thompson 1971; Dahlheim and Ljungblad 1990; Moore and Clarke 2002) and in their responsiveness to underwater noise associated with oil and gas activities (Malme et al., 1986; Moore and Clarke 2002).

3.5.5.2 Odontocetes (Toothed Whales)

The hearing range of at least some odontocetes species range from 40 Hz to 150 kHz and is most sensitive in the range of 10 – 100 kHz (Figure 3.3-1). The hearing abilities of some odontocetes have been studied in detail and hearing sensitivity has been determined to be a function of frequency (Richardson et al. 1995; Szymanski et al. 1999; Au et al. 2000; Hemila et al. 2001; Kastelein et al. 2003; Finneran and Houser 2006; Houser and Finneran 2007). The small to moderate-sized toothed whales whose hearing has been studied have relatively poor hearing sensitivity at frequencies below 1 kHz, but extremely good sensitivity at and above several kHz.

Based on studies of a small number of species of small to medium-sized odontocetes including the Risso's dolphin (Nachtigall et al. 1995), odontocetes hear sounds over a wide range of frequencies (Richardson et al. 1995). Hearing extends at least as low as 40-75 Hz in the bottlenose dolphin (Johnson 1967; Turl 1993). However, the hearing sensitivity of small to medium odontocetes at low frequencies is generally poor. In contrast, the high-frequency hearing ability of most small to medium-sized odontocetes is good, likely related to these cetaceans' use of high-frequency sound for echolocation. The hearing range extends up to 80-150 kHz in at least some individuals of all of the species tested to date. Sound data for Dall's porpoise suggest that they produce sounds in the 40 Hz to 160 kHz range. Information on the hearing abilities of a stranded sperm whale neonate was the same as other odontocetes (Carder and Ridgway 1990).

Killer whales can hear sounds ranging from less than 500 Hz to 105 kHz and produce sounds from 100 Hz to 85 kHz. Within the range of frequencies where odontocetes have their best sensitivity, their hearing is very acute. With little background noise, a killer whale could detect a 15-kHz signal of approximately 30 dB re 1 μPa (Hall and Johnson 1972). Killer whales reliably responded to 100 kHz tones presented at 95 dB re 1 μPa.

Toothed whales use echolocation (frequency range of 23-150 kHz) to locate prey and sense the shape of their surroundings. Many toothed whale species produce sounds in the 1 – 25 kHz range to communicate with each other. Based on their ultrasonic signals, toothed whales are divided into two types. Type I species produce maximum energy at frequencies above 100 kHz. Type II species produce peak energy at frequencies below 80 kHz. Type I species are highly adapted to producing and receiving ultrasonic sound (Ketten 1998).

3.5.5.3 Pinnipeds (Seals and Sea Lions)

Pinnipeds produce a variety of sounds including grunts, barks, growls, whistles, and clicks. Some species are rarely vocal and others are very vocal. Seals generally vocalize at frequencies between 100 Hz to 15 kHz with maximum energies at less than 5 kHz (Ketten 1998). The northern elephant seal produces very low-frequency calls in the air and is more sensitive to low-frequency sound (less than 1 kHz) than are other seals. Sea lions and fur seals use higher frequencies than seals. There are audiograms for many pinnipeds (Moore and Schusterman, 1987; Richardson et al. 1995; Kastak and Schusterman 1998, 2002; Wolski et al. 2003).

Underwater Hearing

The hearing range of seals and sea lions is generally from 100 Hz to 60 kHz. Underwater audiograms have been obtained for several species of phocids (true or earless seals). At least some of the phocid seals have better auditory sensitivity at lower frequencies (less than 1 kHz) than do odontocetes (Kastak and Schusterman 1999). Below 30 – 50 kHz, the minimum hearing sensitivity of most species tested ranges between 60 and 85 dB re 1 µPa.

The harbor seal hears almost equally well in air and underwater (Kastak and Schusterman 1998). Harbor seals' peak hearing sensitivity is at 32 kHz in water and 12 kHz in air (Kastak and Schusterman 1998; Wolski et al. 2003). Some phocids can detect underwater sound at high frequencies—up to 180 kHz—if it is sufficiently intense. However, above 60 kHz sensitivity is poor and different frequencies cannot be discriminated (Schusterman 1981; Richardson et al. 1995). Southall et al. (2007) have estimated the functional hearing ranges of pinnipeds as 75 Hz to 75kHz in water, and 75 hz to 30 kHz in air.

Kastak and Schusterman (1996) observed a TTS of 8 dB at 100 Hz from 6-7 hours of intermittent airborne construction noise (200 – 2,000 Hz at 95 – 105 dB unweighted) per day for 6 days, with complete recovery approximately 1 week following exposure. Kastak et al. (1999b) determined that underwater noise of moderate intensity (65 to 75 dB sensation level at center frequency above the animals hearing threshold at 100, 500, and 1,000 Hz) and continuous duration of 20 min is sufficient to induce a small TTS of 4.8 dB in harbor seals.

The northern elephant seal appears to have greater underwater sensitivity than the harbor seal, at least at low frequencies (Kastak and Schusterman 1998, 1999). The audiogram of the northern elephant seal indicates that this species is well-adapted for underwater hearing; sensitivity is best between 3.2 and 45 kHz, with greatest sensitivity at 6.4 kHz, and an upper frequency cutoff of approximately 55 kHz (Kastak and Schusterman 1999).

The range of maximal underwater sensitivity for California sea lions is between 1 and 28 kHz. Functional underwater high frequency hearing limits are between 35 and 40 kHz, with peak sensitivities from 15 to 30 kHz (Schusterman et al. 1972). The California sea lion shows relatively poor hearing at frequencies below 1,000 Hz (Kastak and Schusterman 1998). Peak sensitivities in air are shifted to lower frequencies; the effective upper hearing limit is approximately 36 kHz (Schusterman 1974). The best range of sound detection is from 2 to 16 kHz (Schusterman 1974). Kastak and Schusterman (2002) determined that hearing sensitivity generally worsens with depth—hearing thresholds were lower in shallow water, except at the highest frequency tested (35 kHz), where this trend was reversed. Octave band noise levels of 65 to 70 dB above the animals' threshold produced an average TTS of 4.9 dB in the California sea lion (Kastak et al. 1999b). Center frequencies were 1,000 Hz for corresponding threshold testing at 1,000 Hz and 2,000 Hz for threshold testing at 2,000 Hz; the duration of exposure was 20 min.

The underwater hearing sensitivity of two Steller sea lions was tested and the hearing thresholds of the male were found to be significantly higher than those of the female (Kastelein et al. 2005b). The range of best hearing for the male was from 1 to 16 kHz, with maximum sensitivity (77 dB re 1 µPa) at 1 kHz. The range of best hearing for the female was from 16 to above 25 kHz, with maximum sensitivity (73 dB re 1 µPa) at 25 kHz. It is not known whether the differences in hearing sensitivity are due to individual differences in sensitivity or due to sexual dimorphism in hearing (Kastelein et al. 2005b)

In-Air Hearing

Because pinnipeds spend a significant portion of time above water, they have evolved to respond to airborne as well as underwater sound. In-air sensitivities have been determined behaviorally for a variety of pinniped species. Pinnipeds are less sensitive to airborne sounds below 10 kHz than are humans. Because pinnipeds are adapted to hear underwater sound as well as airborne sound, their in-air sensitivity is likely compromised.

The in-air high-frequency cutoff of some pinnipeds is approximately 20 kHz, considerably lower than their underwater cutoff around 60 kHz (Ridgway and Joyce 1975). In-air sensitivity of pinnipeds deteriorates as frequency decreases below 2 kHz.

3.5.5.4 Sea Otter

Sea otter vocalizations are considered to be most suitable for short range communication among individuals (McShane et al. 1995). Airborne sounds include screams, whines or whistles, hisses, deep-throated snarls or growls, soft cooing sounds, grunts, and barks at frequencies of 3 – 5 kHz (Kenyon 1975; McShane et al. 1995). They are not known to communicate underwater. No data are available on the hearing abilities of this species (Ketten 1998).

3.5.6 Keyport Range Site

3.5.6.1 Existing Conditions

A total of five cetaceans and three pinnipeds are known to occur within central Puget Sound, which encompasses the Keyport action area, but several of these species have not been reported in Port Orchard Reach or in the action area (Table 3.5-8 and refer to Appendix D). Humpback whales, minke whales, killer whales, California sea lions, and Steller sea lions are expected to be rare to very rare in southern Puget Sound and have not been reported in the Keyport action area. Density estimates for these species are available for Puget Sound as a whole, but since these species have not been recorded or observed in the action area, the densities for the action area are shown as "0" to reflect this (Appendix D).

<u>Non-ESA-Listed Species</u>

Minke Whale. Minke whales are one of the most widespread and abundant marine mammals in the world. In the eastern North Pacific, they range from Alaska to Mexico. Groups of up to three minke whales often approach coastal areas and frequently enter bays, inlets, and estuaries where they prey on small fish. Minke whales have not been abundant in Washington waters and there are no population estimates and little distribution information available for this species (Green et al. 1992; Calambokidis et al. 1997a). Their seasonal distributions and movements are not well known because they are inconspicuous compared with other baleen whales.

Although population estimates do not exist, a few dozen, possibly resident, minke whales have been studied in the San Juan Islands, approximately 65 miles (105 km) north of the action area. The minke whale population in the Greater Puget Sound region (approximately 30 individuals) peaks between July and September; they are rarely seen during the winter (Osborne et al. 1988; Dorsey et al. 1990). Reproduction occurs throughout the year with a peak in mating in January and June and peak births in December and June. Minke whales in the Puget Sound feed primarily on juvenile sand lance and juvenile herring (Calambokidis and Baird 1994). They appear to have strong site-fidelity and it is probably uncommon for any members of this population to wander into the more southern waters of Puget Sound (Osborne et al. 1988). Minke whale occurrence within the Keyport action area is expected to be very rare, with a density estimate of zero (Appendix D).

Table 3.5-8 Marine Mammals Known to Occur or Potentially Occur Within the Keyport Range Site Action Area

Species		*Status* *ESA/MMPA*	*Occurrence in Keyport Range Action Area*	*Density Estimate (km²)* *Warm Season*	*Cold Season*
CETACEANS					
Mysticetes					
Minke whale		-/-	Very rare, year-round.	0[a]	0[a]
Humpback whale		E/D	Very rare, warm season; has not been recorded in action area.	0[a]	0[a]
Gray whale		-/-	Very rare, migrant and summer/fall resident population in primarily northern Puget Sound.	0[a]	0[a]
Odontocetes					
Killer whale	Transient	-/-	Very rare, year-round; has not been recorded in action area.	0[a]	0[a]
	S Resident	E, CH/D	Very rare, summer/fall season; has not been recorded in action area.		
Dall's porpoise		-/-	Rare, year-round.	0[a]	0[a]
PINNIPEDS					
Harbor seal		-/-	Common year-round resident.	0.55	0.55
California sea lion		-/-	Rare, cold season.	0[a]	0[a]
Steller sea lion		T/D	Rare, cold season.	0[a]	0[a]

Notes: D = Depleted, E = Endangered, CH = Critical Habitat, T = Threatened.
Warm season = May-October, Cold season = November-April.
abundant = the species is expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; **common** = the species is expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; **uncommon** = the species is expected to be encountered at most a few times a year assuming many visits to the area; **rare** = the species is not expected to be encountered more than once in several years; **very rare** = not expected to be encountered more than once in 10 years.
[a]Density estimates for these species were calculated for Puget Sound as a whole, but these species have not typically been recorded or observed in the action area. The densities for the action area are shown as "0" to reflect this.
Sources: Refer to Appendix D for sources of densities and occurrence estimates.

Recordings of minke whale sounds indicate the production of both high and low-frequency sounds (range: 0.06 to 20 kHz) (Beamish and Mitchell 1973; Winn and Perkins 1976; Mellinger et al. 2000). Source levels for this species have been estimated to range from 151 to 175 dB re 1 µPa-m (Ketten 1998). Source levels for some minke whale sounds have been calculated to range from 150 to 165 dB re 1 µPa-m (Gedamke et al. 2001). "Boings," recently confirmed to be produced by minke whales and suggested to be a breeding display, consist of a brief pulse at 1.3 kHz followed by an amplitude-modulated call with greatest energy at 1.4 kHz, with slight frequency modulation over a duration of 2.5 sec (Rankin and Barlow 2005). While no empirical data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes are most adapted to hear low to infrasonic frequencies.

Gray Whale. Gray whales in Puget Sound fall into two categories. The first group contains stragglers from the migration observed in southern Puget Sound during spring and summer that are rarely observed in multiple years and are often observed dead and emaciated. The second group is composed of gray whales that utilize a highly productive feeding ground in northern Puget Sound and return each spring to feed for 2-3 months. Studies in Puget Sound found that gray whales were feeding on ghost shrimp in shallow mudflats where they may remain to feed for several days to several months (Weitkamp et al. 1992).

Sightings of gray whales have occurred in the northern Puget Sound near Pt. Susan as well as in southern Puget Sound near Olympia (Calambokidis et al. 1992). A small group of gray whales (approximately 10 individuals) has been regularly sighted in northern Puget Sound around Whidbey Island/Hood Canal and occasionally in southern and central Puget Sound (Calambokidis and Baird 1994; Calambokidis et al. 1994; Calambokidis and Quan 1997). These animals appear to show strong site-fidelity to this region and are rarely observed in other areas along the Washington or British Columbia coasts (Calambokidis et al. 1999, 2002). A juvenile gray whale stranded at Naval Base Kitsap-Bremerton, in May 2005 (Cascadia Research 2005). Gray whale occurrence within the Keyport Action Area is expected to be very rare, with a density estimate of zero (Appendix D).

The structure of the gray whale ear is evolved for low-frequency hearing (Ketten 1992). The ability of gray whales to hear frequencies below 2 kHz (as low as 0.8 kHz) has been demonstrated in playback studies (Cummings and Thompson 1971; Dahlheim and Ljungblad 1990; Moore and Clarke 2002) and in their responsiveness to underwater noise associated with oil and gas activities (Malme et al. 1986; Moore and Clarke 2002).

Dall's Porpoise. Dall's porpoise are widely distributed in coastal to deep waters of the northern North Pacific and Bering Sea. In North America, they are found inshore and offshore from Southern California to Alaska. In Washington, they are most abundant in offshore waters. They are year-round residents in Washington (Green et al. 1992), but their distribution is highly variable between years likely due to changes in oceanographic conditions (Forney and Barlow 1998). Dall's porpoise eat squid, crustaceans, and fishes such as eelpout, herring, pollock, whiting, and sand lance (Walker et al. 1998).

Dall’s porpoise are observed throughout the year in Puget Sound north of Seattle (Osborne et al. 1988) and also are seen occasionally in southern Puget Sound. Although the exact population size is unknown, the number of Dall’s porpoise is considered to be relatively low in Puget Sound. Dall’s porpoise are more common in the Strait of Juan de Fuca and the San Juan Islands. Resident Dall’s porpoise breed in Puget Sound from August through September. Breeding and calving typically occurs in the spring and summer (Angell and Balcomb 1982). Dall’s porpoise are expected to be rare in the Keyport action area, with a density estimate of zero (Appendix D).

Calving occurs in the north Pacific from early June through late July (Ferrero and Walker 1999) with a smaller peak in March (Jefferson 1989).

Only short duration pulsed sounds have been recorded for Dall’s porpoise (Houck and Jefferson 1999); this species apparently does not whistle often (Richardson et al. 1995). Dall’s porpoises produce short-duration (50 to 1,500 μs), high-frequency, narrow band clicks, with peak energies between 120 and 160 kHz (Jefferson 1988). There are no published data on the hearing ability of this species.

Killer Whale. Based on appearance, feeding habits, vocalizations, social structure, and distribution and movement patterns, there are three types or populations of killer whales in Washington waters: residents, transients, and offshore animals (Wiles 2004; NMFS 2005d). Genetic analyses indicate that these three populations rarely, if ever, interbreed. They have been recorded throughout almost all salt-water and some fresh-water areas, including many long inlets, narrow channels, and deep embayments. These animals possess a complex vocal repertoire with variation in signals between populations and social groups (Miller and Bain 2000; Thomsen et al. 2001; Yurk et al. 2002). The resident and transient populations have also been divided into different subpopulations based mainly on genetic analyses and distribution; not enough is known about the offshore whales to divide them into subpopulations (Wiles 2004).

The offshore population has been recorded only a handful of times in the inside waters of Puget Sound and is very unlikely to occur in the Keyport Range or vicinity (NMFS 2005d). More information on offshore killer whales can be found in the discussion of the QUTR Site. Transient and resident killer whales are known to occur throughout Puget Sound but have not been recorded within the Keyport action area and are expected to be very rare visitors to the area, with a density of zero. The endangered Southern Resident population is discussed below under the *ESA-Listed Species* subsection.

Killer whale births occur largely from October to March, although births can occur year-round (Olesiuk et al. 1990; Stacey and Baird 1997).

The killer whale produces a wide variety of clicks and whistles, but most of its sounds are pulsed and at 1 to 6 kHz (Richardson et al. 1995). Peak-to-peak source levels of echolocation signals range between 195 and 224 dB re 1 µPa-m (Au et al. 2004). The peak-to-peak source level of social vocalizations ranges between 137 to 157 dB re 1 µPa-m (Veirs 2004). Acoustic studies of resident killer whales in British Columbia have found that there are dialects, in their highly stereotyped, repetitive discrete calls, which are group-specific and shared by all group members (Ford 2002). These dialects likely are used to maintain group identity and cohesion, and may serve as indicators of relatedness that help in the avoidance of inbreeding between closely related whales (Ford 2002). Dialects also have been documented in killer whales occurring in northern Norway, and likely occur in other locales as well (Ford 2002).

Harbor Seal. These seals have a wide distribution over much of the Northern Hemisphere in temperate and subarctic waters. They are the most abundant marine mammals in Washington waters with a population estimate of 14,612 animals for the inland waters based on surveys conducted in the late 1990s. It is estimated that their abundance in Washington has increased by 7-10 times since 1970 (Jeffries et al. 2003).

Harbor seals occur throughout Puget Sound. Harbor seals are typically seen in small groups resting on tidal reefs, boulders, mudflats, man-made structures, and sandbars. They have a diverse diet consisting of fish, octopi, and squid and move up river mouths to follow salmon runs (Baird 2001b). Fish are the preferred prey, and many different species are consumed. In Puget Sound, the most common prey fishes are Pacific hake and Pacific herring. Salmonids are also taken particularly when adult salmon are returning to rivers to spawn or when smolts or fry are leaving the rivers (London et al. 2002).

Harbor seals are year-round, non-migratory residents in the Keyport action area and give birth (pup) from August through January. Unlike sea lions, harbor seals do not congregate on rookeries, but breed throughout most of their range. Harbor seal pups are precocial at birth and are reared in the water as well as on land (Riedman 1990). No harbor seal haulouts have been recorded within or in the vicinity of Keyport Range although individuals may use opportunistic haulouts in the area. The closest harbor seal haulout is within the northern extent of Liberty Bay (Poulsbo Marina) approximately 5 mi (8.0 km) north of Keyport Range. Approximately 100 harbor seals transit the Keyport action area from this haulout site (Jeffries et al. 2000) and they are considered common in the area. The density of harbor seals in the Keyport Action Area, $0.55/km^2$, is based on the Puget Sound population as explained in Appendix D.

In coastal and inland regions of Washington State, pups are born from April through January; pups are generally born earlier in the coastal estuaries and later in the Puget Sound/Hood Canal region (Calambokidis and Jeffries 1991; Jeffries et al. 2000).

Adult males produce low frequency vocalizations underwater during the breeding season (Hanggi and Schusterman 1994; Van Parijs et al. 2003). Male harbor seals produce communication sounds in the frequency range of 100 to 1,000 Hz (Richardson et al. 1995).

California Sea Lion. California sea lions move north into the Puget Sound region during fall from their breeding colonies in Mexico and California, and most return south by late winter or spring. Peak abundance in Puget Sound is between September and May. An estimated 3,000-5,000 California sea lions spend the winter in British Columbia and Washington and more than 1,000 have been counted in Puget Sound (Jeffries et al. 2000). California sea lions feed primarily on fish such as salmonids, hake, walleye pollock, herring, and spiny dogfish in the Puget Sound region (Calambokidis and Baird 1994). While in Puget Sound, groups of California sea lions haul out on a variety of sites including offshore rocks and islands, jetties, log booms, docks, and navigation markers or raft together on the surface of the water. No sea lion haulouts have been recorded within or in the vicinity of the Keyport action area. The closest known haulout is 10 mi (16.1 km) southeast of Keyport Range Site on a channel buoy in Rich Passage at the southern end of Bainbridge Island (Jeffries et al. 2000), but they commonly haulout in many opportune areas. California sea lions are expected to be rare within the Keyport action area, with a density estimate of zero (Appendix D).

The pupping and mating season for sea lions in California and Mexico begins in late May and continues through July (Heath 2002).

The male barks have most of their energy at less than 1 kHz (Schusterman et al. 1967). Males vary both the number and rhythm of their barks depending on the social context; the barks appear to control the movements and other behavior patterns of nearby conspecifics (Schusterman 1977). Females produce barks, squeals, belches, and growls in the frequency range of 0.25 to 5 kHz, while pups make bleating sounds at 0.25 to 6 kHz (Richardson et al. 1995). California sea lions produce two types of underwater sounds: clicks (or short-duration sound pulses) and barks (Schusterman et al. 1966, 1967; Schusterman and Baillet 1969). All underwater sounds have most of their energy below 4 kHz (Schusterman et al. 1967).

ESA-Listed Species and Associated Critical Habitat

Humpback Whale. Humpback whales are primarily a coastal species that travel over deep pelagic waters migrating between high-latitude feeding areas in Alaska and low-latitude breeding grounds in Hawaii or Mexico. They are a common seasonal inhabitant of the oceanic waters of Washington where they feed on a variety of species of small schooling fishes and invertebrates (Green et al. 1992). They can eat relatively large species such as cod and squid but prefer herring and euphausiids.

Humpback whales formerly were regular, common species in the inland waters of Washington but are now only occasional visitors. Sightings of humpbacks in the Strait of Georgia and Puget Sound remained infrequent through the late 1990s and a total of 13 individuals were identified in 2003 and 2004 (Falcone et al. 2005). Every 1 to 2 years, a humpback whale is sighted in Puget Sound, even as far south as Budd Inlet near Olympia, but these visits to inland waters are unusual. Most sightings appear to be of wandering juveniles apparently looking for a passageway back out of Puget Sound (NUWC Keyport 2000). The monitoring of a humpback whale in Puget Sound during 1988 found that this individual traveled as far south as Olympia, but was not reported within Port Orchard Reach (Calambokidis and Steiger 1990). Humpback whales have not been recorded within or in the vicinity of the Keyport action area and they are expected to be a very rare visitor to the area, with a density estimate of zero (Appendix D).

Humpback whales migrate south to the waters off Mexico and Costa Rica to breed and to give birth (Calambokidis et al. 2004).

Humpback whales are known to produce three classes of vocalizations: (1) "songs" in the late fall, winter, and spring by solitary males; (2) sounds made within groups on the wintering (calving) grounds; and (3) social sounds made on the feeding grounds (Richardson et al. 1995). The best-known types of sounds produced by humpback whales are songs, which are thought to be breeding displays used only by adult males (Helweg et al. 1992). Singing is most common on breeding grounds during the winter and spring months, but is occasionally heard outside breeding areas and out of season (Matilla et al. 1987; Clark and Clapham 2004). There is geographical variation in humpback whale song, with different populations singing different songs, and all members of a population using the same basic song. However, the song evolves over the course of a breeding season, but remains nearly unchanged from the end of one season to the start of the next (Payne et al. 1983). Social calls are from 50 Hz to over 10 kilohertz (kHz), with the highest energy below 3 kHz (Silber 1986). Female vocalizations appear to be simple; Simão and Moreira (2005) noted little complexity. The male song, however, is complex and changes between seasons. Components of the song range from under 20 Hz to occasionally 8 kHz, with source levels of 144 to 174 dB re 1 µPa-m, with a mean of 155 dB re 1 µPa-m (Thompson et al. 1979; Payne and Payne 1985, Frazer and Mercado 2000).

Songs have also been recorded on feeding grounds (Mattila et al., 1987; Clark and Clapham, 2004). Au *et al.* (2006) took recordings of whales off Hawaii and found high frequency harmonics of songs extending beyond 24 kHz, which may indicate that they can hear at least as high as this frequency. The main energy lies between 0.2 and 3.0 kHz, with frequency peaks at 4.7 kHz. Feeding calls, unlike song and social sounds, are highly stereotyped series of narrow-band trumpeting calls. They are 20 Hz to 2 kHz, less than 1 sec in duration, and have source levels of 175 to 192 dB re 1 µPa-m. The fundamental frequency of feeding calls is approximately 500 Hz (D'Vincent et al. 1985).

Killer Whale. The Southern Resident population comprises three pods totaling 90 whales (NMFS 2006e) and typically range between inland waters of Washington and southern Vancouver Island, British Columbia in spring and summer. The Southern Resident population spends much of its time in the region north of Keyport Range, especially near the San Juan Islands, the mouth of the Fraser River, and near the southern end of Vancouver Island. Most resident pods leave the area in fall (October - November) and return to the area in spring (May - June). These whales enter nearly all of Puget Sound and specialize in fish prey, in particular salmon (Ford et al. 1998; Saulitis et al. 2000). The population declined by approximately 15 percent during the 1990s; however in recent years numbers have increased. The causes of the decline in the 1990s are not known, but could include exposure to chemical contaminants, reduced availability of prey resources, and increased human activities. Recent studies of killer whales have shown that these whales are highly contaminated by polychlorinated biphenyls (PCBs) (Hayteas and Duffield 2000; Ross et al. 2000; Grant and Ross 2002).

In 2003, the Southern Resident population of the Puget Sound region was listed as a "depleted" stock under the MMPA (Krahn et al. 2002). In November 2005, NMFS listed the Southern Resident population as endangered under the ESA (NMFS 2005e) and, in November 2006, NMFS also designated critical habitat for Southern Resident killer whales within 2,500 mi^2 (6,475.0 km^2) of marine habitat that includes Haro Strait and the waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca. A number of military operating areas are excluded from this critical habitat designation, including the current Keyport Range Site (NMFS 2006a). However, critical habitat was designated for the waters of the proposed range extension (Figure 3.5-7). Southern Resident killer whales have not been recorded within the Keyport action area and they are expected to be very rare visitors to the area, with a density estimate of zero (Appendix D).

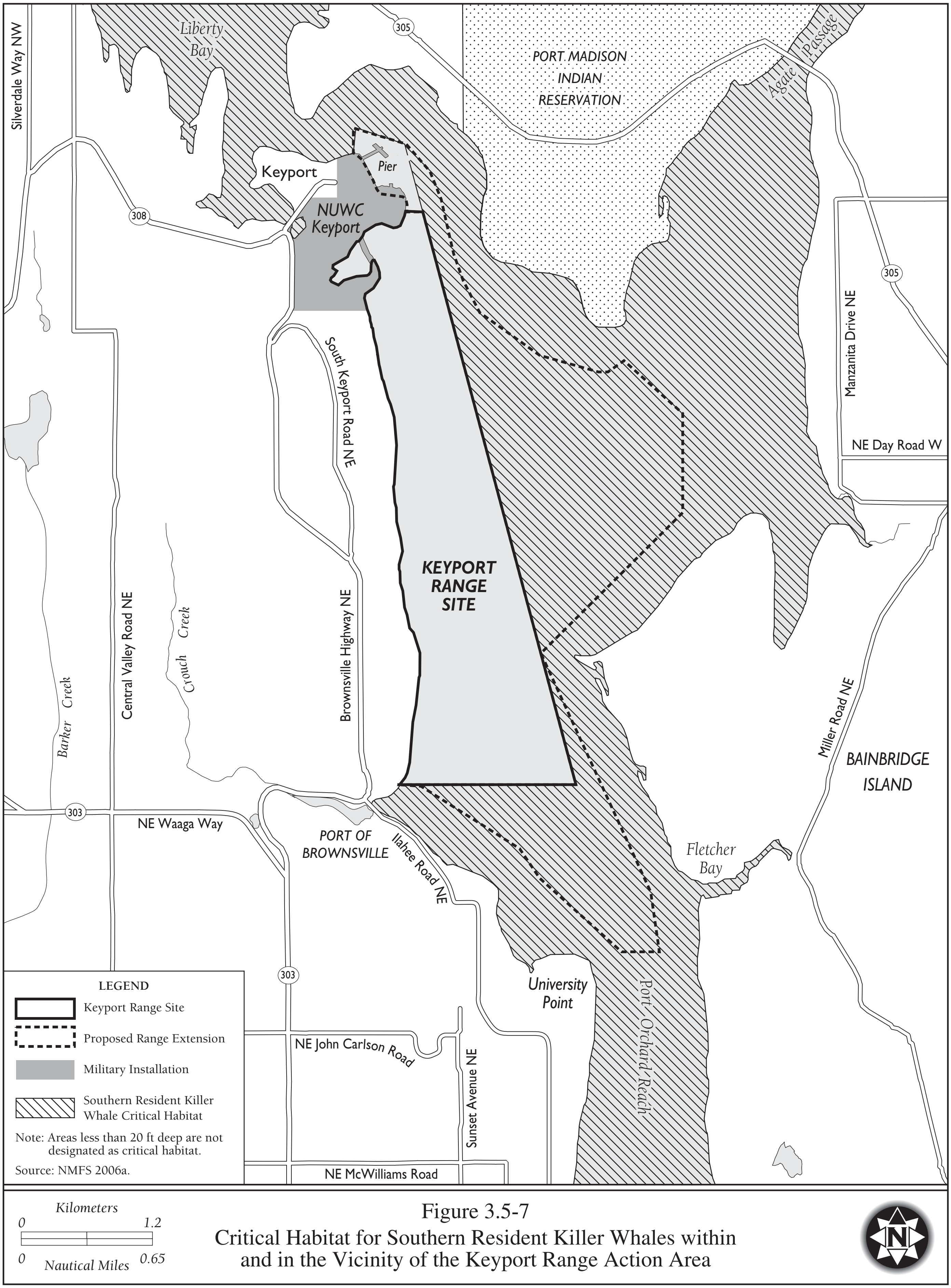


Figure 3.5-7
Critical Habitat for Southern Resident Killer Whales within and in the Vicinity of the Keyport Range Action Area

Steller Sea Lion. Steller sea lions range from California northwards along the Pacific coast to Alaska and northeast Asia. Breeding rookeries are located in California, Oregon, British Columbia, and Alaska but none are known in Washington. Two population segments are recognized: the western population, listed as endangered, ranges from Russia to the Gulf of Alaska, and the eastern population, listed as threatened, ranges from southeast Alaska to California, including Puget Sound (NMFS 1992).

The breeding season occurs from mid-May through mid-July (Pitcher and Calkins 1981), although Steller sea lions do not breed in Washington. Most Washington Steller sea lions are found at traditional haulout sites on the outer coast. They feed on a variety of local fish including rockfish, skate, hake, salmon, halibut, and black cod, as well as squid and octopi (NMFS 1992). Steller sea lions generally move into Puget Sound in the fall; by midwinter they may number several hundred (Angell and Balcomb 1982). They have been known to frequent Sucia Island, Race Rocks off southern Vancouver Island, and Sombrio Point in northern Puget Sound but are generally rare south of Admiralty Inlet (Yates 1988). During El Niño years, Steller sea lions have been observed hauling out on Gertrude Island in Carr Inlet near Tacoma (Navy 2002a). Steller sea lions have not been recorded in the vicinity of the Keyport action area (Jeffries et al. 2000), and their density is estimated to be zero for the Keyport Range site for all months (Appendix D).

The in-air territorial vocalizations of male Steller sea lion are usually low frequency roars (Navy 2006a). Campbell et al. (2002) determined that females have distinctive acoustic signatures. These calls range in frequency from 30 to 3000 Hz with peak frequencies from 150 to 1000 Hz; typical duration is 1000 to 1500 milliseconds. Loughlin et al. 1987, foung that underwater sounds are similar to in-air signals. The underwater hearing sensitivity of two Steller sea lions was recently tested; the hearing thresholds of the male were significantly higher than those of the female (Kastelein et al. 2005). The range of best hearing for the male was from 1 to 16 kHz, with maximum sensitivity (77 dB re 1 µPa-m) at 1 kHz. The range of best hearing for the female was from 16 to above 25 kHz, with maximum sensitivity (73 dB re 1 µPa-m) at 25 kHz. It is not known whether the differences in hearing sensitivity are due to individual differences in sensitivity or due to sexual dimorphism in hearing (Kastelein et al. 2005).

3.5.6.2 Environmental Consequences

<u>Keyport Range Alternative 1 – Preferred Alternative</u>

Acoustic Impacts

Estimated marine mammal densities per unit area for those marine mammal species expected to occur within the Keyport action area were obtained from the scientific literature (Table 3.5-8). Using these animal densities and depth distributions (Appendix D), the expected acoustic model exposure volumes from the types of acoustic sources, and annual level of use, the number of potential exposures per species per acoustic source was calculated (Appendix C). Future activities within the proposed extended Keyport Range Site would involve the use of a variety of acoustic sources including UUV payload and side-scan sonars above 100 kHz; range tracking, torpedoes, and range targets in the 5 to 100 kHz range; and target simulators and sub-bottom profilers at approximately 5 kHz (Table 1-2). For the acoustic analysis (Appendix C), eight representative acoustic sources were selected for marine mammal acoustic effects analysis (Table 3.5-6). Under Alternative 1, the only activities within the proposed extended Keyport Range Site expected to increase are the use of test vehicles from 45 to 60 activities/year.

Table 3.5-9 shows the annual MMPA exposures for the species associated with the Keyport Range Site. Based on this annual usage of representative acoustic sources within the proposed extended Keyport Range Site, there would be no Level A (PTS) exposures of any species, and no Level B exposures of any cetaceans due to the use of acoustic sources associated with NUWC Keyport activities within the Keyport action area.

As a result of acoustic effects associated with the use of active acoustic sources in the Keyport action area, implementation of Keyport Alternative 1 may result in incidental Level B behavioral and TTS harassment of relatively small numbers of harbor seals per year (Table 3.5-9). No serious injury or mortality of any marine mammal species is reasonably foreseeable. Based on the relatively low intensity of sonar sources and their limited use (less than 1,570 hours annually for all range sites), the relatively small number of takes in relation to the size of the inland waters stock of harbor seals, and the absence of specific areas of reproductive importance to harbor seals or other marine mammals in the action area, no adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

The potential for behavioral (Level B) harassment would be reduced by implementation of the lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as described in the ROP discussed in Sections 1.3.4 and 2.3.4. In particular, in accordance with Section 6-4 of the NUWC Keyport ROP, active acoustic activities would be halted or delayed if cetaceans (i.e., whales, dolphins, and porpoises) were observed on the range site, and there is a 100-yd (91-m) exclusion zone for pinnipeds from the intended track of the test vehicle. The small space and ability to conduct shore-to-shore surveillance of the range site affords the operators and the public an opportunity to see and report any cetaceans in the area.

Table 3.5-9 Annual MMPA Exposures for Keyport Range Alternative 1[1]

Species[2]		*Level B* *Risk Function* *(Sub TTS Behavioral)*	*Level B* *TTS*	*Level A* *PTS*
CETACEANS				
Minke whale		0	0	0
Humpback whale		0	0	0
Gray whale		0	0	0
Killer whale	Transient	0	0	0
	S Resident	0	0	0
Dall's porpoise		0	0	0
PINNIPEDS				
Harbor seal		109	41	0
California sea lion		0	0	0
Steller sea lion		0	0	0

1. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.

ESA-Listed Species. Based on the above analysis of potential impacts to marine mammals from the proposed use of active acoustic sources in the Keyport action area, implementation of Keyport Alternative 1 would have no effect on ESA-listed marine mammals. The NMFS draft BO concludes that adverse effects on ESA-listed marine mammals are unlikely to occur.

Non-Acoustic Impacts

LIDAR. LIDAR is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship, or diffuse objects such as a smoke plume or cloud. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, LIDAR that is designed to penetrate water uses light in the blue-green part of the spectrum as it attenuates the least. Typical civilian uses of LIDAR in the ocean include seabed mapping and fish detection. There are three generic types of LIDAR:

- Range finders: used to measure the distance from the LIDAR instrument to a solid target.
- Differential Absorption LIDAR (DIAL): used to measure chemical concentrations in the air.
- Doppler LIDARs: used to measure the velocity of an object.

Because the human eye is more sensitive to laser radiation than either the cetacean or pinniped eye, LIDARs that currently meet human laser safety standards are expected to have no harmful effect on the eyes of marine mammals (Zorn et al. 1998). In addition, the likelihood that a LIDAR's beam would directly contact a marine mammal eye is considered extremely remote given the movement of marine mammals underwater and at the surface. Therefore, there would be no impacts to marine mammals and no effect to ESA-listed species or their critical habitat due to the use of LIDAR with implementation of Keyport Alternative 1 within the proposed extended Keyport Range Site.

Inert Mine Hunting and Inert Mine Clearance Exercises. A series of inert mine shapes are set out in a uniform or random pattern to test the detection, classification, and localization capability of the system under test. They are made from plastic, metal, and concrete and vary in shape. For example, an inert mine shape can measure about 10 by 1.75 ft (3.0 by 0.5 m) and weigh about 800 lbs (363 kg). Inert mine shapes either sit on the bottom or are tethered by an anchor to the bottom at various depths. Inert mine shapes can be placed approximately 200 – 300 yards (183 – 274 m) apart using a support craft and remain on the bottom until they need to be removed. For example a concrete clump can be put on the bottom. It may be initially identified as a possible inert mine, but as the sensor becomes more sophisticated it will mark the clump as a non-mine and move on to locate other more probable inert-mine shapes. The example scenario for the Keyport Range Site is an inert-mine hunting evolution. All major components of all inert-mine systems used as 'targets' for inert-mine hunting systems are removed within 2 years.

The potential for direct physical contact between a marine mammal and an inert-mine shape is extremely low given the low probability of occurrence of a marine mammal in the area and the negligible probability that a marine mammal would collide with an inert mine shape. It is expected that any marine mammal encountering an inert-mine shape would simply avoid it much as it would avoid a rocky outcrop along the sea floor. Therefore, there would be no adverse impacts to marine mammals and no takes under MMPA due to the placement and use of inert-mine shapes upon implementation of Keyport Alternative 1 within the extended Keyport Range Site. Therefore, there is little potential for this to cause adverse impacts on marine mammals.

UUVs. There are two types of UUVs proposed for use within the Keyport action area: swimmers and crawlers. Swimmer UUVs are self-powered, submersible vehicles 2 – 32 ft (0.6 – 9.8 m) long, controlled by an onboard navigation system. Swimmers are typically placed into and retrieved from the water with a crane located at the NUWC Keyport pier. Crawler UUVs are self-powered underwater vehicles designed to operate on land, in the surf zone, or in very shallow water. They can measure about 2.5 ft (0.8 m) long and weigh about 90 pounds (40.8 kg). They move along the bottom on tracks or wheels. Crawlers have many of the same capabilities as swimmers, but operate along the bottom or in waters too shallow for swimmer UUVs.

The chance of a collision between a UUV and a marine mammal is considered extremely remote for the reasons discussed below under *Vessels and Torpedoes*. Observations for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. Due to the small size of the Keyport Range Site with shore-to-shore surveillance and the high civilian boat traffic in the area, it is highly unlikely that a cetacean could enter the Keyport action area without being detected. In addition to the 100-yd (91-m) exclusion zone for pinnipeds, pinnipeds are smaller and more maneuverable than cetaceans and are not expected to be susceptible to a collision with a UUV.

Some UUVs communicate with a surface vessel, shore-based, or pier-based facility with a 0.01-inch (254-micron) diameter fiber-optic cable. The cable is made of very fine glass and is very brittle. Due to the extremely small diameter (0.01 inch (254-micron)) of the fiber-optic cable, if a marine mammal would encounter the cable it would most likely break immediately and there would be no risk of entanglement. Therefore, there would be no adverse impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat due to the use of UUVs under Keyport Alternative 1 within the extended Keyport Range Site.

Vessels, Torpedoes, and Targets. NUWC Keyport uses the ROP to reduce the potential for collisions with marine mammals at the surface or underwater (Sections 1.3.4 and 2.3.4). Observations for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. For cetaceans, the exclusion zones must be at least as large as the area in which the test vehicle may operate in and must extend at least 1,000 yards (914 m) from the intended track of the test vehicle. For pinnipeds, the exclusion zone extends out 100 yards (91 m) from the intended track of the test vehicle. The exclusion zones for cetaceans and pinnipeds are established prior to an in-water exercise (NUWC Keyport 2004c). In addition, NMFS recommends that vessels not intentionally approach within 100 yards (91 m) of marine mammals. Naval vessels and aircraft, including all helicopters, under the control of NUWC Keyport shall comply with this recommendation. Vessels are expected to implement actions, where feasible, to avoid interactions with marine mammals, including maneuvering away from the marine mammal or slowing the vessel. Due to the relatively small size of the Keyport Range Site with shore-to-shore surveillance and the high civilian boat traffic in the area, it is unlikely that a whale could enter the Keyport action area undetected. However, during reduced visibility conditions (i.e., fog, high sea state, darkness) detecting marine mammals requires more diligence. Historically there has not been a reported vessel strike of a marine mammal within the Keyport Range site, including periods of reduced visibility. A collision between a vessel and a marine mammal is considered extremely unlikely.

Targets are used to simulate potential threat platforms (i.e., something that simulates a real-world threat) or to stimulate the system under test. They are often equipped with one or a combination of the following devices: shapes that reflect acoustic energy, acoustic projectors, and magnetic sources to trigger magnetic detectors.

There is a negligible risk of a collision of a torpedo or target with a marine mammal. Large and/or slow-moving species would be more at risk of being struck than smaller, faster swimmers. Upon review of the Navy's use of torpedoes in training and testing exercises over the past 30 years, there have been no recorded or reported cases of a marine mammal being struck (Navy 2002b). Historically, there has not been a reported torpedo strike of a marine mammal within the Keyport Range site. The execution of the NUWC Keyport ROP when cetaceans are present makes the possibility of a collision between a marine mammal and a torpedo or target even more unlikely. Therefore, there would be no impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat due to vessel, torpedo, or target strikes with implementation of Keyport Alternative 1 within the proposed extended Keyport Range.

Expendable Materials. Activities within the Keyport action area would produce few expendable materials. There would be approximately 76 losses of expendable materials per year over a 3.2-nm^2 (11.0-$km^{2)}$ area, which represents approximately 24 expendables lost per nm^2 or 0.03 per acre. A torpedo may be equipped with a guidance wire or fiber-optic cable, which are negatively buoyant and sink to the sea floor as it pays out behind the vehicle under test. These sink rapidly and settle as a single line. About 40 lbs of guidance wire could be expended with each exercise torpedo. The plastic-jacketed copper guidance wire used for torpedo communication to the launch platform is specified to be approximately 26 ft-lbs (3.6 kg-m) of tensile strength. The Navy previously analyzed the potential for entanglement of torpedo control wires with marine mammals and concluded that the potential for entanglement would not be significant (Navy 2005b). Because the control wire is trailed behind the vehicle and Keyport Range Site activities do not occur when whales are on range, it is unlikely a whale would encounter, much less be entangled, in the wire or fiber-optic cable while it is being paid out. Any wire that is recovered in the process of retrieving any torpedo or range asset such as a tracking array is disposed of on land in accordance with applicable federal and state regulations.

There may be some expended materials that are not recovered and may be encountered by marine mammals (Table 2-3). The primary hazards to marine mammals from expendable materials are entanglement and injury due to ingestion. Major components are recovered to the maximum extent practicable. NUWC Keyport is known for being able to recover test vehicles and other components, providing assistance to the Federal Aviation Administration to locate and recover downed planes, etc. Most marine mammal species feed at the surface or in the water column. Consequently, it is unlikely that marine mammals that occur in the Keyport Action Area would ingest expendable materials because most large materials are recovered and other materials would sink to the bottom. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the Keyport action area would produce few expendable materials and the likelihood of a marine mammal encountering, much less ingesting, expended material is negligible.

All packaging, food wastes, and trash that are generated by the range craft during the course of an exercise are required to be retained on board until return to port where they are properly disposed of in a landfill or recycled. For Keyport and Dabob Bay areas there is a no discharge policy. Grey and black water are stored aboard and pumped at nearby land based stations. Therefore, there would be no impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat due to potential ingestion and entanglement associated with expendable materials under Keyport Alternative 1 within the proposed extended Keyport Range Site.

Hydrocarbon-based Materials. During testing activities, a variety of hydrocarbon or other chemical liquids could be accidentally spilled. In the event of an accidental release of fuel oil or other hazardous substance during range activities, contingency plans developed by the Navy are followed that provide instructions on proper spill notification and response actions (Section 3.6, *Sediments and Water Quality*).

Therefore, impacts to marine mammals from hydrocarbon-based materials would be minimal with implementation of Keyport Alternative 1 and there would be no effect to ESA-listed species or their critical habitat.

Other Potentially Toxic Materials. Various markers, sensors, and other materials are expended during test activities. There is also a potential for loss of normally recoverable equipment. Potential effects include degradation of water and sediment quality from contaminants introduced to the ocean. The materials involved are diverse including lead, copper, aluminum, steel, nylon, various plastics, lithium, zinc, fiberglass, tungsten, and iron.

Lithium, antimony, and other materials contained in expendables are potentially toxic, but the quantities introduced annually into the Keyport Range Site are very small. The quantities involved are low and spread over a large area and do not warrant concern. Copper, lead, and other metals are relatively inert. They are slowly released into water, or are rapidly diluted. Lead and copper become attached to suspended particulates and accumulate in sediments.

Most zinc associated with expendable materials used in the test areas is in the form of zinc alloys and coatings. Zinc corrodes rapidly in sea water and is frequently used in sacrificial anodes and coatings for corrosion protection. Zinc is commonly used on all commercial and recreational vessels for corrosion protection. Average concentrations of zinc in seawater are less than 10 parts per billion. Zinc is effectively immobilized in sediment as organic and sulphide complexes. Exposed zinc corrodes and rapidly dilutes to background concentrations. Because zinc is unpalatable, it is unlikely to be ingested by marine mammals. The addition of zinc to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Copper may be contained in some probes, sonobuoy cable, electronics of sonobuoys, targets and signal devices. Most copper associated with expendable materials is coated copper wire (torpedo guidance wire) and coated electrical circuitry. The plastic coatings are long-lived in the ocean because of the relatively low temperatures and absence of ultra-violet light. Once the copper is exposed, the corrosion rate is about 50 microns per year (Efird 1976). If buried in anoxic sediments, copper will not be oxidized and will not be bioavailable. As with lead, dissolved copper attaches to suspended particulates and accumulates in sediments. The addition of copper to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Lead is very inert and corrodes and dissolves slowly in seawater. Under oxygenated conditions the rate of dissolution is 8 to 30 microns per year. Under anoxic conditions a surface layer of sulphide forms with low solubility inhibiting further corrosion. Sources of lead include some weights, ballast, and batteries. Dissolved lead attaches to suspended particulates and accumulates in sediments. The potential effects of lead, zinc, copper, and other materials on water quality are not expected to be significant (Section 3.6, *Sediments and Water Quality*). Therefore, under Keyport Alternative 1, there would be no impacts to marine mammals and no adverse effects to ESA-listed species or their critical habitat with the release of the small quantities of lead, copper, plastic, or other materials into the proposed extended Keyport Range Site. As more "environmentally-friendly" techniques and substances become technologically feasible and available, the Navy is committed to moving towards the use of new technologies on a routine basis.

ESA-Listed Species and Associated Critical Habitat. Based on the above analysis of potential impacts to marine mammals from non-acoustic activities, implementation of Keyport Alternative 1 would have no effects on ESA-listed marine mammals and would not adversely modify designated critical habitat for the Southern Resident killer whale. The NMFS draft BO concludes that adverse effects on ESA-listed marine mammals are unlikely to occur.

No-Action Alternative

Acoustic Impacts

Current activities within the existing Keyport Range Site involve the use of a variety of acoustic sources including UUV payload and side-scan sonars above 100 kHz; range tracking, torpedoes, and range targets in the 5 to 100 kHz range; and target simulators and sub-bottom profilers at approximately 5 kHz (Table 1-2). A large variation of frequency and output levels and directionality have been modeled and listed in Appendix C. This appendix will be used to determine if future projects proposed for the NAVSEA NUWC Keyport Range Complex fall within the parameters of acoustic systems that have been analyzed in this EIS/OEIS.

Eight types of sonars were selected for investigation that cover a variety of frequencies and output levels (Table 3.5-6). Based on the current annual usage of representative acoustic sources within the existing Keyport Range Site, there would be no Level A (PTS) of any species, and no Level B exposures of any cetaceans due to the use of acoustic sources associated with NUWC Keyport activities within the existing Keyport Range Site (Table 3.5-10).

As a result of acoustic effects associated with the use of active acoustic sources at the existing Keyport Range Site, implementation of the No-Action Alternative may result in incidental Level B behavioral and TTS harassment of relatively small numbers of harbor seals per year. No serious injury or mortality of any marine mammal species is reasonably foreseeable. No adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

The potential for behavioral (Level B) harassment would be reduced by implementation of the lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as described in the ROP discussed in Sections 1.3.4 and 2.3.4. In particular, in accordance with Section 6-4 of the NUWC Keyport ROP, active acoustic activities would be halted or delayed if cetaceans (i.e., whales, dolphins, and porpoises) were observed on the range site, and there is a 100-yd (91-m) exclusion zone for pinnipeds. The small space and ability to conduct shore-to-shore surveillance of the range site affords the operators and the public an opportunity to see and report any cetaceans in the area.

Table 3.5-10 Annual MMPA Exposures for Keyport Range No-Action Alternative[1]

Species[2]		*Level B* *Risk Function* *(Sub TTS Behavioral)*	*Level B* *TTS*	*Level A* *PTS*
CETACEANS				
Minke whale		0	0	0
Humpback whale		0	0	0
Gray whale		0	0	0
Killer whale	Transient	0	0	0
	S Resident	0	0	0
Dall’s porpoise		0	0	0
PINNIPEDS				
Harbor seal		55	6	0
California sea lion		0	0	0
Steller sea lion		0	0	0

1. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.

Under the No-Action Alternative, current activities would continue within the existing boundaries of the Keyport Range Site. Impacts of increased NUWC Keyport activities within the existing Keyport Range site were analyzed in the previous analysis of Keyport Range Alternative 1. Since there were no significant impacts to marine mammal species under Keyport Alternative 1 with the proposed range extension and an increase in activities, there would be no adverse impacts to marine mammal species under the No-Action Alternative.

ESA-Listed Species. Since there were no effects to ESA-listed marine mammals from proposed active acoustic sources under Keyport Alternative 1 with the proposed range extension and an increase in activities, there would be no effects to ESA-listed marine mammals under the No-Action Alternative. The NMFS draft BO concludes that adverse effects on ESA-listed marine mammals are unlikely to occur at the Keyport site.

Non-Acoustic Impacts

All other non-acoustic impacts would be the same as those previously discussed under Keyport Alternative 1. Therefore, there would be no adverse impacts to marine mammals with implementation of the No-Action Alternative within the Keyport Range Site.

ESA-Listed Species and Associated Critical Habitat. Since there were no effects to ESA-listed marine mammals from non-acoustic activities under Keyport Alternative 1 with the proposed range extension and an increase in activities, there would be no effects to ESA-listed species under the No-Action Alternative. The NMFS draft BO concludes that adverse effects on ESA-listed marine mammals are unlikely to occur.

3.5.6.3 Mitigation Measures

The draft NMFS BO did not identify adverse effects that would be likely to occur for ESA-listed marine mammals. To the extent practicable, NUWC Keyport will comply with any reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

Proposed Measures

To maximize the ability of Navy personnel to recognize instances when marine mammals are in the vicinity the following procedures will be implemented:

1. General Maritime Protective Measures: Personnel Training
    a. All lookouts onboard platforms involved in range events will have reviewed NMFS approved Marine Species Awareness Training (MSAT) material prior to use of MFA/HFA sonar.
    b. Navy lookouts will undertake extensive training in order to qualify as a lookout.
    c. Lookouts will be trained in the most effective means to ensure quick and effective communication with the command structure in order to facilitate implementation of protective measures if marine species are spotted.
2. General Maritime Protective Measures: Lookout Responsibilities
    a. There will always be at least one person on watch whose duties include observing the water surface around the vessel or platform.
    b. Personnel on lookout will have at least one set of binoculars available to aid in the detection of marine mammals.

   c. After sunset and prior to sunrise, lookouts will employ night lookout techniques.

3. Operating Procedures

   a. Craft personnel will make use of marine species detection information to limit interaction with marine species to the maximum extent possible consistent with safety of the craft.

   b. All personnel engaged in passive acoustic sonar operation will monitor for marine mammal vocalizations and report the detection of any marine mammal to the Range Officer for dissemination and appropriate action.

   c. During MFA/HFA operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.

   d. Safety Zones – When cetaceans are detected by any means within 1,000 yards of the intended track of the test vehicle, the transmissions will be terminated. For all range sites the sources are either on or off; there is no capability to reduce source levels.

   e. Prior to start-up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

4. Coordination and Reporting

   a. Navy will coordinate with the local NMFS Stranding Coordinator regarding any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with a test event.

<u>LOA-Required Measures</u>

Mitigation measures and monitoring and reporting were specified in NMFS Proposed Rule (2009a) to issue the LOA for the proposed activities on the Keyport Range Complex. Following Navy and public review of the Proposed Rule, NMFS is preparing a Final Rule which will contain the mitigation measures and monitoring and reporting as required by the MMPA. Keyport will comply with these requirements to the extent practicable.

3.5.7 DBRC Site

3.5.7.1 Existing Conditions

Five cetaceans and three pinnipeds are known to occur or potentially occur within the DBRC action area (Table 3.5-11 and refer to Appendix D). The general ecology and natural history for each of these species was previously presented in Section 3.5.6, *Keyport Range Site* . ESA-listed species are discussed separately at the end of this section; there is no designated or proposed critical habitat for marine mammals within the DBRC action area.

<u>Non ESA-Listed Species</u>

Minke Whale. Groups of up to three minke whales often approach coastal areas and frequently enter bays, inlets and estuaries where they prey on small fish. Although population estimates do not exist, a few dozen, possibly resident minke whales have been studied in the San Juan Islands. The minke whale population in the Greater Puget Sound region (approximately 30 individuals) peaks between July and September; they are rarely seen during the winter (Osborne et al. 1988; Dorsey et al. 1990). They appear to have strong site-fidelity to that area and it is probably rare for any members of this population to wander south into Hood Canal (Osborne et al. 1988). They have not been recorded within the DBRC action area and are expected to be very rare within Hood Canal, with a density estimate of zero (Appendix D).

Gray Whale. Gray whales are regularly seen in Puget Sound in very small numbers at all times of the year (Osborne et al. 1988), suggesting that some of these animals may not undertake an annual migration. A small group of gray whales (approximately 10 individuals) has been regularly sighted in northern Puget Sound around Whidbey Island/Hood Canal and occasionally in southern and central Puget Sound (Calambokidis and Baird 1994; Calambokidis et al. 1994; Calambokidis and Quan 1997). At least one historical gray whale record exists for Hood Canal (Calambokidis et al. 1992). Gray whales may enter the DBRC on very rare occasions. The density of gray whales in the DBRC Action Area is estimated to be zero (Appendix D).

Table 3.5-11 Marine Mammals Known to Occur or Potentially Occurring within the DBRC Action Area

Species		Status ESA/MMPA	Occurrence in DBRC Action Area	Density Estimate (km^2) Warm Season	Cold Season
CETACEANS					
Mysticetes					
Minke whale		-/-	Very rare, year-round; has not been recorded in action area.	0[(a)]	0[(a)]
Humpback whale		E/D	Very rare, warm season migrant; has not been recorded in action area.	0[(a)]	0[(a)]
Gray whale		-/-	Very rare, spring/fall migrant and summer/fall resident population in primarily northern Puget Sound.	0[(a)]	0[(a)]
Odontocetes					
Killer whale	Transient	-/-	Uncommon, spring/summer.	Jan-Jun: 0.038	Jul-Dec: 0
	S Resident	E/D	Very rare; no recorded occurrences in Hood Canal.	0[(a)]	0[(a)]
Dall's porpoise		-/-	Very rare, year-round.	0	0
PINNIPEDS					
Harbor seal		-/-	Common year-round resident.	1.31	1.31
California sea lion		-/-	Common resident and seasonal migrant.	0	Aug-Apr: 0.052
Steller sea lion		T/D	Very rare, cold season; has not been recorded in action area.	0[(a)]	0[(a)]

Notes: D = Depleted, E = Endangered, CH = Critical Habitat, T = Threatened.
Warm season = May-October, Cold season = November-April;
abundant = the species is expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; **common** = the species is expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; **uncommon** = the species is expected to be encountered at most a few times a year assuming many visits to the area; **rare** = the species is not expected to be encountered more than once in several years; **very rare** = not expected to be encountered more than once in 10 years.
[(a)]These species have not typically been recorded or observed in the action area. The densities for the action area are shown as "0" to reflect this.
Sources: Refer to Appendix C for sources of densities and occurrence estimates.

Dall's Porpoise. Dall's porpoise are expected to be very rare within the DBRC and Hood Canal, with a density estimate of zero (Appendix D).

Killer Whale. Resident killer whales have not been observed in Dabob Bay, but transient pods were observed in Hood Canal for lengthy periods of time in 2003 (January-March) and 2005 (February-June), feeding on harbor seals (London 2006). The offshore population has been recorded only a very few times in Puget Sound and is very unlikely to occur in the DBRC or vicinity.

Transients form small pods of two to four animals and feed on marine mammals such as seals, sea lions, and porpoises, but also sea turtles, sea birds, and sea and river otters (Baird and Dill 1995, 1996; Ford et al. 1998; Baird and Whitehead 2000; Saulitis et al. 2000). About 225 individual transient killer whales range throughout the coastal waters of Washington, British Columbia, and southeast Alaska (Ford and Ellis 1999) and their distributions are not predictable and can be seen anywhere at anytime (Laskeek Bay Conservation Society 2003, DFOC 2003). Although about one-third of all known transient killer whales have been detected in Washington State, the number of transient killer whales present in Washington's waters at any one time is likely fewer than 20 individuals (Wiles 2004).

Transients are uncommon visitors to Hood Canal. In 2003 and 2005, small groups of transient killer whales (6 – 11 individuals per event) visited Hood Canal to feed on harbor seals and remained in the area for significant periods of time (59 – 172 days) between the months of January and July. Based on this data, the density for Transient killer whales in the DBRC Action Area for January to June is 0.038/km^2. These whales used the entire expanse of Hood Canal for feeding. Subsequent aerial surveys suggest that there has not been a sharp decline in the local seal population from these sustained feeding events (London 2006).

The home range of resident killer whales is relatively small during the summer and fall, while transients travel more widely, moving up and down the coast and passing through areas inhabited by different resident pods. Residents live in large pods of 6 to 50 animals and prey mostly on fish, in particular, salmon (Ford et al. 1998; Saulitis et al. 2000; Center for Whale Research 2004). Resident killer whales are sometimes seen in winter, but leave for months at a time during winter months. A few members of the Northern Resident population have been seen in Washington waters, but these animals are generally confined to northern Vancouver Island and further north and have not been recorded within DBRC or Hood Canal. The Southern Resident population is listed as endangered and is discussed below under the *ESA-Listed Species* subsection.

Harbor Seal. Harbor seals occur throughout Hood Canal, and harbor seals are common in the DBRC action area. They spend much of their time hauled-out on beaches, rocks, mudflats, man-made structures, and islets. They are year-round, non-migratory residents in the DBRC and give birth (pup) there. Surveys in Hood Canal from the mid-1970s to 2000 show a fairly stable population of between about 600-1,200 seals (Jeffries et al. 2003). As described in Appendix D, the density for harbor seals in the DBRC Action Area is 1.31/km^2. In 2003 and 2005, small groups of transient killer whales (6-11 individuals per event) visited Hood Canal to feed on harbor seals and remained in the area for significant periods of time (59 – 172 days) between the months of January and July. These whales used the entire expanse of Hood Canal for feeding. Subsequent aerial surveys suggest that there has not been a sharp decline in the local seal population from these sustained feeding events (London 2006).

In Hood Canal, there are 13 harbor seal haulouts recognized in the stock assessments by NOAA are located within 3 mi (5 km) of the existing or proposed extension of the DBRC (Figure 3.5-8). Most of the key haulouts are at estuaries of main rivers that flow into Hood Canal. During previous surveys, four haulouts within 1 mi (1.6 km) of the DBRC action area were being used at times by 100 to 500 seals. These haulouts are in Quilcene Bay along the Bolton Peninsula, at the Dosewallips River estuary, at the Duckabush River estuary, and at the Hamma Hamma River estuary (Jefferies et al. 2000). Harbor seals commonly haulout in many opportune areas.

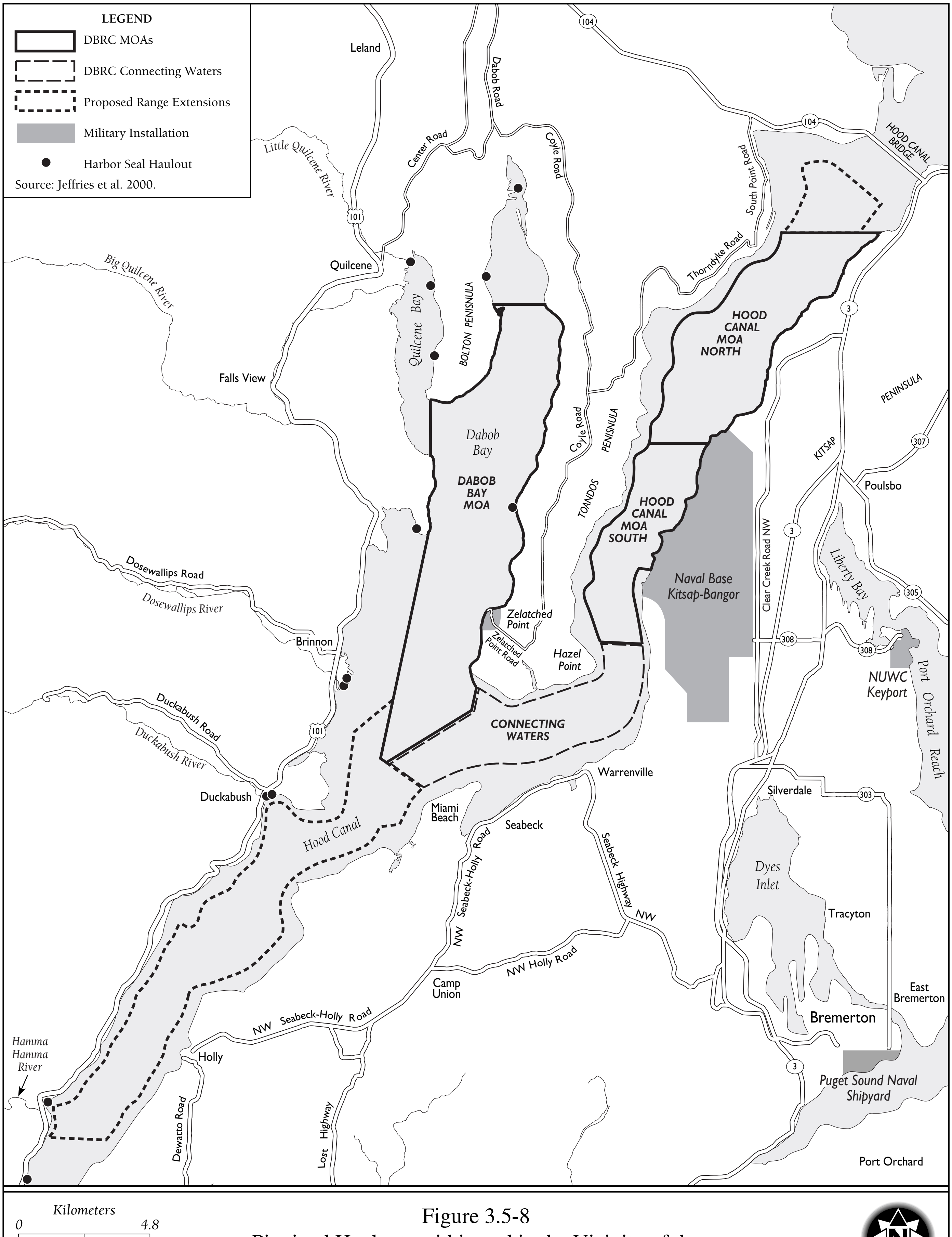


Figure 3.5-8
Pinniped Haulouts within and in the Vicinity of the Existing DBRC Action Area

California Sea Lion. California sea lions move north into the Puget Sound area during fall from their breeding colonies in Mexico and California, and most return south by late winter or spring. Peak abundance in Puget Sound is between September and May. More than 1,000 California sea lions have been counted in Puget Sound during surveys in recent years. While in Puget Sound, groups of California sea lions haul out on a variety of sites including offshore rocks and islands, jetties, log booms, docks and navigation markers or raft together on the surface of the water. Although there are no regular California sea lion haulouts within Hood Canal (Jeffries et al. 2000), they may haulout at several opportune areas. They are expected to be common visitors to the DBRC action area. As described in Appendix D, the density of California sea lions in the DBRC Action Area is 0.052/km2 from August to April.

ESA-Listed Species

Humpback Whale. Humpback whales formerly were regular, common species in the inland waters of Washington but at present are very rarely seen. Sightings of humpbacks in the Strait of Georgia and Puget Sound remained infrequent through the late 1990s and a total of 13 individuals were identified in 2003 and 2004 (Falcone et al. 2005). Humpback whales have not been recorded within the DBRC action area. They are expected to be very rare visitors to the area, with a density estimate of zero (Appendix D).

Killer whale. The Southern Resident Population spends much of its time in the region north of the DBRC action area, especially near the San Juan Islands, and in southern British Columbia near the mouth of the Fraser River and the southern end of Vancouver Island. Although NMFS has designated over 2,500 mi^2 (6,475.0 km^2) within Puget Sound as critical habitat for Southern Resident killer whales, the entire area of Hood Canal was not included in the designation. There have been no confirmed sightings of Southern Resident killer whales within Hood Canal (NMFS 2006a). Therefore their density is estimated to be zero (Appendix D).

Note: Transient Killer Whales are uncommon visitors to Hood Canal. In 2003 and 2005, small groups of transient killer whales (6 – 11 individuals per event) visited Hood Canal to feed on harbor seals and remained in the area for significant periods of time (59 – 172 days) between the months of January and July. These whales used the entire expanse of Hood Canal for feeding. However, the Transient Killer Whale Population is not and ESA-Listed Species.

Steller Sea Lion. Steller sea lions have not been recorded within the DBRC action area (Jeffries et al. 2000) and their density is estimated to be zero for the DBRC action area for all months (Appendix D).

3.5.7.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension Only)

Acoustic Impacts

Estimated marine mammal densities for those species expected to occur within DBRC were obtained from scientific literature (Table 3.5-11). Using these animal densities and the expected acoustic model exposure volumes from the types of acoustic sources and annual level of use, the number of potential exposures per species per acoustic source was calculated.

Future activities within the proposed extended DBRC Site would involve the use of a variety of acoustic sources including UUV payload and side-scan sonars above 100 kHz; range tracking, torpedoes, range targets, and dipping sonars in the 2 to 100 kHz range; and target simulators and sub-bottom profilers at approximately 5 kHz (Table 1-2). For the acoustic analysis (Appendix C), eight representative acoustic sources were selected for marine mammal acoustic effects analysis. The proposed number of activities of each acoustic source would not change from current annual use within the existing DBRC Site. Activities in the proposed extended DBRC Site are not expected to increase the temporal use of any of the acoustic sources used in DBRC, only the spatial extent of the use of sources will be affected with the utilization of the proposed extended range area.

Table 3.5-12 shows the annual MMPA exposures for the species associated with the DBRC Site. Based on this annual usage of representative acoustic sources within the proposed extended DBRC Site, there would be no Level A (PTS) exposures of any species, and no Level B exposures of any cetaceans due to the use of acoustic sources associated with NUWC Keyport activities within the DBRC action area.

The potential for behavioral (Level B) harassment would be further avoided by implementation of the lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance described in the ROP in Sections 1.3.4 and 2.3.4. In particular, the cessation of all active acoustic source activities when cetaceans are detected in the range area would eliminate the potential for exposures of cetaceans. Range activities were halted during the last visit to Hood Canal by transient killer whales in 2005. Sounds from these killer whales were recorded and provided to the public, scientists, and schools for educational purposes.

Table 3.5-12 Annual MMPA Exposures for DBRC Alternative 1[1]

Species[2]		*Level B Risk Function (Sub TTS Behavioral)*	*Level B TTS*	*Level A PTS*
CETACEANS				
Minke whale		0	0	0
Humpback whale		0	0	0
Gray whale		0	0	0
Killer whale	Transient	0	0	0
	S Resident	0	0	0
Dall's porpoise		0	0	0
PINNIPEDS				
Harbor seal		3285	1963	0
California sea lion		108	0	0
Steller sea lion		0	0	0

1. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.

As a result of acoustic effects associated with the use of active acoustic sources in the existing DBRC and proposed southern range extension, implementation of DBRC Alternative 1 may result in incidental Level B (Behavioral) harassment of harbor seals and California sea lions and Level B (TTS) harassment of harbor seals. California sea lions are very common animals that occur in abundance. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. No serious injury or mortality of any marine mammal species is reasonably foreseeable. Based on the relatively low intensity of sonar sources and their limited use (less than 1,570 hours annually for all range sites), the relatively small number of takes in relation to the stock sizes of affected species, and the absence of specific areas of reproductive importance to harbor seals, California sea lions, or other marine mammals in the action area, no adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

ESA-Listed Species. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 1 would have no effect on ESA-listed marine mammals.

Aircraft. In addition to the acoustic sources discussed above, helicopters would be used during range activities in the DBRC action area. This section addresses possible harassment of marine mammals by helicopter noise that has propagated from the source through the air, across the air-sea interface, and into the water. The discussion comes largely from the *EA/Overseas EA of Parametric Airborne Dipping Sonar Helicopter Flight Demonstration Test Program* (Navy 2000).

Very few data are available on the reactions of marine mammals to helicopters hovering at low altitude. The high noise level at the surface below the helicopter and the extended duration of exposure are expected to result in stronger responses by marine mammals than to over-flights of aircraft at higher altitude.

Except when aircraft fly at low altitude, most toothed whales do not appear to react to aircraft over-flights. Beaked whales and pygmy and dwarf sperm whales appear to react more strongly to helicopter over-flights than do dolphins or sperm whales. Whales that do react dive hastily, turn, or swim away from the flight path. Feeding or socializing cetaceans are less likely to react than those otherwise engaged (Richardson et al. 1995).

There are direct measurements of H-60 series helicopter noise in water as determined in Navy tests (Navy 2000). During these tests, an H-60 flew over calibrated sonobuoys (receiver depth 400 ft [122 m]) at altitudes ranging from 246 to 4,291 ft (75 to 1,308 m). Results showed a spectrum dominated by low-frequency energy with total intensity level of about 100 dB re 1 µPa-m.

Propagation of acoustic energy from air into water is a much-studied problem and can be reliably modeled using a number of techniques (Navy 2000). Starting with the measured intensity level in water and the aircraft altitude at the time, models yield source levels for the helicopter of about 150 dB re 1 µPa @ 1 m. This source level is consistent with measured helicopter radiated noise levels in air. Based on these measurements, intensity levels were modeled using various helicopter altitudes and water depths. Table 3.5-13 shows the received underwater noise levels generated by an H-60 hovering at altitudes of 50 and 250 ft (15 and 76 m). Received levels were calculated for points directly below the aircraft. A water depth of 3.2 ft (1.0 m) was used as a conservative value to simulate the depth of a marine animal just under the surface.

Table 3.5-13 Helicopter Noise in Water: Sound Pressure Levels (dB re 1 µPa)

Altitude	*Source Level (at 1 m)*	*Depth = 1 m*	*Depth = 122 m*
15 m	150 dB	130 dB	100 dB
76 m	150 dB	119 dB	100 dB

Source: Navy 2000.

The maximum in each case is for the level at the surface (labeled here as 3 ft [1 m]). For a helicopter at an altitude of 49 ft (15 m), the estimated noise level directly below the aircraft is 130 dB. The level is lower for receiving points farther away from the source (in depth and/or in range) (Navy 2000). For a maximum 130-dB intensity level in water, total energy level in water is bounded by

$$\text{EFDL (dB re 1 } \mu\text{Pa}^2 \cdot \text{s)} \leq 130 + 10 \log T$$

where T is exposure time in sec. It is apparent that an animal would have to be exposed for a very long time period ($10^{6.5}$ sec, or about 880 hours) to accumulate enough energy to approach the cetacean TTS threshold of 195 dB. However, it is unlikely that exposure time for any given animal could exceed an hour (given hover time and animal motion).

There are no published reports of pinniped responses to aircraft noise when they are below the water's surface and receive sound there. Pinnipeds in open water often dive when overflown by an aircraft at low altitude. However, these reactions appear to be short term. In the proposed extended DBRC Site, reactions by pinnipeds in the water to helicopter overflights are expected to be infrequent, of brief duration, and with minimal impacts on individual animals. In accordance with the ROP, aircraft (helicopter and fixed-wing) associated with range activities within DBRC would maintain a minimum elevation of 1,000 ft (305 m) over land and, correspondingly, over any pinniped haulout sites. Therefore, there would no effect to marine mammals due to the use of helicopters with implementation of Alternative 1 within the proposed extended DBRC.

Non-Acoustic Impacts

LIDAR. LIDAR is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship, or diffuse objects such as a smoke plume or cloud. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, LIDAR that is designed to penetrate water uses light in the blue-green part of the spectrum as it attenuates the least. Common civilian uses of LIDAR in the ocean include seabed mapping and fish detection. There are three generic types of LIDAR:

- Range finders: used to measure the distance from the LIDAR instrument to a solid target.
- Differential Absorption LIDAR (DIAL): used to measure chemical concentrations in the air.
- Doppler LIDARs: used to measure the velocity of an object.

Because the human eye is more sensitive to laser radiation than either the cetacean or pinniped eye, LIDARs that currently meet human laser safety standards are expected to have no harmful effect on the eyes of marine mammals (Zorn et al. 1998). In addition, the likelihood that a LIDAR's beam would directly contact a marine mammal eye is considered extremely remote given the movement of marine mammals underwater and at the surface. Therefore, there would be no impacts to marine mammals due to the use of LIDAR with implementation of DBRC Alternative 1 within the proposed DBRC Site southern range extension.

Inert Mine Hunting and Inert Mine Clearance Exercises. Associated with testing, a series of target inert-mine shapes are set out in a uniform or random pattern to test the detection, classification and localization capability of the system under test. They are made from plastic, metal, and concrete and vary in shape. For example, an inert-mine shape can measure about 10 by 1.75 ft (3.0 by 0.5 m) and weigh about 800 lbs (362.0 kg). Inert-mine shapes either sit on the bottom or are tethered by an anchor to the bottom at various depths. Inert-mine shapes can be placed approximately 200 – 300 yards (183 – 274 m) apart using a support craft and remain on the bottom until they need to be removed. For example a concrete clump can be put on the bottom. It may be initially identified as a possible inert mine, but as the sensor becomes more sophisticated it will mark the clump as a false target and move on to locate other more probable inert-mine shapes. All major components of all inert-mine systems used as 'targets' for inert-mine hunting systems are removed within 2 years after use.

The potential for direct physical contact between a marine mammal and an inert-mine shape is extremely low given the low probability of occurrence of a marine mammal in the area and the negligible probability that a marine mammal would collide with an inert mine shape. It is expected that any marine mammal encountering an inert-mine shape would simply avoid it much as it would avoid a rocky outcrop along the sea floor. Therefore, there would be minimal impacts to marine mammals and no takes under MMPA due to the placement and use of inert-mine shapes with implementation of DBRC Alternative 1 within the existing DBRC and proposed southern extension. Therefore, there is little potential for this to cause adverse impacts on marine mammals and the impacts are considered to be minimal.

UUVs. There are two types of UUVs proposed for use within the DBRC action area: swimmers and crawlers. Swimmer UUVs are self-powered, submersible vehicles 2 – 32 ft (0.6-9.8 m) long, controlled by an onboard navigation system. Swimmers are typically placed into and retrieved from the water with a crane located at the NUWC Keyport pier. Crawler UUVs are self-powered underwater vehicles designed to operate on land, in the surf zone, or in very shallow water. They can measure about 2.5 ft (0.8 m) long and weigh about 90 pounds (40.8 kg). They move along the bottom on tracks. Crawlers have many of the same capabilities as swimmers, but operate along the bottom or in waters too shallow for swimmers.

The chance of a collision between a UUV and a marine mammal is considered extremely remote for the reasons discussed below under *Vessels and Torpedoes*. Observations for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. Due to the ability to conduct shore-to-shore and ship-to-shore surveillance and daily boat traffic in the area, it is highly unlikely that a cetacean could enter the DBRC action area without being detected. In addition to the 100-yd (91.4-m) exclusion zone for pinnipeds, pinnipeds are smaller and more maneuverable than cetaceans and are not expected to be susceptible to a collision with a UUV.

Some UUVs communicate with a surface vessel, shore-based, or pier-based facility with a 0.01 inch (254-micron) diameter fiber-optic cable. The cable is made of very fine glass and is very brittle. Due to the extremely small diameter of the fiber-optic cable, if a marine mammal would encounter the cable it would most likely break immediately and there would be no risk of entanglement. Therefore, there would be no adverse impacts to marine mammals and no takes under MMPA due to the use of UUVs under DBRC Alternative 1 within the extended DBRC Range Site.

Vessels, Torpedoes, and Targets. NUWC Keyport has policies and procedures within the ROP to reduce the potential for collisions with marine mammals at the surface or underwater (Sections 1.3.4 and 2.3.4). Observations for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. For cetaceans the exclusion zones must be as least as large as the area in which the test vehicle may operate in and must extend at least 1,000 yards (914 m) from the intended track of the test vehicle. For pinnipeds, the exclusion zone extends out 100 yards (91 m) from the intended track of the test vehicle. The exclusion zones for cetaceans and pinnipeds are established prior to an in-water exercise (NUWC Keyport 2004c). In addition, NMFS recommends that vessels not intentionally approach within 100 yards (91 m) of marine mammals. Naval vessels and aircraft, including all helicopters, under the control of NUWC Keyport shall comply with this recommendation. Vessels are expected to implement actions, where feasible, to avoid interactions with marine mammals, including maneuvering away from the marine mammal or slowing the vessel. Due to the ability to conduct shore-to-shore and ship-to-shore surveillance and daily boat traffic in the area, it is unlikely that a whale could enter the DBRC action area undetected. However, during reduced visibility conditions (i.e., fog, high sea state, darkness) detecting marine mammals requires more diligence. Historically there has not been a reported vessel strike of a marine mammal within the DBRC action area including periods of reduced visibility. A collision between a vessel and a marine mammal is considered extremely unlikely.

It is possible, but highly unlikely, that a marine mammal could be struck by a submarine while it is under water. When traveling on the surface, the chances of a strike are probably much the same as for any vessel of the same size moving at the same speed. Smaller animals like pinnipeds and porpoises are expected to be able to detect and avoid boats and ships. The greatest risk is from baleen whales (e.g., minke, humpback) which generally do not occur within the DBRC action area. The potential for a ship strike would be reduced with implementation of the lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as described in the ROP discussed in Sections 1.3.4 and 2.3.4. Therefore, there would be minimal impacts to marine mammals and no takes under MMPA with the use of submarines in the proposed southern range extension under DBRC Alternative 1.

Targets are used to simulate potential threat platforms (i.e., something that simulates a real-world threat) or to stimulate the system under test. They are often equipped with one or a combination of the following devices: shapes that reflect acoustic energy, acoustic projectors, and magnetic sources to trigger magnetic detectors.

There is a negligible risk of a collision of a torpedo or a target with a marine mammal. Large and/or slow-moving species would be more at risk of being struck than smaller, faster swimmers. Upon review of the Navy's use of torpedoes in training and testing exercises over the past 30 years, there have been no recorded or reported cases of a marine mammal being struck (Navy 2002b). Historically there has not been a reported torpedo strike of a marine mammal within the DBRC Site. The implementation of NUWC Keyport ROP when cetaceans are present make the possibility of a collision between a marine mammal and a torpedo even more unlikely. Therefore, there would be minimal impacts to marine mammals and no takes under MMPA due to vessel, torpedo, or target strikes with implementation of DBRC Alternative 1 within the existing DBRC and the proposed southern range extension.

During an air drop of a torpedo, a variety of accessories are also released, all of which consist of materials that are considered to be non-hazardous. Depending on the type of launch craft used, MK 46 Torpedo air launch accessories may consist of a nose cap, suspension bands, air stabilizer (parachute), release wire, and propeller baffle. These accessories could be ingested by or entangle marine mammals. Most pieces vary in size and sink rapidly, but are too small to recover individually. The air stabilizer canopy could billow, potentially posing an entanglement threat to marine mammals that feed on the bottom. With the exception of a highly unlikely encounter of a marine mammal with the air launch accessories as they sink to the bottom, marine mammals would only be vulnerable to potential entanglement or ingestion impacts if their diving or feeding behaviors place them in contact with the sea floor. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the DBRC action area would produce few expendable materials and the likelihood of a marine mammal encountering, much less ingesting, expended material is negligible. Although bottom currents may cause the air stabilizer canopy to billow, potentially causing an entanglement threat to marine mammals along the bottom, the canopy is large and highly visible compared to gill nets and fishing line with which marine mammals are known to become entangled. Although considered highly unlikely, if a marine mammal did encounter an air stabilizer along the sea floor, the animal is expected to avoid it. In addition, after a period of time the air stabilizer would become covered with sediment and would no longer pose an entanglement issue.

A torpedo may be equipped with a guidance wire or fiber-optic cable, which are negatively buoyant and sinks to the sea floor as it pays out behind the vehicle. These sink rapidly and settle as a single line.

About 40 lbs of guidance wire could be expended with each exercise torpedo. The plastic-jacketed copper guidance wire used for torpedo communication to the launch platform is specified to be approximately 26 ft-lbs (3.6 kg-m) of tensile strength. The Navy previously analyzed the potential for entanglement of torpedo control wires with marine mammals and concluded that the potential for entanglement would not be significant (Navy 2005b). Because the control wire is trailed behind the vehicle and DBRC activities do not occur when whales are on range, it is unlikely a whale would be entangled in the wire or fiber-optic cable while it is being paid out. Any wire that is recovered in the process of retrieving any torpedo or range asset such as a tracking array is disposed of on land in accordance with applicable federal and state regulations.

Therefore, the use of torpedoes and associated systems and activities (e.g., launch systems) under the DBRC Alternative 1 would have minimal impacts to marine mammals and would not result in a take under the MMPA.

Expendable Materials. Activities within the DBRC action area would produce few expendable materials. There would be approximately 364 losses of expendable materials per year over a 44.0 nm^2 (150.8 km^2), which represents approximately 8 expendables lost per nm^2 or 0.01 per acre. There may be some parts of torpedo launching accessories and target parts and components that are not recovered and may be encountered by marine mammals. The primary hazards to marine mammals from expendable materials are entanglement and injury due to ingestion. Major components are recovered to the maximum extent practicable. NUWC Keyport is known for being able to recover test and other components, providing assistance to the Federal Aviation Administration to locate and recover downed planes, etc. Most marine mammal species feed at the surface or in the water column. Consequently, it is unlikely that marine mammals would ingest expendable materials because most large materials are recovered and other materials would sink to the bottom. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the DBRC action area would produce few expendable materials and the likelihood of a marine mammal encountering, much less ingesting, expended material is negligible. All packaging, food wastes, and trash that are generated by the range craft during the course of an exercise are required to be retained on board until return to port where they are properly disposed of in a landfill or recycled. Therefore, there would be minimal potential for impacts to marine mammals and no takes under MMPA due to potential ingestion and entanglement associated with expendable materials under DBRC Alternative 1 within the proposed extended DBRC Range Site.

Hydrocarbon-based Materials. During testing activities, a variety of hydrocarbon or other chemical liquids could be accidentally spilled. In the event of an accidental release of fuel oil or other hazardous substance during range activities, contingency plans developed by NUWC Keyport are followed that provide instructions on proper spill notification and response actions (Section 3.6, *Sediments and Water Quality*). Therefore, impacts to marine mammals from hydrocarbon-based materials would be minimal with implementation of DBRC Alternative 1.

Other Potentially Toxic Materials. Various markers, sensors, and other materials are expended during test activities. There is also a potential for loss of normally recoverable equipment. Potential effects include degradation of water and sediment quality from contaminants introduced to the ocean. The materials involved are diverse including lead, copper, aluminum, steel, nylon, various plastics, lithium, zinc, fiberglass, tungsten and iron.

Most zinc associated with expendable materials used in the test areas is in the form of zinc alloys and coatings. Zinc corrodes rapidly in sea water and is frequently used in sacrificial anodes and coatings for corrosion protection. Zinc is commonly used on all commercial and recreational vessels for corrosion protection. Average concentrations of zinc in seawater are less than 10 parts per billion. Zinc is effectively immobilized in sediment as organic and sulphide complexes. Exposed zinc corrodes and rapidly dilutes to background concentrations. Because zinc is unpalatable, it is unlikely to be ingested by marine mammals. The addition of zinc to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Copper may be contained in some probes, sonobuoy cable, electronics of sonobuoys, targets and signal devices. Most copper associated with expendable materials is coated copper wire (torpedo guidance wire) and coated electrical circuitry. The plastic coatings are long-lived in the ocean because of the relatively low temperatures and absence of ultra-violet light. Once the copper is exposed, the corrosion rate is about 50 microns per year (Efird 1976). If buried in anoxic sediments, copper will not be oxidized and will not be bioavailable. As with lead, dissolved copper attaches to suspended particulates and accumulates in sediments. The addition of copper to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Lead is very inert and corrodes and dissolves slowly in seawater. Under oxygenated conditions the rate of dissolution is 8-30 microns per year. Under anoxic conditions a surface layer of sulphide forms with low solubility inhibiting further corrosion. Sources of lead include some weights/ballast, Dissolved lead attaches to suspended particulates and accumulates in sediments. The potential effects of lead, zinc, copper, and other materials on water quality are not expected to be adverse (Section 3.6, *Sediments and Water Quality*). Therefore, under DBRC Alternative 1, there would be minimal impacts to marine mammals with the release of the small quantities of lead, copper, plastic, and other materials into the DBRC Site and proposed southern extension. As more environmentally friendly techniques and substances become technologically feasible and available, the Navy is committed to moving towards the use of new technologies on a routine basis.

<u>ESA-Listed Species</u>. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 1 would have no effect on ESA-listed marine mammals.

<u>DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Acoustic Impacts

The additional area of the proposed northern extension would slightly increase the predicted number of marine mammal Level B TTS and sub-TTS exposures under DBRC Alternative 2 (Table 3.5-14). Table 3.5-14 shows the annual MMPA exposures for the species associated with the DBRC Site Alternative 2. Based on this annual usage of representative acoustic sources within the proposed extended DBRC Site Alternative 2, there would be no Level A (PTS) exposures of any species, and no Level B exposures of any cetaceans due to the use of acoustic sources associated with NUWC Keyport activities within the Keyport action area.

As a result of acoustic effects associated with the use of active acoustic sources in the existing DBRC and proposed southern and northern range extensions, implementation of DBRC Alternative 2 may result in incidental Level B (behavioral) harassment of harbor seals and California sea lions and Level B (TTS) harassment of harbor seals. California sea lions are very common animals that occur in abundance. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. (Table 3.5-14). The potential for behavioral (Level B) harassment would be reduced by implementation of the lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as described in the policies and procedures in the ROP discussed in Section 1.3.4 and 2.3.4. In particular, implementation of the ROP procedure requiring cessation of all active acoustic source activities when cetaceans are detected in the range area would effectively eliminate the potential for exposures of cetaceans.

Table 3.5-14 Annual MMPA Exposures for DBRC Alternative 2[1]

Species[2]		*Level B* *Risk Function* *(Sub TTS Behavioral)*	*Level B* *TTS*	*Level A* *PTS*
CETACEANS				
Minke whale		0	0	0
Humpback whale		0	0	0
Gray whale		0	0	0
Killer whale	Transient	0	0	0
	S Resident	0	0	0
Dall's porpoise		0	0	0
PINNIPEDS				
Harbor seal		3320	1998	0
California sea lion		109	0	0
Steller sea lion		0	0	0

1. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.

No serious injury or mortality of any marine mammal species is reasonably foreseeable. No adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B behavioral harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

ESA-Listed Species. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 2 would have no effect on ESA-listed marine mammals.

Non-Acoustic Impacts

Implementation of Alternative 2 would result in the same effects to marine mammals as previously described under DBRC Alternative 1. The additional area of the proposed northern extension would not increase the potential impacts to marine mammals under DBRC Alternative 2 since the number of yearly activities and density of marine mammals remains the same under both alternatives. Therefore, there would be minimal impacts to marine mammals from non-acoustic activities with implementation of DBRC Alternative 2 within the DBRC Site and proposed northern and southern range extensions.

ESA-Listed Species. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 2 would have no effect on ESA-listed marine mammals.

No-Action Alternative

Acoustic Impacts

As a result of acoustic effects associated with the use of active acoustic sources in the existing DBRC, implementation of the No-Action Alternative Level B (behavioral) harassment of harbor seals and California sea lions and Level B (TTS) harassment of harbor seals. California sea lions are very common animals that occur in abundance. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. (Table 3.5-15). No serious injury or mortality of any marine mammal species is reasonably foreseeable. No adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B behavioral harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

Table 3.5-15 Annual MMPA Exposures for DBRC No-Action Alternative[1]

Species[2]		*Level B* *Risk Function* *(Sub TTS Behavioral)*	*Level B* *TTS*	*Level A* *PTS*
CETACEANS				
Minke whale		0	0	0
Humpback whale		0	0	0
Gray whale		0	0	0
Killer whale	Transient	0	0	0
	S Resident	0	0	0
Dall's porpoise		0	0	0
PINNIPEDS				
Harbor seal		3542	2157	0
California sea lion		115	0	0
Steller sea lion		0	0	0

1. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.

ESA-Listed Species. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 2 would have no effect on ESA-listed marine mammals.

Non-Acoustic Impacts

Implementation of the No-Action Alternative would result in similar effects to marine mammals as previously described under DBRC Alternatives 1 and 2. Therefore, there would be minimal impacts to marine mammals with implementation of the No-Alternative within the existing DBRC Site.

ESA-Listed Species. There are no ESA-listed marine mammals in the DBRC action area. Therefore, implementation of DBRC Alternative 2 would have no effect on ESA-listed marine mammals.

3.5.7.3 Mitigation Measures

The draft NMFS BO did not identify adverse effects that would be likely to occur for ESA-listed marine mammals. To the extent practicable, NUWC Keyport will comply with any reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

Proposed Measures

To maximize the ability of Navy personnel to recognize instances when marine mammals are in the vicinity the following procedures will be implemented:

1. General Maritime Protective Measures: Personnel Training
    a. All lookouts onboard platforms involved in range events will have reviewed NMFS approved Marine Species Awareness Training (MSAT) material prior to use of MFA/HFA sonar.
    b. Navy lookouts will undertake extensive training in order to qualify as a lookout.
    c. Lookouts will be trained in the most effective means to ensure quick and effective communication with the command structure in order to facilitate implementation of protective measures if marine species are spotted.

2. General Maritime Protective Measures: Lookout Responsibilities
    a. There will always be at least one person on watch whose duties include observing the water surface around the vessel or platform.
    b. Personnel on lookout will have at least one set of binoculars available to aid in the detection of marine mammals.
    c. After sunset and prior to sunrise, lookouts will employ night lookout techniques.
3. Operating Procedures
    a. Craft personnel will make use of marine species detection information to limit interaction with marine species to the maximum extent possible consistent with safety of the craft.
    b. All personnel engaged in passive acoustic sonar operation will monitor for marine mammal vocalizations and report the detection of any marine mammal to the Range Officer for dissemination and appropriate action.
    c. During MFA/HFA operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.
    d. Safety Zones – When cetaceans are detected by any means within 1,000 yards of the intended track of the test vehicle, the transmissions will be terminated. For all range sites the sources are either on or off; there is no capability to reduce source levels.
    e. Prior to start-up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.
4. Coordination and Reporting
    a. Navy will coordinate with the local NMFS Stranding Coordinator regarding any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with a test event.

LOA-Required Measures

Mitigation measures and monitoring and reporting were specified in NMFS Proposed Rule (2009a) to issue the LOA for the proposed activities on the Keyport Range Complex. Following Navy and public review of the Proposed Rule, NMFS is preparing a Final Rule which will contain the mitigation measures and monitoring and reporting as required by the MMPA. Keyport will comply with these requirements to the extent practicable.

3.5.8 QUTR Site

3.5.8.1 Existing Conditions

The diversity of marine mammals that occur in QUTR is greater than that in the Puget Sound ranges, with 19 cetaceans, 5 pinnipeds, and 1 mustelid (Table 3.5-16). They include species present all year, species that occur seasonally, and those that merely migrate through the area. It should be noted that survey data from the scientific literature used for the distribution, occurrence, and density estimates of marine mammals in the QUTR action area do not provide an indication as to whether the data were collected within 12 nm (22.2-km) or outside 12 nm of shore. Therefore, it is not possible to differentiate densities of marine mammals within versus outside of the 12-nm (22.2-km) boundary in the discussion and analysis presented in this EIS/OEIS.

Table 3.5-16 Marine Mammals Known to Occur or Potentially Occurring within the QUTR Action Area

Species		*Status* ESA/MMPA*	*Occurrence in QUTR Action Area*	*Density Estimate (km²)* Warm Season	Cold Season
CETACEANS					
Mysticetes					
Blue whale		E/D	Rare, warm season.	0.0003	0
Fin whale		E/D	Rare, year-round.	0.0012	0.0012
Gray whale	Resident	-/-	Uncommon, year-round	0.003	0.003
	Migratory	-/-	Abundant briefly during cold season migrations.	0	See text
Humpback whale		E/D	Uncommon, warm season.	0.0237	0
Minke whale		-/-	Rare, year-round.	0.0004	0.0004
North Pacific right whale		E/D	Very rare, warm season.	0[a]	0[a]
Sei whale		E/D	Very rare, year-round.	0.0002	0.0002
Odontocetes					
Baird's beaked whale		-/-	Uncommon, year-round.	0.0027	0.0027
Hubb's and Stejneger's beaked whale		-/-	Uncommon, year-round	0.0027	0.0027
Dall's porpoise		-/-	Abundant, year-round	0.1718	0.1718
Harbor porpoise		-/-	Abundant, year-round	2.86	2.86
Northern right whale dolphin		-/-	Common, year-round	0.0419	0.0419
Pacific white-sided dolphin		-/-	Abundant, warm season	0.1929	0
Risso's dolphin		-/-	Uncommon, year-round	0.002	0.002
Short-beaked common dolphin		-/-	Uncommon, warm season.	0.0012	0
Striped dolphin		-/-	Very rare, warm season.	0.0002	0
Dwarf & pygmy sperm whales		-/-	Uncommon, warm season.	0.0015	0
Sperm whale		E/D	Uncommon, year-round	0.0011	0.0011
Killer whale (densities for all populations)	N Resident	-/-	Rare, year-round.	0.0028	0.0028
	S Resident	E/D	Rare, year-round.		
	Offshore	-/-	Uncommon, year-round.		
	Transient	-/-	Uncommon, cold season.		
PINNIPEDS					
Phocids					
Harbor seal		-/-	Abundant, year-round.	0.44	0.44
Northern elephant seal		-/-	Uncommon, year-round.	Dec-Feb: 0.019 Mar-Apr: 0.026 May-Jul: 0.038 Aug-Nov: 0.047	
Otariids					
California sea lion		-/-	Common, year-round except May-July	Aug-Apr: 0.283 May-Jul: 0	
Northern fur seal		-/D	Common, year-round.	0.091	0.117
Steller sea lion		T/D	Uncommon, year-round.	0.0096	0.0096
MUSTELIDS					
Sea otter		-/-	Does not presently occur within the action area.	0[a]	0[a]

Notes: Warm season = May-October, Cold season = November-April. *D = depleted, E = endangered, T = threatened.

abundant = expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; **common** = expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; **uncommon** = expected to be encountered at most a few times a year assuming many visits to the area; **rare** = not expected to be encountered more than once in several years; **very rare** = not expected to be encountered more than once in 10 years.

[(a)]These species have not typically been recorded or observed in the action area. The densities for the action area are shown as "0" to reflect this.

Sources: Refer to Appendix D for sources of densities and occurrence estimates.

Non ESA-Listed Species

Gray Whale. The world population of gray whales reached approximately 22,000 in 1994 and was subsequently removed from the U.S. Endangered Species List. By 1997-98, the population had reached a peak of approximately 26,000 individuals (Rugh et al. 1999). The 2001 population estimates for Eastern Pacific gray whale are about 17,000, a marked decline from the peak in 1997-98, suggesting possible food limitation on their summering grounds in the Bering Sea (Moore et al. 2001). The Eastern North Pacific stock is currently estimated at 18,813 (CV=0.07) individuals (Anglis and Outlaw 2007).

The majority of eastern Pacific gray whales pass by the Washington coast twice yearly during their spring-fall migration along the west coast of North America from winter breeding and calving grounds in Baja, Mexico to summer feeding grounds in the Bering and Chukchi seas (Rugh 2003). Gray whales can be found year-round along the Washington coast but are more common during January and March when they are migrating along the coast. An estimated 261-298 individuals are summer residents from April to November at locations along the migration route (e.g., coastal Oregon, Washington, British Columbia) (Darling et al. 1998; Dunham and Duffus 2001, 2002; Calambokidis et al. 2002). These resident gray whales are known to move between the waters of Washington and British Columbia throughout April to November (Calambokidis et al. 2002; Calambokidis 2003). There is some evidence that the number of gray whales utilizing Washington and British Columbia waters during the spring-fall period is increasing, in particular, cow-calf pairs (Personal communication, D. Duffus, University of Victoria Whale Laboratory 2006). Based on this data the year-round density of gray whales in QUTR Action Area is $0.003/km^2$.

Gray whales are primarily shallow-water bottom feeders that ingest benthic invertebrates by straining sediment through their baleen plates. They are the only baleen whales that feed in this manner. In general, gray whales feed little along their migration route or in calving grounds.

Along the outer coast of Washington, most gray whales are likely feeding on mysid crustaceans in shallow water (less than 98 ft [30 m]) that is less than 0.6 mi (1 km) from shore near shallow and exposed reefs and kelp forests and over rocky substrates (Darling et al. 1998; Dunham and Duffus 2001, 2002; Meier 2003). The distribution and abundance of mysids are variable within and between summer feeding seasons; therefore the distribution and abundance of gray whales likely fluctuates with this variability and resident gray whales can be found ranging the Washington coast in potential mysid habitat within 0.3 mi (0.5 km) of the coast (Sumich 1984; Gosho et al. 1999a, b; Megill et al. 1999). Gray whales may also bottom feed in areas with suitable substrate.

During migration, approximately 90 percent of gray whales travel more than 3 mi (5 km) from shore and 40 percent travel greater than 6 mi (10 km) from shore. Gray whales occur further offshore during the southbound migration (3 – 27 mi [5 – 43 km]) than the northbound migration (0.6 – 12 mi [1 – 19 km]), with the widest migration corridor observed along the Washington coast (Green et al. 1992). Migrating gray whales do not spend much time in the area of QUTR and typically pass through in a day or less (NMFS 2006d). As a result, the density of migrants is usually zero.

Calving generally occurs in the shallow, protected waters of lagoons or bays on the Pacific coast of Baja California (Urban et al. 2003).

Gray whales produce broadband signals ranging from 100 Hz to 4 kHz (and up to 12 kHz) (Dahlheim et al. 1984; Jones and Swartz 2002). The most common sounds on the breeding and feeding grounds are knocks (Jones and Swartz 2002), which are broadband pulses from about 100 Hz to 2 kHz and most energy at 327 to 825 Hz (Richardson et al. 1995). The source level for knocks is approximately 142 dB re

1 μPa-m (Cummings et al. 1968). The structure of the gray whale ear is evolved for low-frequency hearing (Ketten 1992). The ability of gray whales to hear frequencies below 2 kHz (as low as 0.8 kHz) has been demonstrated in playback studies (Cummings and Thompson 1971; Dahlheim and Ljungblad 1990; Moore and Clarke 2002) and in their responsiveness to underwater noise associated with oil and gas activities (Malme et al. 1986; Moore and Clarke 2002).

Minke Whale. In the northeast Pacific, minke whales range from Alaska, south to Baja California, and Mexico. Groups consisting of one to three individuals often approach coastal areas and frequently enter bays, inlets, and estuaries where they prey on plankton, squid and fish (herring, cod, sardines, and other small fish). In Washington waters, minke whales appear to establish home ranges (Dorsey et al. 1990) suggesting that minke whales are present year-round. Minke whales have not been abundant in Washington waters and there are no population estimates and little distribution information for this species in Washington (Green et al. 1992; Calambokidis et al. 1997a). During vessel surveys along the Washington and Oregon coasts in 1996 and 2001, two and one minke whales were observed, respectively (Barlow 2003; Appler et al. 2004). Based on the offshore surveys conducted in Washington and Oregon in 2001, the density of minke whales was $0.0004/km^2$. This density is applicable to the QUTR site year round.

Stewart and Leatherwood (1985) suggested that mating occurs in winter or early spring although it had not been observed.

Recordings in the presence of minke whales have included both high-and low-frequency sounds (Beamish and Mitchell 1973; Winn and Perkins 1976; Mellinger et al. 2000). Mellinger et al. (2000) described two basic forms of pulse trains that were attributed to minke whales: a "speed up" pulse train with energy in the 200 to 400 Hz band, with individual pulses lasting 40 to 60 msec, and a less-common "slow-down" pulse train characterized by a decelerating series of pulses with energy in the 250 to 350 Hz band. Recorded vocalizations from minke whales have dominant frequencies of 60 Hz to greater than 12,000 Hz, depending on vocalization type (Richardson et al. 1995). Recorded source levels, depending on vocalization type, range from 151 to 175 dB re 1 μPa-m (Ketten 1998). Gedamke et al. (2001) recorded a complex and stereotyped sound sequence ("star-wars vocalization") in the Southern Hemisphere that spanned a frequency range of 50 Hz to 9.4 kHz. Broadband source levels between 150 and 165 dB re 1 μPa-m were calculated. "Boings," recently confirmed to be produced by minke whales and suggested to be a breeding call, consist of a brief pulse at 1.3 kHz, followed by an amplitude-modulated call with greatest energy at 1.4 kHz, with slight frequency modulation over a duration of 2.5 sec (Rankin and Barlow 2005). While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Striped Dolphin. Striped dolphins occur primarily in offshore warm-temperate, subtropical, and tropical waters, although they may move closer to shore during spring and summer months in southern latitudes. Along the west coast of North America, they tend to occur well offshore (Carretta et al. 2002). Striped dolphins occur in groups of a few to a few thousand individuals with average groups sizes ranging from 100-500. Although striped dolphins have been known to bow-ride, they are generally wary of vessels. The striped dolphin has a varied diet of mid-water fish, squid, and krill; however, approximately a third of its diet is made up of the lanternfish. During ship-based linear transects off the Washington and Oregon coasts from July-November 1996, only one group of three striped dolphins was observed during 2,702 mi (4,348.4 km) of transects. No striped dolphins were observed during 1,947 mi (3,133.3 km) of transects in 2001 (Barlow 2003) or during a similar survey in 2005 (Forney 2007). Barlow (2003) estimated a population size of 64 animals off the entire coast of Oregon and Washington during 1996. Therefore, based on the 1996 data, the density for the QUTR Action Area is 0.0002/km^2 for May to October.

There is no information on the breeding behavior in this area.

Striped dolphin whistles range from 6 to at least 24 kHz, with dominant frequencies ranging from 8 to 12.5 kHz (Richardson et al. 1995). The striped dolphin's range of most sensitive hearing (defined as the frequency range with sensitivities within 10 dB of maximum sensitivity) was determined to be 29 to 123 kHz using standard psycho-acoustic techniques; maximum sensitivity occurred at 64 kHz (Kastelein et al. 2003). Hearing ability became less sensitive below 32 kHz and above 120 kHz (Kastelein et al. 2003).

Short-beaked Common Dolphin . The short-beaked common dolphin is found in coastal and offshore waters along the eastern Pacific coast from Peru to Vancouver Island. They are widely distributed to 300 nm (556 km) offshore (Carretta et al. 2002). Common dolphins are usually found in large groups of hundreds to thousands of individuals and are often associated with other marine mammal species (American Cetacean Society 2004). They feed on squid and small schooling fish.

Barlow (2003) estimated a total population of short-beaked common dolphins present in Oregon and Washington waters during the July–November period at 6,316 during 1996 and 398 during 2001. Therefore, although short-beaked common dolphins can be expected to occur in the QUTR action area, their presence at any given time would be uncommon and the density is 0.0012/km^2 for May to October (Appendix D).

The peak calving season for short beaked common dolphins occurs from spring and early summer (Forney 1994).

Recorded vocalizations include whistles, chirps, barks, and clicks (Ketten 1998). Clicks and whistles have dominant frequency ranges of 23 to 67 kHz and 0.5 to 18 kHz, respectively (Ketten, 1998). Maximum source levels were approximately 180 dB re 1 μPa-m (Fish and Turl 1976). Oswald et al. (2003) found that short-beaked common dolphins in the ETP have whistles with a mean frequency range of 6.3 kHz, mean maximum frequency of 13.6 kHz, and mean duration of 0.8 sec. Popov and Klishin (1998) recorded auditory brainstem responses from a common dolphin. The audiogram was U-shaped with a steeper high-frequency branch. The audiogram bandwidth was up to 128 kHz at a level of 100 dB above the minimum threshold. The minimum thresholds were observed at frequencies of 60 to 70 kHz.

Pacific White-sided Dolphin. Pacific white-sided dolphins are endemic to temperate waters of the North Pacific Ocean and are common both on the high seas and along continental margins in shelf and slope waters (Carretta et al. 2002). From sighting patterns it is suspected that the northern form of the Pacific white-sided dolphins residing along the coast of the continental U.S. migrates north beginning in late spring and summer and spends the colder months off the coast of California (Green et al. 1992; Forney 1994). There is also a movement relative to shore. Pacific white-sided dolphins move close to the southern California shore during the winter and spring, but as they move north they also move farther out to sea during the summer and fall (Leatherwood and Reeves 1978).

Pacific white-sided dolphins hunt primarily at night, preying on herring, salmon, cod, shrimp, capelin, and sardine (Megill and Gray 1996; Heise 1997; Morton 2000) and often occur with other species of cetaceans (Jefferson et al. 1993; Brownell et al. 1999). They are more common in coastal waters during fall and winter and move offshore in spring and summer, in response to the distribution of prey (van Waerebeek 2002). Pacific white-sided dolphins are very inquisitive, gregarious and are known to approach boats (Carwardine 1995) and bowride (Jefferson et al. 1993). Calving occurs during the summer-fall period (Jefferson et al. 1993). They are usually seen in groups from 10-50 but groups up to 1,000 have been observed (Morton 2000).

The abundance along Washington and Oregon in 1992 was estimated to be 23,400 animals (Green et al. 1992); however, more recent estimates are considerably lower: 8,683 in 1996, 10,934 in 2001 (Barlow 2003), and 7,645 in 2005 (Forney 2007). Based on these observations, it is estimated that during the warm months of May to October the density of Pacific white-sided dolphins in the QUTR Action Area is 0.1929/km^2. Pacific white-sided dolphins calving occurs from June through August (Heise 1997).

Vocalizations produced by Pacific white-sided dolphins include whistles and clicks. Whistles are in the frequency range of 2 to 20 Hz (Richardson et al. 1995). Peak frequencies of the pulse trains for echolocation fall between 50 and 80 kHz; the peak amplitude is 170 dB re 1µPa-m (Fahner et al. 2004). Tremel et al. (1998) measured the underwater hearing sensitivity of the Pacific white-sided dolphin from 75 Hz through 150 kHz. The greatest sensitivities were from 4 to 128 kHz, while the lowest measurable sensitivities were 145 dB at 100 Hz and 131 dB at 140 kHz. Below 8 Hz and above 100 kHz, this dolphin's hearing was similar to that of other toothed whales.

Risso's Dolphin. Risso's dolphins are found throughout the world in tropical to warm temperate waters. They are commonly seen in waters off California, Oregon, and Washington (Carretta et al. 2002). The species undergoes seasonal shifts in distribution based on changing water temperatures, moving north and offshore in the summer (Green et al. 1992; Forney and Barlow 1998) and is probably more likely to be observed in Washington waters in years with higher than average water temperatures. Risso's dolphins feed on fish and give birth in December. Recent estimates of Risso's dolphins in Washington and Oregon are 8,187 in 1996, 5,917 in 2001 (Barlow 2003), and 616 in 2005 (Forney 2007). Based on recent survey data (Forney 2007) the density is estimated at 0.002/km^2 for the QUTR Action Area year round.

There is no information on the breeding behavior of Risso's dolphins in this area.

Risso's dolphin vocalizations include broadband clicks, barks, buzzes, grunts, chirps, whistles, and simultaneous whistle and burst-pulse sounds (Corkeron and Van Parijs 2001). The combined whistle and burst pulse sound appears to be unique to Risso's dolphin (Corkeron and Van Parijs 2001). Corkeron and Van Parijs (2001) recorded five different whistle types, ranging in frequency from 4 to 22 kHz. Broadband clicks had a frequency range of 6 to greater than 22 kHz. Low-frequency narrowband grunt vocalizations had a frequency range of 0.4 to 0.8 kHz. A recent study established empirically that Risso's dolphins echolocate; estimated peak-to-peak source levels were up to 216 dB re 1 µPa-m (Philips et al. 2003).

Based on the behavioral responses of a 30-year old Risso's dolphin, the range of hearing in this species was estimated as 1.6-122.9 kHz with maximum sensitivity occurring between 8 and 64 kHz (Nachtigall et al. 1995). A more recent study used neurological responses (auditory evoked potentials) to measure the hearing of an infant Risso's dolphin (Nachtigall et al. 2005). That study revealed that the infant dolphin had greater sensitivity at high frequencies. It was able to hear at sound levels as much as 20dB less than the previously tested adult subject, and exhibited greatest sensitivity between 22.5 kHz and 90 kHz. The infant dolphin was also able to hear sounds at 150 kHz, the highest frequency tested.

Northern Right Whale Dolphin. Northern right whale dolphins are endemic to temperate waters of the North Pacific Ocean and are commonly seen both on the high seas and along continental margins in shelf and slope waters (Carretta et al. 2002). They feed primarily on squid and deep water fish (e.g., lanternfish). From sighting patterns it is suspected that the northern right whale dolphins residing along the coast of the continental U.S. migrate north beginning in late spring and summer and spend the colder months off the coast of California (Green et al. 1992; Forney et al. 1995). The abundance along Washington and Oregon was estimated to be 5,026 in 1996, 10,190 in 2001 (Barlow 2003), and 7,723 in 2005 (Forney 2007). Based on recent survey data (Forney 2007) the density is estimated at 0.0419/km^2 for the QUTR Action Area year round. The majority of the population is expected to occur beyond the 328-ft (100-m) isobath, the remainder would be found inshore.

The calving season is unknown although small calves are seen in winter or early spring (Jefferson et al. 1994).

Clicks with high repetition rates and whistles have been recorded from animals at sea (Fish and Turl 1976; Leatherwood and Walker 1979). Maximum source levels were approximately 170 dB 1 µPa-m (Fish and Turl 1976). There is no published data on the hearing abilities of this species.

Harbor Porpoise . Harbor porpoises are found year-round primarily in the coastal shallow waters of harbors, bays, and river mouths (Green et al. 1992). They eat a variety of fishes, such as herring, mackerel, pollock, small cod, sole, and sardines, as well as squid, octopi and crustaceans. Their seasonal movements appear to be inshore-offshore, rather than north-south, as a response to the abundance and distribution of food resources (Dohl et al. 1983; Barlow 1988). Harbor porpoise are generally not found in water deeper than 100 m, and decline linearly as depth increases (Carretta et al. 2001; Barlow 1988; Angliss and Outlaw 2007). Abundance for each stock was determined based on aerial surveys conducted in 2002 and 2003. The Coastal Stock, from Cape Blanco, Oregon, north to the Cape Flattery, Washington, was estimated at 37,735 animals (Carretta et al. 2007). Abundance and density for subregions of the Coastal Stock were provided by Jeff Laake based on aerial surveys conducted in 2002 (Laake 2007). Density for region "F", which most closely approximates the Quinault area, was calculated by Laake (2007) as 2.86/km^2. Most of those animals are likely within the 328-ft (100-m) isobath during the cold season.

Harbor porpoise calves are born in late spring (Read 1990b; Read and Hohn 1995) and many females are pregnant and lactating simultaneously (Read 1990a; Read and Hohn 1995).

Harbor porpoise vocalizations include clicks and pulses (Ketten 1998), as well as whistle-like signals (Verboom and Kastelein 1995). The dominant frequency range is 110 to 150 kHz, with source levels of 135 to 177 dB re 1 µPa-m (Ketten 1998). Echolocation signals include one or two low-frequency components in the 1.4 to 2.5 kHz range (Verboom and Kastelein 1995). A behavioral audiogram of a harbor porpoise indicated the range of best sensitivity is 8 to 32 kHz at levels between 45 and 50 dB re 1 µPa (Andersen 1970); however, auditory-evoked potential studies showed a much higher frequency of approximately 125 to 130 kHz (Bibikov 1992). The auditory-evoked potential method suggests that the harbor porpoise actually has two frequency ranges of best sensitivity. More recent psycho-acoustic studies found the range of best hearing to be 16 to 140 kHz, with a reduced sensitivity around 64 kHz (Kastelein et al. 2002). Maximum sensitivity occurs between 100 and 140 kHz (Kastelein et al. 2002).

Dall's Porpoise. Dall's porpoise is expected to be one of the most numerous species of marine mammals present in the QUTR action area. The California/Oregon/ Washington stock is currently estimated at 98,617 animals (Carretta et al. 2007). Density of Dall's porpoise in the Olympic Coast-Slope stratum in 2005 (Forney 2007) was estimated at 0.1718/km^2, which is applicable to the QUTR Site year-round.

Only short duration pulsed sounds have been recorded for Dall's porpoise (Houck and Jefferson 1999); this species apparently does not whistle often (Richardson et al. 1995). Dall's porpoises produce short-duration (50 to 1,500 µs), high-frequency, narrow band clicks, with peak energies between 120 and 160 kHz (Jefferson 1988). There are no published data on the hearing ability of this species.

Beaked Whales. Cuvier's, Baird's, Hubb's, and Stejneger's beaked whales may all be present in very low numbers in the QUTR action area. Very few studies of beaked whales have been conducted and little is known of their biology and most information has come from stranded individuals and whaling records (Willis and Baird 1998). Beaked whales are usually found in deep waters (greater than or equal to 3,281 ft [1,000 m]) (and hence outside 12 nm [22.2 km]), particularly in regions with submarine escarpments and seamounts (Kasuya and Ohsumi 1984) where they feed upon squid and deepwater fishes. Jefferson et al. (1993) report that in addition to areas of deepwater near seamounts, beaked whales may also be seen close to shore where deep water approaches the coast. There is some evidence that beaked whales may be more vulnerable to low-to-high-frequency anthropogenic noise than other cetaceans due to their inability to flee the noise source when feeding within a canyon (Jepson et al. 2003).

Baird's beaked whales are the most commonly seen beaked whale in their range as they travel in schools from a few to several dozen and are relatively large and gregarious. They are migratory and occupy continental slope waters during summer and fall months when water temperatures are higher (Kasuya 1986). Baird's beaked whales have been seen or caught off Washington between April and October and they were frequently seen by whalers off the west coast of Vancouver Island from May through October, with their peak occurrence being in August (Balcomb 1989). During aerial and ship board surveys conducted during 1989-90, 5 sightings totaling 21 Baird's beaked whales were made in Oregon (Green et al. 1992), and during more recent shipboard surveys, three sightings totaling five whales were made in 1996, 2 sightings totaling 6 whales were made in 2001 (Barlow 2003), and 3 sightings were made in 2005 (Forney 2007). Based on the 2005 survey data (Forney 2007) the density for Baird's beaked whales is estimated at $0.0027/km^2$ for the QUTR Action Area year round. Refer to Appendix D for discussion of the other species of beaked whales (Hubb's beaked whale and Stejinger's beaked whale) in the action area.

There is no information regarding the reproductive behavior of beaked whales in this area.

MacLeod (1999) suggested that beaked whales use frequencies of between 300 Hz and 129 kHz for echolocation, and between 2 and 10 kHz, and possibly up to 16 kHz, for social communication. Rankin and Barlow (2007) reported on the vocalizations of Blaineville's beaked whales in Hawaii that included four mid frequency sounds: a frequency-modulated whistle and three frequency and amplitude modulated pulsed sounds within the range of 6 and 16 kHz. Vocalizations recorded from two juvenile Hubb's beaked whales consisted of low and high frequency click trains ranging in frequency from 300 Hz to 80 kHz and whistles with a frequency range of 2.6 to 10.7 kHz and duration of 156 to 450 msec (Lynn and Reiss 1992; Marten 2000).

Recent information on the hearing abilities of beaked whales (Blaineville's, Cuvier's and Gervais' beaked whales) show that they are most sensitive from 40 to 80 kHz with an overall range of 5 to 80 kHz (Cook et al. 2006).

Dwarf Sperm and Pygmy Sperm W hales. Dwarf and pygmy sperm whales are found in tropical and warm-temperate waters worldwide. They are often confused with each other and often considered together as members of the same genus, *Kogia*. They prefer deep water and feed over the continental shelf where they feed on small fish, deep-sea shrimps, and squid. They are rarely observed at sea and little is known of their biology. The most recent stock estimate for the California/Oregon/Washington stock of *Kogia* sp. was 247 (Carretta et al. 2007). There was one sighting of *Kogia* offshore Oregon/Washington in 1996, no sightings in 2001 (Barlow 2003) and no sightings in 2005 (Forney 2007). Density of *Kogia* was estimated as $0.0015/km^2$ based on surveys conducted in 1996 (Barlow 2003); this estimate is applicable to the QUTR Site from May-October. According to densities derived from the 1996 survey, up to eight dwarf and pygmy sperm whales could be expected in the expanded QUTR action area during some years and, based on the 2001 data, none in other years. The majority of those animals would be found in offshore waters and are uncommon during warm years.

There is no information on the breeding behavior of *Kogia* in this area.

There is limited information available on *Kogia* vocalizations or hearing capabilities. Pygmy sperm whale clicks range from 60 to 200 kHz, with a dominant frequency of 120 kHz (Richardson et al. 1995). An auditory brainstem response study indicates that pygmy sperm whales have their best hearing between 90 and 150 kHz (Ridgway and Carder 2001).

Killer Whale. Based on morphology, ecology, genetics, and behavior there are three types of killer whales in Washington waters: offshore, transients, and residents (Northern and Southern) (Baird et al. 1992; Hoelzel et al. 1998; Baird 2001a; Yurk et al. 2002). The Eastern North Pacific Southern Resident stock feeds primarily on fish, and ranges from the inland waters of Washington and southern British Columbia to near shore waters as far north as the Queen Charlotte Islands of British Columbia and south to at least central California (Wiles 2004). The latest published NMFS count of the three pods in the Southern Resident Stock is 91 (Carretta et al. 2007). Southern resident pods are present in the inland waters of Washington primarily in summer (May-November), with occurrence centered in Georgia Basin and Haro Strait, although they do make excursions to the outer coast of sufficient duration to enter the QUTR Site. In fall, occurrence may shift to Puget Sound as residents take advantage of returning chum and Chinook salmon (Wiles 2004). In fall, they also occur more frequently on the outer coast. The Eastern North Pacific Northern Resident stock also feeds on fish, but its range is primarily the inland waters of British Columbia. This stock, which numbers approximately 16 pods, will occasionally venture into the Strait of Juan de Fuca and offshore of the Olympic Peninsula of Washington (Wiles 2004). The Eastern North Pacific Offshore Stock is found year-round ranging from offshore California north to offshore Washington and occasionally British Columbia, and also apparently feeds primarily on fish. The current stock estimate is 466 animals; 211 have been photo-identified (Carretta et al. 2007). The West Coast Transient stock ranges year-round from Alaska to California, and feeds primarily on other marine mammals. The minimum estimate based on photo ID for that population is 314.

Density for killer whales in the OCNMS stratum (Forney 2007) was estimated at $0.0028/km^2$, which is applicable year-round for the QUTR Site; this density does not differentiate between killer whale stocks (i.e., likely includes killer whales from more than one stock). Based on ship-based transect observations and calculated densities, it is estimated that 14 killer whales are likely to occur in the expanded QUTR action area. The majority of these animals are likely to be members of the Offshore population; lesser numbers of Transients are expected to occur in the QUTR action area, and then only during winter.

Harbor Seal. Harbor seals are typically seen in small groups resting on tidal reefs, boulders, and sandbars. They also can forage at the mouths of freshwater rivers and streams and occasionally travel several hundred kilometers upstream. They have a diverse diet consisting of fish, octopi and squid and move up river mouths to follow salmon runs (Baird 2001b). Unlike sea lions, harbor seals do not congregate in rookeries, but breed throughout most of their range.

Harbor seals are present in coastal Washington waters all year long and are the only pinniped that breeds in coastal and inland Washington waters (Huber et al. 2001). Females give birth in spring and summer. The timing of pupping varies throughout the state with pupping along the coast in mid-June and in the coastal estuaries in early June (Huber et al. 2001). Their molting season occurs between spring and autumn when they spend more time hauled out of the water. Harbor seals are generally non-migratory with local movements associated with biophysical factors such as tides, weather, season, food availability, and reproduction (Bigg 1981; Frost et al. 1996; Swain et al. 1996). Individuals show strong site-fidelity to haulout sites (Pitcher and McAllister 1981; Baird 2001b). During late autumn and winter, seals can be at sea continuously for several weeks to regain weight lost during the mating and molting seasons.

Harbor seals are the most abundant marine mammal in Washington waters. The most recent estimate for the Oregon/Washington Coastal stock, based on counts of hauled out seals including pups and conducted in 1999, was 24,732 (Carretta et al. 2007). Most animals are recorded over shelf waters less than 656 ft (200.0 m) deep and 66 percent of sightings are found 3-12 mi (4.8-19.3 km) from the coast (Bonnell et al. 1992; Laake et al. 1998). The coastal stock is composed of seals in Oregon, the Columbia River, the Washington coastal estuaries of Grays Harbor and Willapa Bay, and the outer Olympic Peninsula coast (Huber et al. 2001).

Although no harbor seal haulouts are located within the QUTR action area, a few haulouts are close enough such that individuals from these sites could at times be present in the area (Figure 3.5-9) (Jeffries et al. 2000). Harbor seals commonly haulout of the water in many opportune areas. Harbor seals regularly occupy Destruction Island, Sea Lion Rock, the Split Rock area consisting of numerous rocky islets, and are intermittently observed at Flat Rock (between Split Rock and Cape Elizabeth) with up to 100 individuals at each site; a haulout is also in the intertidal reef areas off Cape Elizabeth where 100-500 individuals could be present.

The 1999 count of harbor seals along the outer Olympic Peninsula region alone was 7,117 (Jeffries et al. 2003) which, when adjusted by a correction factor of 1.53 (from Huber et al. 2001) to account for seals in the water (and not counted), provides an estimate for that region of 10,889. Therefore, the density of harbor seals year-round in the waters of the QUTR Site was estimated as $0.44/km^2$; this density is applicable to nearshore (<50 km) areas only, and would, therefore, apply only to the nearshore portion, which is approximately 52 percent, of the QUTR extension area. Large groups of seals also haulout in Grays Harbor on low-relief islands and mudflats in the North Bay, East Bay, and Sand Island areas, as well as on the south side of the main channel (Bonnell et al. 1992; Jeffries et al. 2000).

Northern Fur Seal. The northern fur seal is endemic to the north Pacific. Breeding sites are located in the Pribilof Islands (up to 70 percent of the world population) and Bogoslof Island in the Bering Sea, Kuril and Commander Islands in the northwest Pacific, and San Miguel Island in the southern California Bight. Abundance of the Eastern Pacific Stock has been decreasing at the Pribilof Islands since the 1940s although increasing on Bogoslof Island. The stock is currently estimated to number 721,935 (NMFS 2006f). The San Miguel Island stock is much smaller, estimated at 7,784 (Carretta et al. 2007); this stock is believed to remain predominantly offshore California year-round.

Males are present in the Pribilof Island rookeries from around mid-May until August; females are present in the rookeries from mid-June to late-October. Nearly all fur seals from the Pribilof Island rookeries are foraging at sea from fall through late spring. Females and young males migrate through the Gulf of Alaska and feed primarily off the coasts of British Columbia, Washington, Oregon and California before migrating north again to the rookeries (Ream et al. 2005); there were several northern fur seal sightings in the OCNMS region during June 2005 vessel surveys. Immature males and females may remain in southern foraging areas year-round until they are old enough to mate (NMFS 2006a). Adult males migrate only as far south as the Gulf of Alaska or to the west off the Kuril Islands. Therefore, adult female (November-April) and all non-adult fur seals (year-round) can potentially be found offshore Washington depending on the time of year.

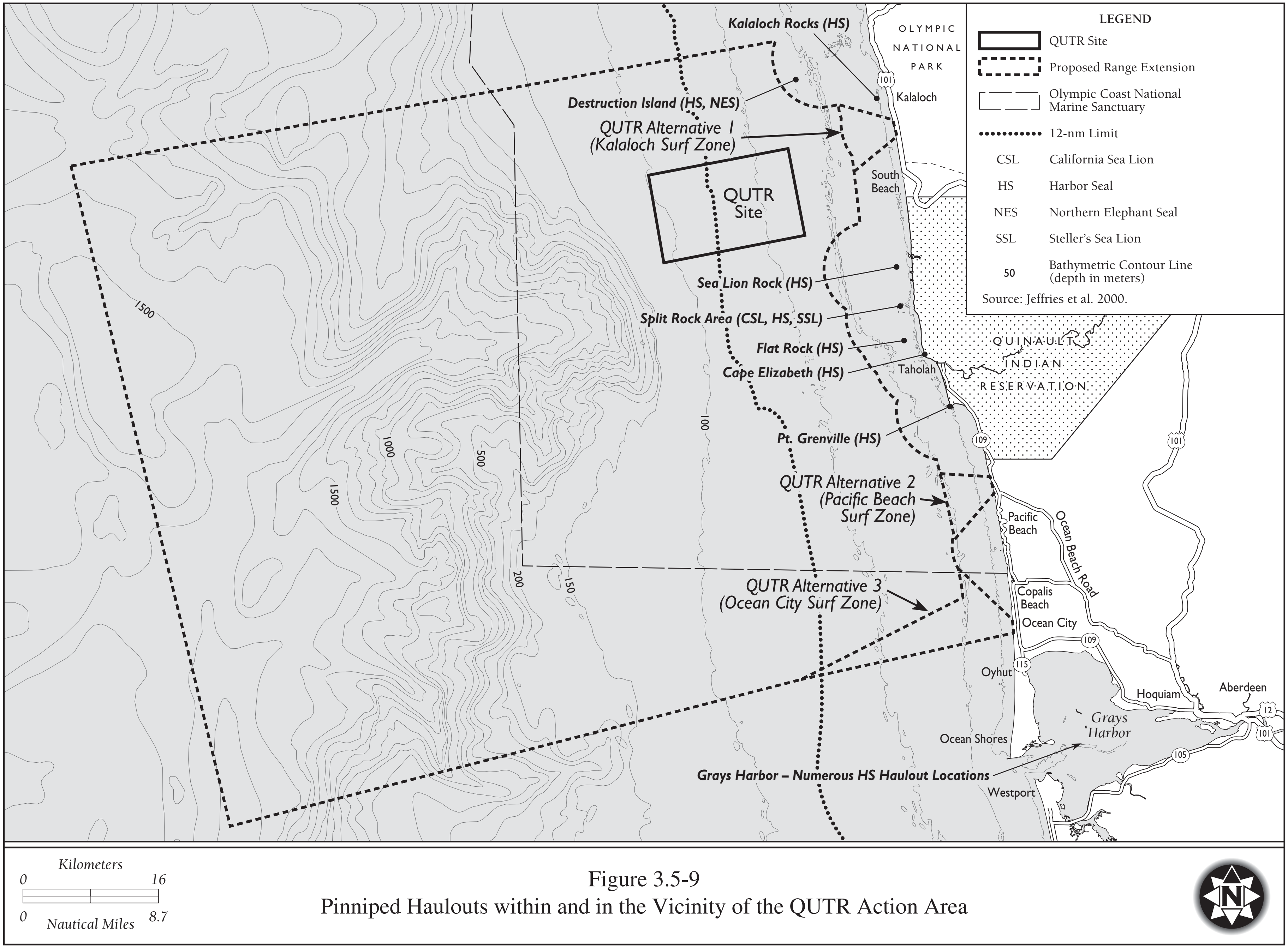


Figure 3.5-9
Pinniped Haulouts within and in the Vicinity of the QUTR Action Area

To determine the number of fur seals in this area from November-May, adult females plus non-breeding immature males and females from the Eastern North Pacific Stock (711,957; NMFS 2006f) were added to the entire stock from San Miguel Island (7,784; Carretta et al. 2007) for a total of 719,741. Density was then calculated as 719,741 fur seals/6,165,000 km^2, or 0.117/km^2 , which is applicable for the QUTR Site for November-May.

To determine density for the rest of the year (June-October) when only immature non-breeding fur seals would be present (adult breeding seals would be returning to the rookeries), the same geographic area was used. Number of animals was adjusted to remove adult females (162,786) which, when subtracted from the total determined above (719,741) results in 559,149 fur seals. Density of immature fur seals from June-October was 559,149/6,165,000 km^2 or 0.091/km^2, which is applicable for the QUTR Site.

The northern fur seal pupping and mating season begins in June and continues through July at breeding sites in Alaska, Southern California and Russia (Gentry 2002).

Northern fur seals produce underwater clicks, and in-air bleating, barking, coughing, and roaring sounds (Schusterman 1978; Richardson et al. 1995). Males vocalize (roar) almost continuously at rookeries (Gentry 1998). In-air and underwater audiograms are available for the northern fur seal. The underwater hearing range of the northern fur seal ranges from 0.5 Hz to 40 kHz (Moore and Schusterman, 1987; Babushina et al. 1991); the threshold is 50 to 60 dB re 1 µPa (Moore and Schusterman 1987). The underwater hearing threshold is 90 to 100 dB re 1 µPa at 1 kHz; best underwater hearing occurs between 4 and 17 to 28 kHz (Moore and Schusterman 1987; Babushina et al. 1991). The underwater hearing sensitivity of this species is 15 to 20 dB better than in the air (Babushina et al. 1991). The maximum sensitivity in air is at 3 to 5 kHz (Babushina et al. 1991), after which there is an anomalous hearing loss at around 4 or 5 kHz (Moore and Schusterman 1987; Babushina 1999).

Northern Elephant Seal. The California stock of elephant seals breeds at rookeries located along the California coast; breeding season is December through February (Reeves et al. 2002). The most recent population estimate (2001) was 101,000 animals and was based primarily on pup counts (Carretta et al. 2007). Except during breeding season and annual molt, elephant seals remain largely at-sea and rarely haulout for long periods of time. Adult male elephant seals migrate north via the California current to the Gulf of Alaska during foraging trips, and could potentially be passing through the area offshore Washington in May and August (migrating to and from molting periods) and November and February (migrating to and from breeding periods), but likely their presence there is transient and short-lived. Elephant seals seen at Washington State haulouts have been mostly solitary adult males (Jeffries et al. 2000); known haulouts are along the outer coast and the Strait of Juan de Fuca. Adult females and juveniles forage in the California current offshore California to British Columbia (LeBoeuf et al. 1986, 2000). Pups remain onshore for up to 3 months after birth before they venture offshore. Females and juveniles return to rookeries and haulouts to molt from March through July.

During the breeding period (December-February), offshore occurrence would be limited to immature (non-breeding) seals which is estimated at 37,630 immature seals. Density for December-February was calculated as 37,630 seals/2,032,000 km^2, or 0.019/km^2 and applies to the entire QUTR Site. In March-April, offshore occurrence would include adult females and juveniles minus the number of animals expected to not be foraging offshore due to molting, for a total of 53,180 and a calculated density of 0.026/km^2. From May-July, offshore occurrence would include adult females, juveniles, and pups of the year minus the number of animals expected to not be foraging offshore due to molting for a total of 76,256 and a calculated density of 0.038/km^2. In August-November, offshore occurrence would include all elephant seals except adult males, and there is no molting taking place so the estimated abundance offshore would be 95,320. Therefore, density in the QUTR Site in August-November would be 0.047/km^2. For a detailed explanation of these calculations, see Appendix D.

Northern elephant seals haul out on land to give birth and breed in California and Mexico from December through March, and pups remain hauled out through April.

The mean fundamental frequencies of airborne vocalizations are in the range of 147 to 334 Hz for adult males (Le Boeuf and Petrinovich 1974). The mean source level of the male-produced vocalizations during the breeding season is 110 dB re 20 µPa (Sanvito and Galimberti 2003). The mean fundamental frequency of airborne calls by adult females is 500 to 1,000 Hz (Bartholomew and Collias 1962). In-air sounds produced by females include a <0.7 kHz belch roar used in aggressive situations and a 0.5 to 1 kHz bark used to attract the pup (Bartholomew and Collias 1962). As noted by Kastak and Schusterman (1999), evidence for underwater sound production by this species is scant. Burgess et al. (1998) detected possible vocalizations in the form of click trains that resembled those used by males for communication in air.

California Sea Lion. The U.S. stock of California sea lions breeds in the Channel Islands in the southern California Bight. The population is currently estimated at 237,000 to 244,000, based on pup counts conducted in 2001 (Carretta et al. 2007). There are two additional stocks of California sea lions; one breeds on islands off the west coast of Baja California, while the other breeds on islands in the Gulf of California. There is some mixing between all three stocks during the non-breeding season, although the extent is unknown. Pupping and breeding occur from May-July. Females generally do not migrate as far north as males, remaining closer to the rookeries. Adult male California sea lions will migrate north after the breeding season (August-April) to near shore waters of Washington, Oregon and British Columbia, and a few immature males will remain in northern feeding areas year-round. Jeffries et al. (2000) identified 46 haulout locations used by California sea lions along the Washington/southern British Columbia coast and inland waterways. Most haulouts were in southern Puget Sound, with two large (100-500 animals each) haulouts located along the outer coast in the Split Rock area. California sea lions feed near the mainland coast and around seamounts; in Washington, males position themselves near river and stream mouths to take advantage of fish migrations.

As with other pinniped species, geographic area and number of animals need to be identified to determine density (Appendix D). Geographic area was approximated from the 14 Washington Coast haulout regions delineated by Jeffries et al. (2000) in the Atlas of Pinniped Haulout Sites and was estimated as ~17,650 km^2. California sea lions do not use haulouts in all 14 of the regions, however, they would be traversing many of the areas during migration or foraging. Jeffries et al. (2000) estimated that peak numbers of 3,000 to 5,000 California sea lions migrate into northwest numbers from fall until late spring. Density, therefore, was estimated as 5,000/17,650 km^2, or 0.283/km^2 (Table 3.5-16). This density is applicable only to the very near shore waters of Washington State from August to April.

Sea Otter. S ea otters are protected under the MMPA and are managed by the USFWS. A total of 59 otters from Alaska were translocated to Washington in 1969 (29 otters) and 1970 (30 otters) and the population has slowly increased since these translocations. In 2001, aerial and ground surveys reported 555 otters in Washington waters. Although this is lower than the 1999 survey count of 605 individuals, Jameson and Jeffries (2001) suggest that the overall trend shows a positive growth in the population.

Sea otters occur in groups of up to 100 individuals or "rafts" and usually consist of females and pups or males. The species inhabits shallow, coastal waters usually associated with rocky substrates supporting kelp forests; however, some use sand bottom habitat where kelp is not present (Riedman and Estes 1990; DeMaster et al. 1996). They seldom range more than 0.6-1.2 mi (1.0-1.9 km) from shore and usually forage in depths of 131 ft (40.0 m) or less, primarily on shellfish (sea urchins, abalone, clams, crabs). Most individuals travel between feeding sites and protected resting areas each day and occupy seasonal home ranges of 2-4 mi^2 (5.2-10.4 km^2). Female home ranges can encompass over 10 mi (16.1 km) of coastline while male home ranges are typically between 0.6-1.9 mi (1.0-3.1 km) of coastline (Lance et al. 2004). Habitat use varies seasonally with weather and ocean conditions. Females are usually found in more protected waters and males often use more exposed areas. Mating can occur at any time of year, but peaks in the fall; most births occur in the spring/early summer.

Most of the current sea otter range in Washington is within the OCNMS and extends from Destruction Island to Neah Bay (Lance et al. 2004). Since 1999, the largest concentration of sea otters occurs near Destruction Island, northeast of the proposed QUTR action area. Summer surveys in 2004 and 2005 observed 342 and 307 otters, respectively, near Destruction Island (Jameson and Jeffries 2005). In 1999, two individuals were observed 10 mi (16.1 km) off Grays Harbor, well south of its core Washington range. In 2000, there was an extension of the winter range with 43 sea otters observed near Kalaloch Rocks (Lance et al. 2004), 1 otter was observed near Split Rock during summer 2000 surveys, and 14 otters were observed near Kalaloch Rocks during summer 2005 surveys. It is possible that sea otters will eventually extend southward into the nearshore area east of the proposed QUTR extension; however, the current range of sea otters is presently restricted to north of Destruction Island (Jameson and Jeffries 2005). Therefore, sea otters are not expected to occur within the QUTR action area.

Sea otters breed throughout their range and have two peaks in pupping (January to March and October; USFWS 2003).

In-air mother-pup contact vocalizations have most of their energy at 3 to 5 kHz, but there are higher harmonics (McShane et al. 1995; Richardson et al. 1995). There is no hearing data available for this species (Ketten 1998).

ESA-Listed Species

Humpback Whale. Humpbacks begin migrating in March and April from breeding areas in Hawaii, Mexico, Costa Rica, and Japan to feeding areas in Alaska, British Columbia, and the west coast of the USA. Some whales continue north until they reach feeding grounds in the Bering Strait and the Chuckchi Sea whereas others range along the Washington/Oregon/California coast to feed. Recent photo-identification and genetics research has indicated that whales show strong maternally driven site-fidelity to feeding areas (Baker et al. 1998) and there is little interchange of feeding whales between British Columbia and Washington/Oregon/California aggregations, suggesting that the U.S./Canada border is an approximate geographic boundary between feeding populations (Calambokidis et al. 1996, 2000).

Whales reach Washington in July (Calambokidis 1997; Calambokidis et al.1997b, 2000, 2001), departing in September, and are usually not observed in winter (Green et al. 1992). Most individuals that summer along the Washington/Oregon/California coast spend winters in Central America, mainland Mexico, and Baja California (Calambokidis et al. 2000, 2001).

Although humpback whales are observed along both the shelf and slope, concentrations of humpback whales have been observed in steep slope waters near Grays, Astoria, and Nitinat canyons. Humpback whales appear to be more common in Washington waters late in summer (August-September) and exhibit a north-south seasonal movement pattern (Green et al. 1992).

Humpbacks can be found in all depth zones (shelf, slope, offshore) but most commonly frequent slope waters (Green et al. 1992). Humpback whales eat mostly euphausiids, but are also known to eat large quantities of fish such as herring, anchovies, sardines, cod, and pilchard. A single calf is born every 1-3 years primarily between December and April (Baird 2003).

Although the population of humpback whales in Washington appears to be increasing, it is still much lower than it was before whaling (Gregr et al. 2000; Calambokidis and Barlow 2004). Potential threats to humpbacks include entanglement in fishing gear, ship strikes, and pollution.

No estimates exist for population numbers of humpback whales in coastal Washington waters but are estimated to be in the hundreds (Baird 2003; Barlow 2003) and are only a fraction of the numbers that were found historically (Gregr et al. 2000). From 1999 to 2000, approximately 115 individual whales were identified off southern British Columbia and northern Washington (Baird 2003). The population of humpback whales in California, Oregon, and Washington was estimated to be 1,177 from ship surveys in 1993 and 1996 (Barlow and Taylor 2001) and 850 in 1998 from mark-recapture methods (Calambokidis et al. 2001). Barlow (2003) estimated a population size of 366 humpback whales off the Washington and Oregon coasts during 2001. A subsequent survey in 2005 estimated a population size of 202 (Forney 2007). Therefore, the density estimate for the QUTR Action Area is 0.0237/km^2 for June to October.

North Pacific Right Whale . Whaling records show that right whales in the North Pacific ranged across the entire North Pacific with concentrations in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan. Right whales are thought to calve in coastal waters during the winter months (Carretta et al. 2002); however, the calving grounds of North Pacific right whales remain unknown (Clapham et al. 2004). Although there have been sightings in Baja California and Hawaii (Herman et al. 1980; NMFS 2004c), migratory patterns and locations of calving grounds are unknown and whales probably spend the summer in high latitude feeding grounds and migrate to more temperate waters for the winter (Carretta et al. 2002). In 2006, critical habitat was designated in the Bering Sea and Gulf of Alaska (NMFS 2006e).

Historical distribution from British Columbia whaling data (1785-1913) is likely relevant to the Washington coast as well. Data show that right whales were present in offshore British Columbia waters during the months of April to October, possibly feeding or migrating to or from sub-tropical calving grounds (Reeves et al. 1985; Nichol et al. 2002). Operating mainly in coastal waters of British Columbia, British Columbia whalers only took seven right whales from 1900 to 1951. The last right whale sighting in British Columbia waters was in 1970 by S. Wada while on board a Japanese scoutboat west of the Queen Charlotte Islands (North Pacific Right Whale Recovery Team 2004). There have been only 13 records of right whales off California since 1955 and the last sighting off the Washington coast was in May 1992 when an individual was seen traveling northward from the Quinault submarine canyon (Rowlett et al. 1994). Rice (1974) stated that, due to a lack of sightings of a cow with a calf in the North Pacific since 1900, the stock was essentially extinct. However, in recent years (1997-2000), right whales have been observed during summer months in the southeastern Bering Sea (Tynan 1999; Moore et al. 2000; Tynan et al. 2001; McDonald and Moore 2002). North Pacific right whales are expected to be very rare within the QUTR action area.

The location of calving grounds for the eastern North Pacific population is unknown (Scarff 1986; Clapham et al. 2004; NMFS 2005e). There are no records of newborn or very young calves in the eastern North Pacific, which appears to reflect a true absence of coastal calving grounds, at least within historic times (Scarff 1986).

North Pacific right whale calls are classified into five categories: (1) up; (2) down-up; (3) down; (4) constant; and (5) unclassified (McDonald and Moore 2002). The 'up' call is the predominant type (McDonald and Moore 2002; Mellinger et al. 2004). Typically, the 'up' call is a signal sweeping from about 90 to 150 Hz in 0.7 sec (McDonald and Moore 2002; Wiggins et al. 2004). Right whales commonly produce calls in a series of 10 to 15 calls lasting 5 to 10 min, followed by silence lasting an hour or more. Some individuals do not call for periods of at least four hours (McDonald and Moore 2002).

Morphometric analyses of the inner ear of right whales resulted in an estimated hearing frequency range of approximately 10 Hz to 22 kHz, although the functional range is somewhat smaller (15 Hz to 18 kHz), based on established marine mammal models (Parks et al. 2004). Research by Nowacek et al. (2004) on North Atlantic right whales suggests that received sound levels of only 133 to 148 dB re 1 µPa for the duration of the sound exposure are likely to disrupt feeding behavior; the authors did note, however, that a return to normal behavior within minutes of when the source is turned off would be expected.

Blue Whale. Blue whales usually are found singly or in small groups (average 2.5 individuals). They feed in deep offshore waters primarily on euphausiids, often near the surface but sometimes to considerable depths. Although most blue whales feed in waters off California from May through November and migrate to waters off Mexico where they spend winter and spring, some range as far north as British Columbia (Calambokidis and Barlow 2004). However, recent passive acoustic monitoring indicated that the greatest blue whale call activity in the northeast Pacific occurred during the winter months, suggesting that not all blue whales migrate south during the fall and winter. Density of blue whales was estimated at 0.0003/km^2, based on surveys conducted in 2001 off Oregon and Washington (Barlow 2003). Blue whale numbers seem to be increasing in abundance in Californian waters (Calambokidis and Barlow 2004), and an estimated 101 blue whales occur along the outer Washington and Oregon coasts (Barlow 2003). According to density estimates for this region, approximately one blue whale could occur in the QUTR action area.

The eastern North Pacific stock feeds in waters from California to Alaska in summer and fall and migrates south to the waters of Mexico to Costa Rica in winter (NMFS 2006e) for breeding and to give birth (Mate et al. 1999).

Blue whale vocalizations are long, patterned low-frequency sounds with durations up to 36 sec (Richardson et al., 1995) repeated every 1 to 2 min (Mellinger and Clark 2003). Their frequency range is 12 to 400 Hz, with dominant energy in the infrasonic range at 12 to 25 Hz (Ketten 1998; Mellinger and Clark 2003). Source levels (1 µPa @ 1 m) are up to 188 decibels (dB) re 1 µPa-m (Ketten 1998; McDonald et al., 2001). During the Magellan II Sea Test (at-sea exercises designed to test systems for antisubmarine warfare), off the coast of California in 1994, blue whale vocalization source levels at 17 Hz were estimated in the range of 195 dB re 1 µPa-m (Aburto et al. 1997). A comparison of recordings between November 2003 and November 1964 and 1965 reveals a strong blue whale presence near San Nicolas Island (McDonald et al. 2006). A long-term shift in the frequency of the sound emitted in the blue whale calls is seen; in 2003 the spectral energy peak was 16 Hz, whereas in 1964-65 the energy peak was near 22.5 Hz, illustrating a more than 30 percent shift in call frequency over four decades (McDonald et al. 2006).

Stafford et al. (2005) recorded the highest calling rates when blue whale prey was closest to the surface during its vertical migration. Wiggins et al. (2005) reported the same trend of reduced vocalization during daytime foraging and then an increase in vocalizations at dusk as prey move up into the water column and disperse. Blue whales make seasonal migrations to areas of high productivity to feed and vocalize less in the feeding grounds than during the migration (Burtenshaw et al., 2004). Oleson et al. (2007) reported higher calling rates in shallow diving (<100 ft) whales, while deeper diving whales (> 165 ft) were likely feeding and calling less.

Blue whales continued foraging when exposed to low frequency active (LFA) sonar sound at about 140 dB and changes in vocalizations were inconsistent and therefore could not be correlated to the LFA exposure (Croll et al. 2001).

As with other mysticete sounds, the function of vocalizations produced by blue whales is unknown. Hypothesized functions include: (1) maintenance of inter-individual distance, (2) species and individual recognition, (3) contextual information transmission (e.g., feeding, alarm, courtship), (4) maintenance of social organization (e.g., contact calls between females and offspring), (5) location of topographic features, and (6) location of prey resources (Thompson et al. 1992). Responses to conspecific sounds have been demonstrated in a number of mysticetes (Edds-Walton 1997), and there is no reason to believe that blue whales do not communicate similarly. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing. Although no recent studies have directly measured the sound sensitivity in blue whales, we assume that blue whales are able to receive sound signals in roughly the same frequencies as the signals they produce.

Fin Whale. The fin whale population in the entire North Pacific is well below pre-whaling numbers, although there is some indication that it may be growing. Although typically associated with offshore waters, whalers frequently encountered this species in some of the channels and inlets on the northern coast of British Columbia and sightings have been recorded in the past decade in British Columbia waters (Gregr and Trites 2001). An analysis of whaling records confirmed anecdotal evidence that fin whales once spent extended periods in the coastal waters (Gregr et al. 2000). Fin whales feed on euphausiids, copepods, squid, and small schooling fish (Flinn et al. 2002).

Passive acoustic monitoring of fin whale vocalizations are detected year-round off Oregon and Washington with a concentration of vocal activity between September and February, suggesting that this area may be a winter feeding area (Moore et al. 1998). Animals that winter off California range from California to the Gulf of Alaska during the summer months (Rice 1974). Although the International Whaling Commission considers all fin whales in the North Pacific to be two stocks (Perry et al. 1999), the NMFS recognizes three stocks: 1) Alaska, 2) California/Oregon/Washington, and 3) Hawaii. The estimated population size of the Oregon/Washington stock of fin whales based on ship surveys in 2001 and 2005 was 380-384 individuals (Barlow 2003; Forney 2007). Based on this survey data, the density estimate is 0.0012/km^2 for the QUTR Action Area year round. Fin whales are generally found in small groups (average 3.5 individuals), but larger groups of up to 130 have been observed in California waters.

Reproductive activities for fin whales occur primarily in low latitude areas in the winter (Carretta et al. 2007).

Underwater sounds produced by fin whales are one of the most studied *Balaenoptera* sounds. Fin whales produce calls with the lowest frequency and highest source levels of all cetaceans. Infrasonic (10-200 Hz), pattern sounds have been documented for fin whales (Watkins et al. 1987; Clark and Fristrup 1997; McDonald and Fox 1999). Fin whales can also produce a variety of sounds with a frequency range up to 750 Hz. The long, patterned 15 to 30 Hz vocal sequence is most typically recorded; only males are known to produce these (Croll et al. 2002). The most typical signals are long, patterned sequences of short duration (0.5-2s) infrasonic pulses in the 18-35 Hz range. Estimated source levels are as high as 190 dB (Watkins et al. 1987; Thompson et al. 1992; McDonald et al. 1995). In temperate waters intense bouts of long patterned sounds are very common from fall through spring, but also occur to a lesser extent during the summer in high latitude feeding areas (Clark and Charif 1998). Short sequences of rapid pulses in the 20-70 Hz band are associated with animals in social groups (McDonald et al. 1995). Each pulse lasts on the order of one second and at 20 Hz (Tyack 1999). Particularly in the breeding season, fin whales produce series of pulses in a regularly repeating pattern. These bouts of pulsing may last for longer than one day (Tyack 1999). The seasonality and stereotype of the bouts of patterned sounds suggest that these sounds are male reproductive displays (Watkins et al. 1987), while the individual counter-calling data of McDonald et al. (1995) suggest that the more variable calls are contact calls. Some authors feel there are geographic differences in the frequency, duration and repetition of the pulses (Thompson et al. 1992). As with other mysticete sounds, the function of vocalizations produced by fin whales is unknown. Hypothesized functions include: (1) maintenance of inter-individual distance, (2) species and individual recognition, (3) contextual information transmission (e.g., feeding, alarm, courtship), (4) maintenance of social organization (e.g., contact calls between females and offspring), (5) location of topographic features, and (6) location of prey resources (review by Thompson et al. 1992). Responses to conspecific sounds have been demonstrated in a number of mysticetes, and there is no reason to believe that fin whales do not communicate similarly (Edds-Walton 1997). The low-frequency sounds produced by fin whales have the potential to travel over long distances, and it is possible that long-distance communication occurs in fin whales (Payne and Webb 1971; Edds-Walton 1997). Also, there is speculation that the sounds may function for long-range echolocation of large-scale geographic targets such as seamounts, which might be used for orientation and navigation (Tyack 1999).

The most typical fin whale sound is a 20 Hz infrasonic pulse (actually an frequency modulated (FM) sweep from about 23 to 18 Hz) with durations of about 1 sec and can reach source levels of 184 to 186 dB re 1 μPa (maximum up to 200 dB) (Richardson et al. 1995; Charif et al. 2002). Croll et al. (2002) suggested that these long, patterned vocalizations might function as male breeding displays, much like those that male humpback whales sing. The source depth, or depth of calling fin whales, has been reported to be about 162 ft (Watkins et al., 1987).

Although no studies have directly measured the sound sensitivity of fin whales, we assume that fin whales are able to receive sound signals in roughly the same frequencies as the signals they produce. This suggests fin whales, like other baleen whales are more likely to have their best hearing capacities at low frequencies, including infrasonic frequencies, rather than at mid- to high-frequencies (Ketten 1997).

Sei Whale. Sei whales are found throughout the world's oceans distributed in offshore waters (Carretta et al. 2002). An oceanic species, sei whales are rare in inshore waters of Washington and are most common off the continental shelf. Historical whaling indicated that sei whales fed on copepods, euphausiids, and a variety of fish (Flinn et al 2002). Although sei whales were more abundant in the 1960s and 1970s, they are now rare in California/Oregon/Washington waters (Forney et al. 1995; Barlow 2003). The only stock estimate for U.S. waters is for the eastern north Pacific stock offshore California, Oregon and Washington (Carretta et al. 2007). Sei whales were not seen during vessel surveys conducted off Washington in 1996 2001 or 2005 (Appler et al. 2004; Barlow 2003; Forney 2007); there were two sightings of sei whales offshore south-central Oregon in 2005 (Forney 2007). Density of sei whales for the Oregon/Washington stratum in 2005 was 0.0002/km^2 which is applicable to the QUTR Site year-round. Therefore, sei whales are very rare and it is unlikely that sei whales are present in offshore waters of the QUTR action area.

No breeding areas have been determined but calving is thought to occur from September to March (Rice, 1977).

Sei whale vocalizations have been recorded only on a few occasions. They consist of paired sequences (0.5 to 0.8 sec, separated by 0.4 to 1.0 sec) of 7 to 20 short (4 milliseconds [msec]) frequency modulated sweeps between 1.5 and 3.5 kHz; source level is not known (Richardson et al. 1995). Sei whales in the Antarctic produced broadband "growls" and "whooshes" at frequency of 433 ±192 Hz and source level of

156 ±3.6 dB re 1 µPa at 1 m (McDonald et al. 2005). While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Sperm Whale. Sperm whales are most common off the outer edges of the world's continental shelves around upwelling areas. In the past, sperm whales were heavily exploited by the whaling industry and are now only occasionally observed (Carretta et al. 2002). Male sperm whales are thought to have larger ranges than females (Reeves and Whitehead 1997) and were historically associated with the shelf break; females were uniformly distributed throughout deeper waters. Sperm whales are most common off Washington during spring and summer and are not present during winter (Green et al. 1992). Vessel surveys conducted in 1996 and 2001 offshore Oregon and Washington yielded several sightings, and abundance for the California/Oregon/Washington stock was estimated at 1,233 (Angliss and Outlaw 2007). Density for sperm whales from the Olympic Coast –Slope stratum (Forney 2007) was estimated at 0.0011/km^2, and is applicable on the QUTR Site year-round. Based on these data, it is expected that up to six sperm whales may be present in the QUTR action area.

Calving generally occurs in the summer at lower latitudes and the tropics (Navy 2006a).

Sperm whales produce short-duration (generally less than 3 sec), broadband clicks from about 0.1 to 20 kHz (Weilgart and Whitehead 1997; Goold and Jones 1995). These clicks range in frequency from 100 Hz to 30 kHz, with dominant energy in two bands (2 to 4 kHz and 10 to 16 kHz). Generally, most of the acoustic energy is present at frequencies below 4 kHz, although diffuse energy up to past 20 kHz has been reported (Thode et al. 2002). The source levels can be up to 236 dB re 1 µPa-m (Møhl et al. 2003). Thode et al. (2002) suggested that the acoustic directivity (angular beam pattern) from sperm whales must range between 10 and 30 dB in the 5 to 20 kHz region. The clicks of neonate sperm whales are very different from usual clicks of adults in that they are of low directionality, long duration, and low-frequency (centroid frequency between 300 and 1,700 Hz) with estimated source levels between 140 and 162 dB re 1 µPa-m (Madsen et al., 2003). Clicks are heard most frequently when sperm whales are engaged in diving/foraging behavior (Whitehead and Weilgart, 1991; Miller et al., 2004; Zimmer et al., 2005). These may be echolocation clicks used in feeding, contact calls (for communication), and orientation during dives. When sperm whales are socializing, they tend to repeat series of clicks (codas), which follow a precise rhythm and may last for hours (Watkins and Schevill 1977). Codas are shared between individuals of a social unit and are considered to be primarily for intragroup communication (Weilgart and Whitehead, 1997; Rendell and Whitehead 2004). Sperm whales have been observed to frequently stop echolocating in the presence of underwater pulses made by echosounders and submarine sonar (Watkins and Schevill 1975; Watkins et al. 1985). They also stop vocalizing for brief periods when codas are being produced by other individuals, perhaps because they can hear better when not vocalizing themselves (Goold and Jones 1995).

The anatomy of the sperm whale's ear indicates that it hears high-frequency sounds (Ketten 1992). Anatomical studies also suggest that the sperm whale has some ultrasonic hearing, but at a lower maximum frequency than many other odontocetes (Ketten 1992). The sperm whale may possess better low-frequency hearing than some other odontocetes, although not as extraordinarily low as many baleen whales (Ketten 1992). The only data on the hearing range of sperm whales are evoked potentials from a stranded neonate (Carder and Ridgway 1990). These data suggest that neonatal sperm whales respond to sounds from 2.5-60 kHz. Auditory brainstem response in a neonatal sperm whale indicated highest sensitivity to frequencies between 5 and 20 kHz (Ridgway and Carder 2001).

Southern Resident Killer Whale. The range of the Southern Residents during the spring, summer, and fall includes the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait

(NMFS 2005d). During winter, they have been documented in the coastal waters off the Queen Charlotte Islands and Vancouver Island to the north, Washington, Oregon, and more recently off the coast of central California (NMFS 2006a). Based on ship-based transect observations and calculated densities (Forney 2007), it is estimated that 13-14 killer whales are likely to occur in the expanded QUTR action area. The majority of these animals are likely to be members of the Offshore population; lesser numbers of Transients and only rarely Southern Residents are expected to occur in the QUTR action area, and then only during winter. As stated previously the density ($0.0028/km^2$) does not differentiate between killer whale stocks.

Steller Sea Lion . Steller sea lions are seasonal visitors to Washington and use haulout sites primarily along the outer coast from the Columbia River to Cape Flattery. Haulout sites are found on jetties, offshore rocks, and coastal islands. Breeding rookeries are present in Oregon and British Columbia, but no breeding rookeries are found in Washington. The primary distribution of Steller sea lions at sea is inshore with approximately 90 percent of animals observed over the continental shelf (less than 656 ft [200 m] depth) with a mean distance from shore of 12 mi (19.3 km); however, individuals have been observed as far as 81 mi (130.4 km) offshore (Bonnell et al. 1992). The number of Steller sea lions in Washington varies with season but peaks at about 1,000 animals during the fall and winter months. Four Steller sea lion haulouts with sea lions numbering in the tens to hundreds are located east of the proposed QUTR Site extension on rocks associated with the Split Rock area (Figure 3.5-9) (Jeffries et al. 2000). The population estimate for the eastern U.S. population is 11,971 (See Appendix D). Density, therefore, was estimated as $0.0096/km^2$, which is applicable to the QUTR action area year-round.

3.5.8.2 Environmental Consequences

<u>QUTR Alternative 1 (Kalaloch Surf Zone Access Area)</u>

Acoustic Impacts

Estimated marine mammal densities per unit area for those marine mammal species expected to occur within the QUTR action area were obtained as described in Appendix D and previously in this section (Table 3.5-16). Using these animal densities and the expected acoustic model exposure volumes from the types of acoustic sources and annual level of use, the number of potential exposures per species per acoustic source was calculated (Appendix C). Since the 12-nm (22.2-km) Territorial Waters limit runs through the middle of the existing QUTR Site, the number of current and proposed NUWC Keyport activities within and outside 12 nm (22.2 km) cannot be determined.

Future activities within the proposed extended QUTR Site would involve the use of a variety of acoustic sources including UUV payload and side-scan sonars above 100 kHz; range tracking, torpedoes, range targets, and dipping sonars in the 2 to 100 kHz range; and target simulators and sub-bottom profilers at approximately 5 kHz (Table 1-2). For the acoustic analysis, eight acoustic sources were selected for analysis of various acoustic effects. Under Alternative 1, various categories of activities would increase; for example, test vehicles would increase from 30 to 60.

Based on this annual usage of representative acoustic sources within the proposed extended QUTR Site, there would be no Level A (PTS) exposures of any species due to the use of acoustic sources associated with activities within the proposed extended QUTR Site (Table 3.5-17). Some of the acoustic sources may be used beyond 12 nm (22.2 km) where densities, at least for pinnipeds, are often an order of magnitude lower than those within Territorial Waters. Because the distribution of proposed activities within versus beyond the 12-nm (22.2-km) Territorial Waters boundary is unknown, all of the activities have been modeled for less than or equal to 12 nm (22.2 km) resulting in ‘worst-case’ or conservative estimates of predicted exposures (Table 3.5-17).

Table 3.5-17 Annual MMPA Exposures for all QUTR Alternatives [1]

Species[2]		Level B Risk Function (Sub TTS Behavioral)	Level B TTS	Level A PTS
CETACEANS				
Blue whale		0	0	0
Fin whale		0	0	0
Gray whale	Resident	0	0	0
	Migratory	0	0	0
Humpback whale		0	0	0
Minke whale		0	0	0
North Pacific right whale		0	0	0
Sei whale		0	0	0
Baird's beaked whale		0	0	0
Hubb's and Stejneger's beaked whale		0	0	0
Dall's porpoise		0	0	0
Harbor porpoise		11,282[3]	1	0
Northern right whale dolphin		0	0	0
Pacific white-sided dolphin		0	0	0
Risso's dolphin		0	0	0
Short-beaked common dolphin		0	0	0
Striped dolphin		0	0	0
Dwarf & pygmy sperm whales		0	0	0
Sperm whale		0	0	0
Killer whale	N Resident	0	0	0
	S Resident	0	0	0
	Offshore	0	0	0
	Transient	0	0	0
PINNIPEDS				
Harbor seal		78	23	0
Northern elephant seal		14	0	0
California sea lion		5	0	0
Northern fur seal		44	0	0
Steller sea lion		0	0	0
Sea otter		0	0	0

1. Does not include the No-Action Alternative. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.
3. As described in Section 3.5.2.5, a step function threshold of 120 dB SPL is used to estimate sub-TTS behavioral takes of harbor porpoises.

The potential for Level B (behavioral) harassment would be further avoided by implementation of the ROP including lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as discussed in Sections 1.3.4 and 2.3.4. In particular, all active acoustic activities would be halted when cetaceans are detected on range, eliminating the potential for exposures of cetaceans.

Table 3.5-17 shows the annual MMPA exposures for the species associated with the QUTR Site. Based on the annual usage of representative acoustic sources within the proposed extended QUTR Site, there would be no Level A (PTS) exposures of any species. Implementation of QUTR Alternative 1 may result in incidental Level B (sub-TTS behavioral) harassment of four species of pinnipeds and one cetacean due to the use of acoustic sources associated with NUWC Keyport activities in this area.

There would also be Level B (TTS) exposures of 23 harbor seals and one harbor porpoise. Harbor porpoises are common animals that occur in abundance. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. The potential number of exposures of harbor seals represents a relatively small number of the harbor seals occurring at the site over the course of a year. These exposures are unlikely to have any long term effects on individuals and given the abundance of the species and their frequent association with maritime activities this is not expected to have any effect on harbor seal numbers or distribution. No serious injury or mortality of any marine mammal species is reasonably foreseeable. Based on the relatively low intensity of sonar sources and their limited use (less than 1,570 hours annually for all range sites), the relatively small number of takes in relation to the stock sizes of affected species, and the absence of specific areas of reproductive importance to marine mammals in the action area, no adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed are expected as a result of the estimated incidents of Level B harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

ESA-Listed Species. Based on the above analysis of potential impacts to marine mammals from the proposed use of active acoustic sources in the QUTR action area, implementation of QUTR Alternative 1 would have no effect on ESA-listed marine mammals. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

Non-Acoustic Impacts

LIDAR. LIDAR is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship, or diffuse objects such as a smoke plume or cloud. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, LIDAR that is designed to penetrate water uses light in the blue-green part of the spectrum as it attenuates the least. Typical civilian uses of LIDAR in the ocean include seabed mapping and fish detection. There are three generic types of LIDAR:

- Range finders: used to measure the distance from the LIDAR instrument to a solid target.
- Differential Absorption LIDAR (DIAL): used to measure chemical concentrations in the air.
- Doppler LIDAR: used to measure the velocity of an object.

Because the human eye is more sensitive to laser radiation than either the cetacean or pinniped eye, LIDARs that currently meet human laser safety standards are expected to have no harmful effect on the eyes of marine mammals (Zorn et al. 1998). In addition, the likelihood that a LIDAR's beam would directly contact a marine mammal eye is considered extremely remote given the movement of marine mammals underwater and at the surface. Therefore, there would be no impacts to marine mammals and no takes under MMPA within Territorial Waters and non-Territorial Waters due to the use of LIDAR with implementation of QUTR Alternative 1 within the QUTR Site, proposed range extension, and Kalaloch Beach surf-zone access area.

Inert Mine Hunting and Inert Mine Clearance Exercises. Associated with testing, a series of inert mine shape targets are set out in a uniform or random pattern to test the detection, classification and localization capability of the system under test. They are made from plastic, metal, and concrete and vary in shape. For example, an inert mine shape can measure about 10 by 1.75 ft (3 by 0.5 m) and weigh about 800 lbs (362.9 kg). Inert mine shapes either sit on the bottom or are tethered by an anchor to the bottom at various depths. Inert mine shapes can be placed approximately 200-300 yards (182.8-274.3 m) apart using a support craft and remain on the bottom until they need to be removed. For example a concrete clump can be put on the bottom. It may be initially identified as a possible inert mine, but as the sensor becomes more sophisticated it will mark the clump as a false target and move on to locate other more probable inert mine shapes. All major components of all inert mine systems used as 'targets' for inert mine hunting systems for proposed extended areas are temporary, meaning they will be removed after use or within 2 years.

The potential for direct physical contact between a marine mammal and an inert-mine shape is extremely low given the low probability of occurrence of a marine mammal in the area and the negligible probability that a marine mammal would collide with an inert mine shape. It is expected that any marine mammal encountering an inert mine shape would simply avoid it much as it would avoid a rocky outcrop along the sea floor. Therefore, there would be no impacts to marine mammals, no effects to ESA-listed species, and no takes under MMPA due to the placement and use of inert mine shapes with implementation of QUTR Alternative 1 within the existing QUTR and proposed extension. Therefore, there is little potential for this to cause adverse impacts to marine mammals within Territorial Waters and non-Territorial Waters.

UUVs. There are two types of UUVs proposed for use within the QUTR action area: swimmers and crawlers. Swimmer UUVs are self-powered, submersible vehicles 2-32 ft (0.6-9.8 m) long, controlled by an onboard navigation system. Crawler UUVs are self-powered underwater vehicles designed to operate on land, in the surf zone, or in very shallow water. They are about 2.5 ft (0.8 m) long and weigh about 90 pounds (40.8 kg). They move along the bottom on tracks. Crawlers have many of the same capabilities as swimmers, but operate along the bottom or in waters too shallow for swimmer UUVs.

The chance of a collision between a UUV and a marine mammal is considered extremely remote for the reasons discussed below under *Vessels and Torpedoes*. Observations for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. In addition to the 100-yd (91.4-m) exclusion zone for pinnipeds, pinnipeds are smaller and more maneuverable than cetaceans and are not expected to be susceptible to a collision with a UUV.

Some UUVs communicate with a surface vessel, shore-based, or pier-based facility, for example via a 0.01 inch (254-micron) diameter fiber-optic cable. The cable is made of very fine glass and is very brittle. Due to the extremely small diameter of the fiber-optic cable, if a marine mammal would encounter the cable it would most likely break immediately and there would be no risk of entanglement. Therefore, there would be no impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat within Territorial Waters and non-Territorial Waters with the use of UUVs with implementation of QUTR Alternative 1 (Kalaloch Beach surf-zone access area).

Vessels, Torpedoes, and Targets. NUWC Keyport has procedures in place to reduce the potential for collisions with marine mammals at the surface (Sections 1.3.4 and 2.3.4). Surveys for marine mammals are conducted prior to each test, and tests are postponed if a cetacean is observed within established exclusion zones. For cetaceans the exclusion zones must be as least as large as the area in which the test vehicle may operate in and must extend at least 1,000 yards (914.4 m) from the intended track of the test vehicle. For pinnipeds, the exclusion zone extends out 100 yards (91.4 m) from the intended track of the test vehicle. The exclusion zone for cetaceans and pinnipeds are established prior to an in-water exercise (NUWC Keyport 2004c). In addition, NMFS recommends that vessels not intentionally approach within 100 yards (91 m) of marine mammals. Naval vessels and aircraft, including all helicopters, under the control of NUWC Keyport shall comply with this recommendation. Vessels are expected to implement actions, where feasible, to avoid interactions with marine mammals, including maneuvering away from the marine mammal or slowing the vessel. It is unlikely that a whale could enter the QUTR action area undetected. However, during reduced visibility conditions (i.e., fog, high sea state, darkness) detecting marine mammals requires more diligence. Historically there has not been a reported vessel strike of a marine mammal within the QUTR action area. A collision between a vessel and a marine mammal within Territorial Waters and non-Territorial Waters is considered extremely unlikely.

The main concerns with submarine activities are potential acoustic effects from the use of sonar. The area is guarded to keep the distance between other craft and the submarine whether it is submerged or in clear sight. It is possible, but highly unlikely given the sophisticated sensing equipment aboard a submarine, that a marine mammal could be struck by a submarine while it is under water. When traveling on the surface, the chances of a strike are probably much the same as for any vessel of the same size moving at the same speed. Smaller animals like pinnipeds and porpoises are expected to be able to detect and avoid boats and ships. Active acoustic activities are halted when cetaceans are on range would prevent collisions between cetaceans and all vessels (Sections 1.3.4 and 2.3.4). Therefore, there would be minimal impacts to marine mammals and no effect to ESA-listed species or their critical habitat within Territorial Waters and non-Territorial Waters with the use of submarines with implementation of QUTR Alternative 1 (Kalaloch Beach surf-zone access area).

Targets are used to simulate potential threat platforms (i.e., something that simulates a real-world threat) or to stimulate the system under test. They are often equipped with one or a combination of the following devices: shapes that reflect acoustic energy, acoustic projectors, and magnetic sources to trigger magnetic detectors.

There is a negligible risk of a collision of a torpedo or a target with a marine mammal. Large and/or slow-moving species would be more at risk of being struck than smaller, faster swimmers. Upon review of the Navy's use of torpedoes in training and testing exercises over the past 30 years, there have been no recorded or reported cases of a marine mammal being struck (Navy 2002b). Historically, there has not been a reported torpedo strike of a marine mammal within the QUTR Site. The implementation of NUWC Keyport ROP when cetaceans are present make the possibility of a collision between a marine mammal and a torpedo even more unlikely. Therefore, there would be minimal impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat within Territorial Waters and non-Territorial Waters due to vessel, torpedo, or target strikes with implementation of QUTR Alternative 1 (Kalaloch Beach surf-zone access area).

During an air drop of a torpedo, a variety of accessories are also released, all of which consist of materials that are considered to be non-hazardous. Depending on the type of launch craft used, MK 46 Torpedo air launch accessories may consist of a nose cap, suspension bands, air stabilizer (parachute), release wire, and propeller baffle. These accessories could be ingested by or entangle marine mammals. Most pieces vary in size and sink rapidly, but are too small to recover individually. The air stabilizer canopy could billow, potentially posing an entanglement threat to marine mammals that feed on the bottom. With the exception of a highly unlikely encounter of a marine mammal with the air launch accessories as they sink to the bottom, marine mammals would only be vulnerable to potential entanglement or ingestion impacts if their diving or feeding behaviors place them in contact with the sea floor. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the QUTR action area would produce few expendable materials and the likelihood of a marine mammal encountering, much less ingesting, expended material is negligible. Although bottom currents may cause the air stabilizer canopy to billow potentially causing an entanglement threat to marine mammals along the bottom, the canopy is large and highly visible compared to gill nets and fishing line with which marine mammals are known to become entangled. Although considered highly unlikely, if a marine mammal did encounter an air stabilizer along the sea floor, the animal is expected to avoid it. In addition, after a period of time the air stabilizer would become covered with sediment and would no longer pose an entanglement issue.

A torpedo may be equipped with a guidance wire or fiber-optic cable, which are negatively buoyant and sinks to the sea floor as it pays out behind the vehicle. These sink rapidly and settle as a single line. About 40 lbs of guidance wire could be expended with each exercise torpedo. The plastic-jacketed copper guidance wire used for torpedo communication to the launch platform is specified to be approximately 26 ft-lbs (3.6 kg-m) of tensile strength. The Navy previously analyzed the potential for entanglement of torpedo control wires with marine mammals and concluded that the potential for entanglement would not be significant (Navy 2005b). Because the control wire is trailed behind the vehicle and QUTR activities do not occur when whales are on range, it is unlikely a whale would be entangled in the wire or fiber-optic cable while it is being paid out. Any wire that is recovered in the process of recovering any torpedo or range asset such as a tracking array is disposed of on land in accordance with applicable federal and state regulations.

Therefore, the use of torpedoes and associated systems and activities (e.g., launch systems) under QUTR Alternative 1 would result in minimal impacts to marine mammals, would not result in takes under the MMPA, and there would be no effect to ESA-listed species or their critical habitat.

<u>Expendable Materials</u>. Activities within the QUTR action area would produce little expendable materials. There would be approximately 617 losses of expendable materials per year over a 1,840.4-nm^2 (6,312.4-km^2) area, which represents approximately 0.34 expendables lost per nm^2 or 0.0004 per acre. There may be some parts of targets, torpedo launching accessories, sonobuoys, markers, target parts and components that are not recovered and may be encountered by marine mammals. The primary hazards to marine mammals from expendable materials are entanglement and injury due to ingestion. Major components are recovered to the maximum extent practicable. NUWC Keyport is known for being able to recover test and other components, providing assistance to the Federal Aviation Administration to locate and recover downed planes, etc. Most marine mammal species feed at the surface or in the water column. Consequently, it is unlikely that marine mammals would ingest expendable materials because most large items are recovered and other materials would sink to the bottom. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the QUTR action area would produce few

expendable materials and the likelihood of a marine mammal encountering, much less ingesting, expended material is negligible. Therefore, there would be minimal potential for impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat due to potential ingestion and entanglement associated with expendable materials under QUTR Alternative 1 within the proposed extended QUTR Range Site.

Hydrocarbon-based Materials. During testing activities, a variety of hydrocarbon or other chemical liquids could be accidentally spilled. In the event of an accidental release of fuel oil or other hazardous substance during range activities, contingency plans developed by NUWC Keyport are followed that provide instructions on proper spill notification and response actions (Section 3.6, *Sediments and Water Quality*). Therefore, no impacts to marine mammals from hydrocarbon-based materials would occur with implementation of QUTR Alternative 1 and there would be no effect to ESA-listed species or their critical habitat.

Other Potentially Toxic Materials. Batteries are expended to the environment with the use of expendable sonobuoys. Batteries contain chemicals such as potassium hydroxide electrolyte, lithium, lithium chloride, lithium hydroxide, nickel, cadmium, lead, and sulphuric acid. Aluminum, iron, and steel are also released during range activities.

Concrete, aluminum, iron, lithium, lead and steel are chemically innocuous at concentrations found naturally and released during range activities. Magnesium is abundant in seawater (average concentration 0.135 percent) and is not a concern. Battery fluids will dilute to concentrations too low to warrant concern.

Various markers, sensors, and other materials are expended during test activities. There is also a potential for loss of normally recoverable equipment. Potential effects include degradation of water and sediment quality from contaminants introduced to the ocean. The materials involved are diverse including lead, copper, aluminum, steel, nylon, ABS, and various plastics, lithium, zinc, fiberglass, tungsten and iron.

Lithium, antimony, and other materials contained in expendables are potentially toxic, but the quantities introduced annually into the QUTR Site are small. The quantities involved are low and spread over a large area and do not warrant concern. Copper and lead, and other metals are relatively inert. They are slowly released into water, or are rapidly diluted. Lead and copper become attached to suspended particulates and accumulate in sediments.

Most zinc associated with expendable materials used in the test areas is in the form of zinc alloys and coatings. Zinc corrodes rapidly in sea water and is frequently used in sacrificial anodes and coatings for corrosion protection. Zinc is commonly used on all commercial and recreational vessels for corrosion protection. Average concentrations of zinc in seawater are less than 10 parts per billion. Zinc is effectively immobilized in sediment as organic and sulphide complexes. Exposed zinc corrodes and rapidly dilutes to background concentrations. Because zinc is unpalatable, it is unlikely to be ingested by marine mammals. The addition of zinc to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Copper may be contained in some probes, sonobuoy cable, electronics of sonobuoys, targets and signal devices. Most copper associated with expendable materials is coated copper wire (e.g., torpedo guidance wire) and coated electrical circuitry. The plastic coatings are long-lived in the ocean because of the relatively low temperatures and absence of ultra-violet light. Once the copper is exposed, the corrosion rate is about 50 microns per year (Efird 1976). If buried in anoxic sediments, copper will not be oxidized and will not be bioavailable. As with lead, dissolved copper attaches to suspended particulates and accumulates in sediments. The addition of copper to the environment would occur over a large area resulting in negligible effects on water and sediment concentrations.

Lead is very inert and corrodes and dissolves slowly in seawater. Under oxygenated conditions the rate of dissolution is 8-30 microns per year. Under anoxic conditions a surface layer of sulphide forms with low solubility inhibiting further corrosion. Sources of lead include some weights, ballast, and batteries. Lead in the form of lead chloride (e.g., older sonobuoy batteries) is not soluble. Dissolved lead attaches to suspended particulates and accumulates in sediments. The potential effects of lead, zinc, copper, and other materials on water quality are not expected to be significant (Section 3.6, *Sediments and W ater Quality*). Therefore, under QUTR Alternative 1, there would be no impacts to marine mammals, no takes under MMPA, and no effect to ESA-listed species or their critical habitat with the release of small quantities of lead, copper, plastic, or other materials into the QUTR Site, proposed range extension, and Kalaloch surf-zone access area within Territorial Waters and non-Territorial Waters. As more environmentally friendly techniques and substances become technologically feasible and available, the Navy is committed to moving towards the use of new technologies on a routine basis.

ESA-Listed Species. Based on the above analysis of potential impacts to marine mammals from non-acoustic activities, implementation of QUTR Alternative 1 would have no effect on ESA-listed marine mammals. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of QUTR Alternative 2 would result in the same impacts to marine mammals as previously described under QUTR Alternative 1. Because the proposed range extension is the same and the Pacific Beach surf-zone access area does not present different distributions or occurrences of marine mammal populations, potential acoustic and non-acoustic impacts are the same (see Table 3.5-17). Therefore, there would be minimal impacts to marine mammals. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. There would be no effect to ESA-listed species or their critical habitat within Territorial Waters and non-Territorial Waters with implementation of QUTR Alternative 2 (Pacific Beach surf-zone access area).

ESA-Listed Species. Implementation of QUTR Alternative 2 would result in the same impacts to ESA-listed marine mammals as previously described under QUTR Alternative 1. Based on the above analysis of potential impacts to marine mammals from proposed NUWC Keyport activities within the QUTR action area under QUTR Alternative 1, implementation of QUTR Alternative 2 would have no effect on ESA-listed marine mammals. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of QUTR Alternative 3 would result in the same impacts to marine mammals, including ESA-listed species, as previously described under QUTR Alternative 1. Because the proposed range extension is the same and the Ocean City surf-zone access area does not present different distributions or occurrences of marine mammal populations, potential acoustic and non-acoustic impacts are the same (see Table 3.5-17). Therefore, there would be minimal impacts to marine mammals. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. There would be no effect to ESA-listed species or their critical habitat within Territorial Waters and non-Territorial Waters with implementation of QUTR Alternative 3 (Ocean City surf-zone access area).

ESA-Listed Species. Implementation of QUTR Alternative 3 would result in the same impacts to ESA-listed marine mammals as previously described under QUTR Alternative 1. Based on the above analysis of potential impacts to marine mammals from proposed NUWC Keyport activities within the QUTR action area under QUTR Alternative 1, implementation of QUTR Alternative 3 would have no effect on ESA-listed marine mammals. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

No-Action Alternative

Acoustic Impacts

Under the No-Action Alternative, current activities would continue within the existing boundaries of the QUTR Site. The existing QUTR Site has been included in the earlier analyses of the alternatives including the maintenance of the shore run of the cables from the Kalaloch ranger station and existing bottom tracking equipment. NUWC Keyport activities have been described in the OCNMS EIS. Since there are minimal acoustic impacts under any of the action alternatives with the proposed range extension, implementation of the No-Action Alternative would minimally impact marine mammals and would not result in a take under MMPA within Territorial Waters and non-Territorial Waters.

Current activities within the existing QUTR Site would involve the use of a variety of acoustic sources including UUV payload and side-scan sonars above 100 kHz; range tracking, torpedoes, range targets, and dipping sonars in the 2 to 100 kHz range; and target simulators and sub-bottom profilers at approximately 5 kHz (Table 1-2). For the acoustic effects analysis, eight acoustic sources were selected for analysis of various marine mammal acoustic effects.

Based on the current annual usage of representative acoustic sources within the existing QUTR Site, there would be no Level A (PTS) exposures of any species due to the use of acoustic sources associated with activities within the existing QUTR Site (Table 3.5-18). Some of the acoustic sources may be used beyond 12 nm (22.2 km) where densities, at least for pinnipeds, are often an order of magnitude lower than those within Territorial Waters. Because activities occur both within and beyond the 12-nm (22.2-km) Territorial Waters boundary, all of the activities have been modeled for less than or equal to 12 nm (22.2 km) resulting in "worst-case" estimates of predicted exposures (Table 3.5-18).

The potential for behavioral (Level B) harassment would be further avoided by implementation of the standard operating procedures and ROP including lookouts, operators trained in marine mammal identification by NMFS, and acoustic surveillance as discussed in Sections 1.3.4 and 2.3.4. In particular, since all active acoustic activities are halted when cetaceans are detected on range, this would eliminate the potential for exposures of cetaceans.

The potential exposures of marine mammals from acoustic activities within the action area would result in incidental Level B (behavioral) harassment of four species of pinnipeds and one cetacean (Table 3.5-18). Harbor porpoises are common animals that occur in abundance. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected. There would also be 23 Level B (TTS) exposures of harbor seals. This represents a relatively small number of the harbor seals occurring at the site over the course of a year. These exposures are unlikely to have any long term effects on individuals and given the abundance of the species and their frequent association with maritime activities this is not expected to have any effect on harbor seal numbers or distribution. Therefore, no adverse effects are expected on the annual rates of recruitment or survival of any of the species and stocks assessed as a result of the estimated incidents of Level B harassment. In accordance with the MMPA, the Navy has requested an LOA regarding Level B exposures.

Table 3.5-18 Annual MMPA Exposures for QUTR No-Action Alternative[1]

Species[2]		Level B Risk Function (Sub TTS Behavioral)	Level B TTS	Level A PTS
CETACEANS				
Blue whale		0	0	0
Fin whale		0	0	0
Gray whale	Resident	0	0	0
	Migratory	0	0	0
Humpback whale		0	0	0
Minke whale		0	0	0
North Pacific right whale		0	0	0
Sei whale		0	0	0
Baird's beaked whale		0	0	0
Hubb's and Stejneger's beaked whale		0	0	0
Dall's porpoise		0	0	0
Harbor porpoise		1,163[3]	0	0
Northern right whale dolphin		0	0	0
Pacific white-sided dolphin		0	0	0
Risso's dolphin		0	0	0
Short-beaked common dolphin		0	0	0
Striped dolphin		0	0	0
Dwarf & pygmy sperm whales		0	0	0
Sperm whale		0	0	0
Killer whale	N Resident	0	0	0
	S Resident	0	0	0
	Offshore	0	0	0
	Transient	0	0	0
PINNIPEDS				
Harbor seal		39	23	0
Northern elephant seal		5	0	0
California sea lion		2	0	0
Northern fur seal		21	0	0
Steller sea lion		0	0	0
Sea otter		0	0	0

1. Does not include the No-Action Alternative. For details see Appendix C. Cetacean exposures are post-ROP.
2. Only species likely to occur are included.
3. As described in Section 3.5.2.5, a step function threshold of 120 dB SPL is used to estimate sub-TTS behavioral takes of harbor porpoises.

ESA-Listed Species. Since there were no effect to ESA-listed marine mammals from proposed acoustic sources under QUTR Alternatives 1, 2, and 3, there would be no effect to ESA-listed marine mammals under the No-Action Alternative. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

Non-Acoustic Impacts

Implementation of the No-Action Alternative would result in the same effects to marine mammals as previously described under QUTR Alternatives 1, 2, and 3. Therefore, there would be minimal non-acoustic impacts to marine mammals with implementation of the No-Action Alternative within the existing DBRC Site.

ESA-Listed Species. Since there were no effects to ESA-listed marine mammals from proposed non-acoustic activities under QUTR Alternatives 1, 2, and 3, there would be no effect to ESA-listed marine mammals from non-acoustic activities under the No-Action Alternative. The NMFS draft BO concluded that adverse effects on ESA-listed marine mammals are unlikely to occur at the QUTR site.

3.5.8.3 Mitigation Measures

The draft NMFS BO did not identify adverse effects that would be likely to occur for ESA-listed marine mammals. To the extent practicable, NUWC Keyport will comply with any reasonable and prudent measures and related terms and conditions that are issued by NMFS in their final BO.

Proposed Measures

To maximize the ability of Navy personnel to recognize instances when marine mammals are in the vicinity the following procedures will be implemented:

1. General Maritime Protective Measures: Personnel Training
    a. All lookouts onboard platforms involved in range events will have reviewed NMFS approved Marine Species Awareness Training (MSAT) material prior to use of MFA/HFA sonar.
    b. Navy lookouts will undertake extensive training in order to qualify as a lookout.
    c. Lookouts will be trained in the most effective means to ensure quick and effective communication with the command structure in order to facilitate implementation of protective measures if marine species are spotted.
2. General Maritime Protective Measures: Lookout Responsibilities
    a. There will always be at least one person on watch whose duties include observing the water surface around the vessel or platform.
    b. Personnel on lookout will have at least one set of binoculars available to aid in the detection of marine mammals.
    c. After sunset and prior to sunrise, lookouts will employ night lookout techniques.
3. Operating Procedures
    a. Craft personnel will make use of marine species detection information to limit interaction with marine species to the maximum extent possible consistent with safety of the craft.
    b. All personnel engaged in passive acoustic sonar operation will monitor for marine mammal vocalizations and report the detection of any marine mammal to the Range Officer for dissemination and appropriate action.
    c. During MFA/HFA operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.

d. Safety Zones – When cetaceans are detected by any means within 1,000 yards of the intended track of the test vehicle, the transmissions will be terminated. For all range sites the sources are either on or off; there is no capability to reduce source levels.

e. Prior to start-up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

4. Coordination and Reporting

   a. Navy will coordinate with the local NMFS Stranding Coordinator regarding any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with a test event.

<u>LOA-Required Measures</u>

Mitigation measures and monitoring and reporting were specified in NMFS Proposed Rule (2009a) to issue the LOA for the proposed activities on the Keyport Range Complex. Following Navy and public review of the Proposed Rule, NMFS is preparing a Final Rule which will contain the mitigation measures and monitoring and reporting as required by the MMPA. Keyport will comply with these requirements to the extent practicable.

3.6 SEDIMENTS AND WATER QUALITY

Sediments and water quality describe the chemical and physical composition of water-related resources as affected by natural conditions and human activities. For the purposes of this analysis, sediments and water quality are evaluated with respect to possible release of hazardous constituents and sedimentation resulting from NUWC Keyport activities. Water resource regulations focus on the right to use water and protection of water quality. The principal federal laws protecting water quality are the Clean Water Act (CWA), as amended (33 USC § 1251 et seq.) and the Safe Drinking Water Act (42 USC § 300f et seq.). Both laws were previously enforced by the USEPA but have subsequently been delegated to the State of Washington for enforcement. The CWA provides protection of surface water quality and preservation of wetlands. The Safe Drinking Water Act is directed at protection of drinking water supplies.

NUWC Keyport Dabob Bay Sediment and Water Quality Report

NUWC Keyport commissioned a field study to document water and sediment quality conditions at DBRC Site in Dabob Bay (Battelle 2001). The purpose of the study was to provide marine chemistry data that would meet the needs of the state and federal agencies that evaluate the potential environmental impacts associated with NUWC Keyport activities at DBRC Site. The study employed methods recognized and approved by state and federal agencies for conducting marine environmental studies in Puget Sound. The results of the study are summarized in Table 3.6-1. The report can be found in Appendix D of the DBRC EA (Navy 2002a). Although conducted for the DBRC Site, the results of the study are applicable to Keyport Range Site because the nature of activities, and the sedimentary, bathymetric, and circulatory conditions are reasonably similar at both locations.

Table 3.6-1 Concentration of Metals in Dabob Bay Water and Sediment Compared to Other Locations

Location	*Cd*	*Cu*	*Li*	*Pb*	*Zn*	*Zr*
Seawater (µg/L)						
Dabob Bay	0.07	0.3	150	0.02	0.50	<0.2
Puget Sound	--	0.45	--	0.08	0.90	--
WDOE Marine Chronic Standard for Dissolved Metals	9.3	3.1	--	8.1	81	1,000
Sediment (µg/g dry wt)						
Dabob Bay	0.3	40	35	16	95	80
Puget Sound	0.4	50	--	40	115	--
WDOE Sediment Standards	5.1	390	--	450	410	--

Source: Battelle 2001.

The study evaluated surface sediment samples collected at 14 stations on the bottom of Dabob Bay along the main axis of the DBRC. Seawater samples were also collected at four of these stations at 3 ft (1 m) below the surface and 30 ft (10 m) above the bottom. The sediment and seawater samples were analyzed for cadmium (Cd), copper (Cu), lithium (Li), lead (Pb), zinc (Zn), and zirconium (Zr); these elements are identified as being present in torpedo exhaust, and/or anchor and dropper weights and other expendable materials generated by activities at the DBRC.

Laboratory results for both the surface and bottom seawater samples indicated that metal concentrations were low in Dabob Bay compared to background levels present in non-urban portions of Puget Sound. The four metals (Cd, Cu, Pb, and Zn) compared with listed Washington State water quality criteria had concentrations well below these criteria. Lithium and zirconium do not have Washington State water quality criteria, but the lithium concentrations present were at the same level as those naturally occurring in the ocean. The zirconium concentrations observed were well below levels considered toxic to aquatic organisms.

Laboratory results for the sediment samples indicated that metal concentrations were low, and consistent with levels found in other muddy, non-urban bays in Puget Sound. The four metals (Cd, Cu, Pb, and Zn) compared with listed Washington State Sediment Quality Standards (SQS) criteria, were well below these criteria. The other two metals (Li and Zr) do not have SQS criteria, but the concentrations seen were considered typical of naturally occurring sedimentary rock.

Under the Proposed Action and alternatives, the types of activities currently conducted at DBRC Site would continue to be conducted; the only change would be the extension of range boundaries to accommodate tests with larger area requirements at DBRC Site. Since the components used in future activities would not differ from existing activities, results of the detailed analysis in the NUWC Keyport Dabob Bay water quality and sediment report (Battelle 2001) are applicable to activities conducted under the Proposed Action and alternatives and are referred to in the impact analysis where appropriate.

3.6.1 Keyport Range Site

3.6.1.1 Existing Conditions

General Marine Environment

*Hydrology***.** The North Kitsap Peninsula drainage area within the vicinity of NUWC Keyport includes numerous independent small streams that enter Port Orchard Reach and Liberty Bay (Figure 3.4-2). There are a total of 16 streams (12 of which are unnamed) with a combined length of approximately 23 stream miles (37.0 km) (Williams *et al*. 1975).

*Bathymetry***.** NUWC Keyport contains approximately 5,000 ft (1,524.0 m) of shoreline on Port Orchard Reach, the majority of which is riprap or bulkhead. On and near the range site, Port Orchard Reach lies to the east and southeast and marine or brackish water bodies consist of tide flats, a marsh, a shallow lagoon, and Liberty Bay to the north and northwest. The Keyport Range Site and the proposed extended operating area are relatively shallow with water depths no greater than 100 ft (30.5 m). Water depths increase from the northwest to south/southeast and are greatest in the southern portion of the proposed extended operating area (NOAA 2007b, Chart 18446).

Tides and Currents **.** Tides within the Keyport Range Site and the proposed extended operating area fluctuate between two high and two low tides per lunar day (i.e., semi-diurnal tide), usually unequal in height. High and low tides vary on average by 10 ft (3.0 m) per day but can differ by more than 17 ft (5.2 m) between extreme high and low tides. Currents at the site are generated by tides, direct wind effects, and by momentum transport from waves.

*Sea State***.** Port Orchard Reach is relatively calm due to its protected location. However, during intense winter storms a few times each year, Port Orchard Reach is subject to moderate seas in response to strong southerly winds. During summer months, Port Orchard Reach is relatively calm, with an average sea state of 3 or less (on the Beaufort scale).

Sediment Composition and Quality

Sediments collected from a sampling station approximately 500 ft (152.4 m) offshore of NUWC Keyport in 1998 consisted of a mix of silt (71 percent), clay (20 percent), and fine to very fine sands (9 percent). Additional sediment samples collected north (Liberty Bay) and east (Bainbridge Island) of the Keyport

Range Site contained higher percentages of medium to fine sands and lower percentages of silts and clays (NOAA 2000).

Washington State has established Sediment Management Standards (SMS) for marine, low salinity, and freshwater surface sediments. The goal of these standards is to eliminate adverse effects on biological resources and significant health threats to humans from surface sediment contamination. The process involves establishing standards for the quality of surface sediments, applying these standards as the basis for management and reduction of pollutant discharges, and providing a management and decision process for the cleanup of contaminated sediments (WDOE 1995). In addition, SMS were approved by the USEPA's Water Quality Program as Water Quality Standards (WQS). Sediment data that violate SMS are considered for 303(d) listing similar to water-column water quality violations (WDOE 2004). SMS are used to place waterbodies (termed "water segments" by WDOE and USEPA in their 2004 Guidance document) in defined categories to describe levels of pollution concern much like WDOE uses WQS to categorize the same water segments (Table 3.6-2).

Table 3.6-2 Washington Department of Ecology Water Quality Standards and Sediment Management Standards

Water Quality Standards Category Definition	*Sediment Management Standards Category Definition*
Category 5 Needs a total maximum daily load (TMDL)	Sites of "potential concern" (cleanup action list).
Category 2 Water of Concern	Sites of "low concern" (no action unless new information shows problem).
Category 4B Has a Pollution Plan	Approved Record of Decision under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Cleanup Action Plan under Model Toxics Control Act (MTCA), or correction measures under Resource Conservation & Recovery Act (RCRA).

Source: WDOE 2005.

The following parameters exceeded the SMS Cleanup Screening Level (CSL) criterion at three NUWC Keyport identified stations: N-nitrosodiphenylamine; 2-methylphenol; 1,2-dichlorobenzene; 1,2,4-trichlorobenzene; pentachlorophenol; hexachlorobenzene; 2,4-dimethylphenol; hexachlorobutadiene; benzyl alcohol; 1,4-dichlorobenzene; bis(2-ethylhexyl) phthalate. These data were used to place the Liberty Bay water segment in a Category 4B sediment listing (WDOE 2004). No further action was required due to an existing ROD in place under CERCLA for the Keyport Range Site (USEPA 1994).

Other sampling conducted at NUWC Keyport examined the potential human exposure to past spills or waste deposits at the onshore facility (adjacent to the Keyport Range Site). Although the spills occurred onshore and outside of the Keyport Range Site, samples of marine sediments were collected from two nearshore sites (Area 1 and Area 9) to determine extent of contaminants from past activities. General descriptions of Area 1 and Area 9 are described below:

- Area 1 (Keyport Landfill) – Former landfill on the west side of the base between Bradley Road and Keys Road.
- Area 9 (Liberty Bay) – Approximately 5,000 ft (1,524.0 m) of shoreline around the NUWC Keyport peninsula, including nearshore areas around two piers which have since been removed (the new pier is to the north).

Keyport Landfill (Area 1) did not have a liner or leachate containment system in place; therefore, there was potential of contaminants from years of landfill use migrating into marine sediments and groundwater

(USEPA 1998). Waste contaminants generated and potentially deposited into the landfill included cadmium, chromium, copper, cyanide, lead, nickel, tin, zinc, carbon tetrachloride, methyl ethyl ketone, and trichloroethylene. Results from sampling determined that metals, chlorinated pesticides, and Dichlorodiphenyl dichloroethylene (DDE) exist in marine sediments near Area 1 but at very low concentrations.

In a 65-year time period, metals such as chromium, cadmium, and lead have been discharged into Liberty Bay (Area 9) as well as paint thinners, lead-acid batteries, and sandblasting residue (USEPA 1994). Potential contamination still existing from these historical discharges warranted investigation. Benzoic acid, bis (2-Ethylhexyl), phthalate, phenol, and arsenic were detected in low concentrations from Area 9 samples (USEPA 1994). A Public Health Assessment prepared as a result of this sampling determined no risk to human health from site-related contaminants (ATSDR 2001).

Anchors, weights, and guidance wires used by Navy activities in the Keyport Range Site contain Cd, Li, Pb, Zn and Zr. These expended materials sit in the sediments where potential leaching of these heavy metals may occur.

Water Quality

Under Section 303(d) of the CWA, WDOE is required to produce a list of surface waters not expected to meet State WQS (designated as impaired water bodies). Washington State has also established WQS for surface waters. These standards set limits on pollution in surface waters in order to protect water quality. Washington State has also applied general water uses and criteria classes to surface waters in the state.

The Keyport Range Site is located within an area classified "Class AA" as having "water quality that markedly and uniformly exceeds the requirements for all or substantially all uses" (WDOE 1997). Port Orchard Reach is not listed as an impaired water body for pollutants as defined in 1998 CWA Section 303[d] list of impaired waters (USEPA 2003).

Adjacent to Liberty Bay (located approximately 1 mi [1.6 km] northwest of the Keyport Range Site) is listed by WDOE as having a "moderate" level of marine water quality concern with high fecal coliform levels, moderate ammonium concentrations, and seasonal density stratification due to non-point source such as outfalls, marinas, and failing septic systems (WDOE 2003a). In addition, based on the physical and chemical characteristics of the Bay and surrounding areas, Liberty Bay is listed as being sensitive to eutrophication (WDOE 2003b).

Activities

As described in Section 1.3.4, the Navy implements a variety of procedures to ensure the safety of the general public during testing activities at all range sites. NUWC Keyport conducts a thorough environmental and safety review for all test systems before the tests are conducted on any of the range sites. Thus, all NUWC Keyport activities are evaluated by the NUWC Keyport Environmental Review Board for any expendable and exhaust constituents early in the planning process. New customers proposing to use the range site are required to provide all information regarding exhaust or expendable materials to the Environmental Review Board as part of the early environmental review. Based on this review, modifications can be made to the system either to minimize or eliminate these constituents, or the system is not tested by NUWC Keyport. All expendables are compared to state and federal water quality requirements.

NUWC Keyport follows the shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance

Integrated Contingency Plan (COMNAVREGNWINST 5090.1). Historically, the incidence of accidental fuel oil or torpedo propellant spills is very low (historically 1 percent) during routine range activities. The potential for a release is further reduced by following best management practices (e.g., secondary containment) when handling oil and hazardous substances. In addition, if there is a propellant or petroleum product release, concentrations of these substances would quickly be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. Tidal and wind-induced currents and water movements also provide a level of dilution.

Crawler UUVs conduct test activities within the nearshore environment creating short-term, temporary turbidity. However, these disturbances do not permanently disrupt nearshore sediments and hazardous constituents are not associated with these activities.

NUWC Keyport also changes instrumentation, sensors, and/or cabling approximately every 2 years to minimize the potential leaching of contaminants. Other activities result in test materials settling to the ocean bottom and temporary increases in water column turbidity arise during the retrieval of these devices from the sea bottom. Analysis of these bottom-disturbing activities indicates that temporary and local turbidity increases occur. Littoral currents in the area, however, generated by tides, direct wind effects, and by momentum transport from waves in Port Orchard Reach dilute the turbidity plume and reduce the likelihood of low DO concentrations (Navy 2003b). Any increased turbidity in the water column remains localized and temporary as disturbed sediments quickly settle back to the bottom (Navy 2003b).

While most test materials are retrieved, some expended materials (e.g., inert mine shapes) may accumulate on the bottom. Most of these materials are chemically inert and do not adversely affect sediment quality. In addition, lead, concrete, and other metal anchors are used for short periods of time, with small dropper weights (made of lead with steel or concrete coverings) used with the concrete and metal anchors to make them heavier. Typically, all anchors are recovered using the best practicable methods. Some anchors and small weights, however, may become fully buried in the mud and are unrecoverable. The majority of these materials are chemically inert since they are in an anaerobic state and do not adversely affect sediment quality.

As described previously, NUWC Keyport commissioned a field study to document water and sediment quality conditions at DBRC Site in Dabob Bay (Battelle 2001). Laboratory results for seawater and sediment samples indicated that metal concentrations were low in Dabob Bay, compared to background levels present in non-urban portions of Puget Sound (Table 3.6-1). The four metals (Cd, Cu, Pb, and Zn) compared with listed Washington State WQS and SQS standards had concentrations well below these criteria. Li and Zr do not have Washington State WQS or SQS criteria, but the lithium concentrations present were at the same level as those naturally occurring in the ocean. The ZR concentrations observed were well below levels considered toxic to aquatic organisms.

3.6.1.2 Environmental Consequences

Proposed activities are analyzed to assess: 1) impacts (chemical, physical, or biological effects) that would be detectable and would be a change from the historical baseline or desired sediment and/or water quality conditions; and/or 2) chemical, physical, or quality standards or criteria that would be locally, slightly, and singularly exceeded on either a short-term or prolonged basis. Potential water or sediment quality effects of activities conducted by NUWC Keyport can be categorized as: 1) torpedo exhaust gas releases into the water; 2) accidental spills of fuel oil, torpedo propellants, and other substances; 3) increased turbidity arising from seabed disturbance during recovery of buried torpedoes and other devices; and 4) potential heavy-metal leaching into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom.

Keyport Range Alternative 1 – Preferred Alternative

Under Alternative 1, the Keyport Range would be extended and all test activities continued, but with a minimal increase in the operational tempo. No new materials would be introduced nor would activities increase to such a level that pollutants would adversely impact marine waters. The types of materials used at the Keyport Range Site are similar to the types of materials used at the DBRC Site. A detailed analysis at the DBRC Site found no evidence of degradation to water or sediment quality due to Navy actions (Battelle 2001).

The EA for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal Military Operating Areas included a quantitative analysis of four major categories of water and sediment quality effects at the DBRC Site, each of which is applicable to activities at the Keyport Range Site. The following conclusions are based on this EA (Navy 2002a):

1. Torpedo activities would release exhaust gas into the water column. The majority of underwater vehicle exhaust gas components would quickly dissipate in the water column and would not require tidal action to reach non-toxic levels. The test run distance would also effectively dilute these exhaust components, given the short duration of each test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

2. Accidental spills of fuel oil, torpedo propellants, and other substances could occur. The probability of accidental fuel oil or torpedo propellant spills is very low during routine range activities, so it is unlikely that water quality would be significantly affected. To ensure oil and hazardous material spills and accidental discharges are kept to a minimum, NUWC Keyport implements shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1). Actions specified under Navy contingency and spill response plans would reduce the potential impacts of any such spill. These plans implement and satisfy the associated requirements of the CWA. NUWC Keyport also participates with the Navy Region Northwest in the Region 10 Regional Response Team, which prepares and updates the Northwest Area Regional Contingency Plan (www.rrt10nwac.com), a document which functions as Washington's statewide master plan for oil spill and hazardous substance release response. These plans provide for coordinated and cooperative responses that minimize the likelihood of spills and associated impacts throughout the region.

3. Increased turbidity could occur from seabed disturbance during recovery of buried torpedoes and other devices. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. Therefore, turbidity would be a minor and temporary adverse effect.

4. Heavy metals could potentially leach into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom. While most test materials are retrieved, some expended materials (e.g., inert mine shapes) may accumulate on the bottom. Most of these materials are chemically inert and do not adversely affect sediment quality. In addition, lead, concrete, and other metal anchors are used for short periods of time, with small dropper weights (made of lead with steel or concrete coverings) used with the concrete and metal anchors to make them heavier. Typically, all anchors are recovered using the best practicable methods. However,

some anchors and small weights may become fully buried in the mud and are unrecoverable. The majority of these materials are chemically inert and do not adversely affect sediment quality. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal. While lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations, these potential sources of contaminants are very unlikely to significantly affect water quality.

Consequently, Washington State WQS and SQS standards would not be exceeded (Navy 2002a).

Under Alternative 1, the number of days of use do not change but there may be a slight increase in the number of activities occurring on a given day. However, the quantitative analysis of water and sediment quality effects applies to each test specifically. This is because chemical propellant byproducts released into the water are either harmless or are not expected to accumulate in sufficient concentrations to affect water and sediment quality. Similarly, these byproducts would disperse over time and space, and would not accumulate in high enough concentrations to significantly affect water quality or contaminate the sediments (Navy 2002a).

Under Alternative 1, test activities would also occur in the proposed range extension area. Since water and sediment conditions are similar in the range extension to the conditions in the existing Keyport Range Site, the previous impact analysis is applicable to both locations.

As previously discussed, Table 3.6-1 documents water and sediment quality conditions at the DBRC Site. Although conducted for the DBRC Site, the results of the study, presented in this table, are applicable to the Keyport Range Site because the nature of activities is similar at both locations. The fact that sediment samples taken in Dabob Bay and northern Hood Canal (with the exception of samples taken at the Bangor Superfund site) do not show elevated levels of Pb, Cu, or other compounds above sediment quality criteria indicates that past DBRC Site activities have not contributed significant levels of contaminants to the sediments at those locations. This was confirmed by the results of the study where low metal (Cd, Cu, Pb, Zn, Li, Zr) concentrations were found in surface sediment samples taken along the axis of the DBRC test range. These concentrations were well below Washington State SQS criteria and are comparable to background levels seen in other muddy bays in non-urban portions of Puget Sound. While sediments directly adjacent to dropped lead anchors may exceed sediment standards, this is a minor and localized event.

The number of RDT&E and other NUWC Keyport managed activities at the Keyport Range Site are less than those that occur at the DBRC site. Based on the smaller number of activities and the conclusions from the sediment and water quality study at the DBRC, Alternative 1 is not expected to have impacts to sediment and water quality in the Keyport Range Site.

<u>No-Action Alternative</u>

Implementation of the No-Action Alternative would not result in changes to existing conditions in sediment and water quality within adjacent waters, the Port Orchard Reach, or nearby Liberty Bay. The existing Keyport Range Site would continue to be used for Navy activities within the existing range boundaries, with no change in activities or equipment used. No evidence was found of degradation to water or sediment quality due to Navy actions at the DBRC Site (Battelle 2001). Constituents analyzed in this report for the DBRC Site are the same types of constituents currently used and proposed for use at the Keyport Range Site. Therefore, implementation of the No-Action Alternative would result in minimal impacts to sediment and water quality at the Keyport Range Site.

3.6.1.3 Mitigation Measures

Since there would be minimal impacts to sediments and water quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.6.2 DBRC Site

3.6.2.1 Existing Conditions

General Marine Environment

Hydrology. There are nine major river systems entering Hood Canal, as well as many smaller creeks and streams (Figure 3.4-7). In northern Hood Canal, there are three major sources of freshwater input: (1) the Big and Little Quilcene Rivers, which drain into Quilcene Bay; (2) the Dosewallips River, which empties out at Sylopash Point; and (3) the Duckabush River, which enters Hood Canal south of Quatsap Point. Smaller sources of freshwater input in the DBRC include Seabeck, Big Beef, and Thorndyke Creeks.

Bathymetry. Glacial scouring formed the deep basin of Dabob Bay and carved a path south forming the main channel of Hood Canal to the Great Bend at Annas Bay. Northern Hood Canal from Tala Point to the tip of the Toandos Peninsula was excluded from the main axis of deep glacial scouring and is considerably shallower (average depth of approximately 200 ft [61 m]) than the Dabob Bay Basin (maximum depth of approximately 600 ft [182.9 m]).

Tides and Currents. Tides within the DBRC fluctuate between two high and two low tides per lunar day, usually unequal in height, and vary on average by 7 ft (2.1 m). The highest tidal current velocities in northern Hood Canal occur north of Hazel Point, where current velocities can exceed 1.5 knots (0.8 m per second).

Sea State. Unlike Port Orchard Reach, Hood Canal is more exposed to strong winds and higher seas. At various times of the year, strong winds can generate moderate to high seas which can make the waters unsafe for small boats. During these events, small-boat warnings are posted by the National Weather Surface. While Hood Canal is exposed to higher sea states, Dabob Bay is more sheltered and the waters are typically much calmer than those found in Hood Canal, especially during summer months when the average sea state is 3 or less (on the Beaufort scale).

Sediment Composition and Quality

In 1999, sediments were collected at five different locations throughout the DBRC – three in the Hood Canal and two within Dabob Bay. Sediments from Hood Canal sites consisted of a mix of fine to very fine sands (approximately 70 percent), silt (approximately 20 percent), and clay (approximately 10 percent). Conversely, sediments from Dabob Bay contained more silt (47 percent) and clay (44 percent) than sand (9 percent) (NOAA 2002b). None of the five sediment samples tested exceeded the SQS. In addition, none of the sites were reported in WDOE's sediment quality information system (SEDQUAL) database for recent exceedances of the SQS (NOAA 2002b). In 2001, sediment samples collected in Dabob Bay revealed that metal analyte concentrations in the sediment were consistent with concentrations present in other non-urban bays in Puget Sound (Battelle 2001).

Water Quality

Hood Canal is classified "Class AA" as having "water quality that markedly and uniformly exceeds the requirements for all or substantially all uses" (WDOE 1997). WDOE currently operates two ambient water quality stations in Hood Canal – one in the north, near King Spit (#HCB006) and the other in the south near the Hamma Hamma River (#HCB003). North Hood Canal is listed by WDOE as having a "high" level of marine water quality concern due to low dissolved oxygen levels (WDOE 2003a). Similarly, South Hood Canal is listed by WDOE as having a "very high" level of marine water quality concern due to very low DO levels, high ammonium concentrations, and persistent density stratification. In addition, due to low DO levels and biological stresses, Hood Canal is listed as being sensitive to eutrophication (WDOE 2003b).

Dabob and Quilcene Bays are listed on the 1998 CWA Section 303[d] list of impaired waters for fecal coliform. The main sources of fecal coliform affecting these areas include failing sewage systems and/or poor pasture management (WDOH [Washington State Department of Health] 2001). Southern Hood Canal (beginning just south of the DBRC) is listed as an impaired water body for fecal coliform and DO (low DO levels) (USEPA 2003). However, water quality samples collected in 2001 show concentrations of CD, CU, Pb, and Zn well below Washington State water quality criteria (Battelle 2001).

<u>Activities</u>

As with the Keyport Range, shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22), and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1)are followed at the DBRC Site to minimize the effects of oil and hazardous material spills. Historically, the incidence of accidental fuel oil or torpedo propellant spills is very low (historically 1 percent) during routine range activities. Only four minor spills (2 quarts [2 liters] or less per incident) were documented over a two-year period associated with NUWC Keyport activities (Navy 2002a). The potential for a release is further reduced by following best management practices (e.g., secondary containment) when handling oil and hazardous substances. In addition, if there is a propellant or petroleum product release, concentrations of these substances would quickly be diluted and dispersed by oceanic mixing processes to non-toxic concentrations. Tidal and wind-induced currents and water movements also provide a level of dilution.

Under existing activities, crawler UUVs conduct test activities within the nearshore environment and cause short-term, temporary increases in turbidity. However, these disturbances do not permanently disrupt nearshore sediments, and hazardous constituents are not associated with these activities. The DBRC southern portion is used primarily to facilitate longer test runs and experiences the majority of the retrieval activities. During retrieval of torpedoes, AUVs, and other devices used in these test runs, temporary increases in water column turbidity arise from seabed disturbance. Previous analysis of bottom-disturbing activities indicated that temporary and local turbidity increases do occur but sediments soon settle back onto the ocean floor. In addition, littoral currents in the area generated by tides, direct wind effects, and by momentum transport in Hood Canal dilute the turbidity plume and reduce the likelihood of low DO concentrations (Navy 2003b).

As described above, NUWC Keyport commissioned a field study to document water and sediment quality conditions at DBRC Site in Dabob Bay (Battelle 2001). Laboratory analysis results for seawater and sediment samples indicated that metal concentrations were low in Dabob Bay, compared to background levels present in non-urban portions of Puget Sound (Table 3.6-1). The four metals (Cd, Cu, Pb, and Zn) compared with listed Washington State WQS and SQS standards had concentrations well below these criteria. Li and Zr do not have Washington State WQS or SQS criteria, but the Li concentrations present were at the same level as those naturally occurring in the ocean. The Zr concentrations observed were well below levels considered toxic to aquatic organisms.

3.6.2.2 Environmental Consequences

Under any of the alternatives, the numbers of days (200) testing occurs would not change. Only UAS tests would be introduced on the DBRC site where they have not occurred before; all other types and numbers of activities would remain the same. Potential water and sediment quality effects of activities conducted by NUWC Keyport can be categorized as: 1) torpedo exhaust gas releases into the water; 2) accidental spills of fuel oil, torpedo propellants, and other substances; 3) increased turbidity arising from seabed disturbance during recovery of buried torpedoes and other devices; and 4) potential heavy metal leaching into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom.

DBRC Alternative 1 (Southern Extension)

The EA for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal MOAs included a quantitative analysis of four major categories of water and sediment quality effects at the DBRC Site, each of which is applicable to the activities at the Keyport Range Site. The following conclusions are based on this EA (Navy 2002a):

1. Torpedo activities would release exhaust gas into the water column. The majority of underwater vehicle exhaust gas components would quickly dissipate in the water column and would not require tidal action to reach non-toxic levels. The test run distance would also effectively dilute these exhaust components, given the short duration of each test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.

2. Accidental spills of fuel oil, torpedo propellants, and other substances could occur. The probability of accidental fuel oil or torpedo propellant spills is very low during routine range activities, so it is unlikely that water quality would be significantly affected. To ensure oil and hazardous material spills and accidental discharges are kept to a minimum, NUWC Keyport follows procedures outlined in its *Oil and Hazar dous Su bstance Release Contingenc y and Response Plan* (Navy 2002a). Actions specified under Navy contingency and spill response plans would reduce the potential impacts of any such spill. The Navy has developed a SPCC Oil Pollution Plan for all its operations as required in OPNAVINST 5090.1B, Chapter 19. The SPCC plan identifies measures and practices to be taken to reduce the potential for an oil spill to occur on soils or navigable waters of the U.S. The Navy has also developed an OHS Release Contingency and Response Plan to address the control, containment, and cleanup of oil and hazardous substances as required by OPNAVINST 5090.1B, Chapter 10. The OHS plan identifies actions to be taken to reduce the impact of a propellant or fuel oil spill which may occur as a result of Navy activities.

3. Increased turbidity could occur from seabed disturbance during recovery of buried torpedoes and other devices. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. Therefore, turbidity would be a minor and temporary adverse effect.

4. Heavy metals could potentially leach into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom. While most test materials are retrieved, some expended materials (e.g., inert mine shapes) may accumulate on the bottom. Most of these materials are chemically inert and do not adversely affect sediment quality. In addition, lead, concrete, and other metal anchors are used for short periods of time, with small dropper weights (made of lead with steel or concrete coverings) used with the concrete and metal anchors to make

them heavier. Typically, all anchors are recovered using the best practicable methods. Some anchors and small weights, however, may become fully buried in the mud and are unrecoverable. The majority of these materials are chemically inert and do not adversely affect sediment quality. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal. Lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations. These potential sources of contaminants are very unlikely to significantly affect water quality.

Consequently, Washington State WQS and SQS standards would not be exceeded (Navy 2002a).

Under Alternative 1, the number of days of use does not change but there may be a slight increase in the number of activities occurring on a given day. However, the quantitative analysis of water and sediment quality effects applies to each test specifically. This is because chemical propellant byproducts released into the water are either harmless or do not accumulate in sufficient concentrations to affect water quality. Similarly, these byproducts would disperse over time and space, and would not accumulate in high enough concentrations to significantly affect water quality or contaminate the sediments (Navy 2002a). Also, the LIDAR testing (the only new activity being introduced at the range) does not entail sea bottom disturbance nor does it introduce any materials that would degrade water quality.

Under Alternative 1, test activities would also occur in the proposed southern range extension area. Low DO levels occur in Hood Canal. However, water and sediment conditions are similar in the southern range extension to the conditions in the existing DBRC Site, so the previous impact analysis is applicable to both locations.

The data presented in Table 3.6-1 summarize water and sediment quality conditions at DBRC Site in Dabob Bay. The fact that sediment samples taken in Dabob Bay and northern Hood Canal (with the exception of samples taken at the Bangor Superfund site) do not show elevated levels of Pb, Cu, or other compounds above sediment quality criteria indicates that past DBRC activities have not significantly contributed significant levels of contaminants to the sediments at those locations. This was confirmed by the results of the study where low metal (Cd, Cu, Pb, Zn, Li, Zr) concentrations were found in surface sediment samples taken along the axis of the DBRC test range. These concentrations were well below Washington State SQS criteria and are comparable to background levels seen in other muddy bays in non-urban portions of Puget Sound. While sediments directly adjacent to dropped lead may exceed sediment standards, this is a minor and localized event. Thus, ongoing and proposed RDT&E and other NUWC Keyport test and training activities at the DBRC Site are also unlikely to contribute significant levels of contaminants to the sediments in Dabob Bay and northern Hood Canal.

Therefore, DBRC Site Alternative 1 is not expected to introduce adverse impacts to sediment and water quality in the southern extension of the DBRC Site.

<u>DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Under Alternative 2 the DBRC Site would extend both to the north and south of the existing DBRC boundaries. The effects of the southern extension are identical to those described for Alternative 1.

The EA for Ongoing and Future Operations at U.S. Navy Dabob Bay and Hood Canal MOAs included a quantitative analysis of four major categories of water and sediment quality effects at DBRC Site, each of which is applicable to the activities at Keyport Range Site. The following conclusions are based on this EA (Navy 2002a):

1. Torpedo activities would release exhaust gas into the water column. The majority of underwater vehicle exhaust gas components would quickly dissipate in the water column and would not require tidal action to reach non-toxic levels. The test run distance would also effectively dilute these exhaust components, given the short duration of each test and the active dispersion of the exhaust from the underwater vehicle into a plume surrounding the vehicle.
2. Accidental spills of fuel oil, torpedo propellants, and other substances could occur. The probability of accidental fuel oil or torpedo propellant spills is very low during routine range activities, so it is unlikely that water quality would be significantly affected. To ensure oil and hazardous material spills and accidental discharges are kept to a minimum, NUWC Keyport follows procedures outlined in its *Oil and Hazardous Substance Release Contingency and Response Plan* (Navy 2002a). Actions specified under Navy contingency and spill response plans would reduce the potential impacts of any such spill. The Navy has developed a SPCC Oil Pollution Plan for all its operations as required in OPNAVINST 5090.1B, Chapter 19. The SPCC plan identifies measures and practices to be taken to reduce the potential for an oil spill to occur on soils or navigable waters of the U.S. The Navy has also developed an OHS Release Contingency and Response Plan to address the control, containment and cleanup of oil and hazardous substances as required by OPNAVINST 5090.1B, Chapter 10. The OHS plan identifies actions to be taken to reduce the impact of a propellant or fuel oil spill which may occur as a result of Navy activities.
3. Increased turbidity could occur from seabed disturbance during recovery of buried torpedoes and other devices. Observations of torpedo recoveries in Dabob Bay indicate that it takes approximately 2 hours for disturbed sediment to completely settle to the bottom. Therefore, turbidity would be a minor and temporary adverse effect.
4. Heavy metals could potentially leach into sediments and the water column from lead anchors and copper core guidance wire on the sea bottom. While most test materials are retrieved, some expended materials (e.g., inert mine shapes) may accumulate on the bottom. Most of these materials are chemically inert and do not adversely affect sediment quality. In addition, lead, concrete, and other metal anchors are used for short periods of time, with small dropper weights (made of lead with steel or concrete coverings) used with the concrete and metal anchors to make them heavier. Typically, all anchors are recovered using the best practicable methods. Some anchors and small weights, however, may become fully buried in the mud and are unrecoverable. The majority of these materials are chemically inert and do not adversely affect sediment quality. These anchors, weights, guidance wires, and devices will all mostly sink into the soft sediments at the bottom of Dabob Bay or Hood Canal. Lead, copper, cadmium, and aluminum can be toxic to many marine organisms in certain forms and at certain concentrations. These potential sources of contaminants are very unlikely to significantly affect water quality.

Consequently, Washington State WQS and SQS standards would not be exceeded (Navy 2002a).

Under Alternative 2, tempo would increase slightly over current activity levels. However, the quantitative analysis of water and sediment quality effects applies to each test specifically. This is because chemical propellant byproducts released into the water are either harmless or do not accumulate in sufficient concentrations to affect water quality. Similarly, these byproducts would disperse over time and space, and would not accumulate in high enough concentrations to significantly affect water quality or contaminate the sediments (Navy 2002a). Also, the LIDAR testing (the only new activity being introduced at the range) does not entail sea bottom disturbance nor does it introduce any materials that would degrade water quality.

Under Alternative 2, test activities would also occur in the proposed southern and northern range extension areas. Currently, North Hood Canal is listed by WDOE as having a "high" level of marine water quality due to low dissolved nitrogen levels. The proposed extensions would not change this status because no new activities would be introduced into the water column to disturb sediments or water quality.

The data presented in Table 3.6-1 summarize water and sediment quality conditions at DBRC Site in Dabob Bay. The fact that sediment samples taken in Dabob Bay and northern Hood Canal (with the exception of samples taken at the Bangor Superfund site) do not show elevated levels of Pb, Cu, or other compounds above sediment quality criteria indicates that past DBRC Site activities have not contributed significant levels of contaminants to the sediments at those locations. This was confirmed by the results of the study where low metal (Cd, Cu, Pb, Zn, Li, Zr) concentrations were found in surface sediment samples taken along the axis of the DBRC test range. These concentrations were well below Washington State SQS criteria and are comparable to background levels seen in other muddy bays in non-urban portions of Puget Sound. While sediments directly adjacent to dropped lead may exceed sediment standards, this is a minor and localized event. Thus, ongoing and proposed RDT&E and other NUWC Keyport managed activities at the DBRC Site are also unlikely to contribute significant levels of contaminants to the sediments in Dabob Bay and northern Hood Canal.

Therefore, DBRC Site Alternative 2 is not expected to introduce adverse impacts to sediment and water quality in the southern extension of the DBRC Site.

No-Action Alternative

The range would continue to be used for Navy activities within the existing DBRC Site boundaries, with no change in activities or equipment. However, if this alternative were implemented, the purpose and need for the DBRC extensions would not be met. The DBRC extensions would provide added space for the longer and more complex test runs, and the unique fresh-water runoff (in the areas proposed for extension) provide variation in buoyancy in a marine environment that could be encountered under more dangerous conditions. No evidence was found of degradation to water or sediment quality due to Navy actions at DBRC Site (Battelle 2001). Therefore, implementation of the No-Action Alternative would have minimal impacts to sediment and water quality at DBRC Site.

3.6.2.3 Mitigation Measures

Since there would be minimal impacts to sediments and water quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.6.3 QUTR Site

3.6.3.1 Existing Conditions

The following existing conditions description is similar for the QUTR Site areas potentially affected by the Proposed Action and all three alternative surf-zone locations.

General Marine Environment

Hydrology. The waters along the Washington coast are dominated by the California Current and are considered to have the greatest volume of upwelling in North America. Upwelling occurs from February to September due to currents and wind driven factors, resulting in nutrient-rich waters (NOAA 1993). Bottom currents and winter storms aid in sediment transfer throughout the year. There is very little freshwater influence at the QUTR Site or in the vicinity of the proposed surf-zone locations.

Bathymetry. The QUTR Site extends beyond the OCNMS boundary, along the Washington coastline and encompasses about 51.8 nm^2 (177.7 km^2). The continental shelf is narrow and ranges in width from 8 to 40 mi (12.9 to 64.4 km). The Juan de Fuca and Quinault canyons reside within the shelf, and the continental slope has a steep upper portion and a gently sloping lower portion, grading into the Cascadia Basin.

Tides and Currents. The coast of Washington is located in an eastern boundary current system where the North Pacific Current divides into the northward flowing Alaskan Current and the southward flowing California Current (Navy 2006a). The California Current extends up to 620 miles offshore (1,000 km) and varies from 370 to 620 miles wide (600 to 1000 km). The current carries cold, nutrient-rich waters southward toward California. Flow is strongest at the surface, but the current extends through the water column to a depth of approximately 1,650 feet (500 m). The California Current is stronger and closer to shore during summer to fall, resulting in predominantly southward circulation at that time of year. As the current weakens and moves offshore during winter-spring, the northward-flowing Davidson Current strengthens, and circulation is predominantly northward (Navy 2006a). During the southward flow in spring and summer, northwesterly winds in combination with the earth's rotation cause surface waters to be deflected offshore. Washington coast and Strait of Juan de Fuca tide cycles are semidiurnal (i.e., twice each day) and mixed, averaging about 11.5 ft (3.5 m) each cycle.

Sea State. The outer coast is known for its rough seas and large waves. The height and direction of waves vary seasonally. During summer, waves are lower in height, predominantly from the northwest, causing longshore currents and sediment transport to the south. These types of sea conditions are often about 4 or less on the Beaufort scale. In winter, waves are generally higher than in the summer, and sea conditions can commonly be at 6 or higher on the Beaufort scale (NOAA 1993). Waves are often from the southwest, causing northerly longshore currents and sediment transport. Data from NOAA buoy 46211 (NOAA 2009) located off Grays Harbor show wave heights frequently exceeeding 13 ft (4 m), and occasionally exceeding 20 ft (6 m), each year during fall-winter (October-March) months. Waves 40 ft (12 m) high occurred in February 2006. Wave heights in excess of 50 ft (15.2 m) have been recorded on and beyond the continental shelf (NOAA 1993).

<u>Sediment Composition and Quality</u>

Glacial deposits comprise the underlying sediments of the continental shelf. Sediments along the southern Washington shelf are deposited by the Columbia River while sediment composition along the northern shelf is deposited by the Strait of Juan de Fuca (NOAA 1993). Sandy silt accumulates along the shelf. The inner shelf near the surf-zone locations is mainly composed of sand, while the outer shelf is primarily silt and clay. Sediment transport ultimately ends up in the Quinault Canyon and down into the Cascadia Basin.

<u>Water Quality</u>

Ocean waters in the QUTR Site and offshore from all of the proposed surf-zone locations are subject to more dynamic mixing influences (e.g., wind, waves) than the inland waters of Keyport Range and the DBRC Site. The coastal oceanic current system is composed of the California Current, Davidson Current, and California Undercurrent. The California Current flows southward beyond the continental shelf year-round, bringing with it low temperature and salinity, high oxygen, and high phosphate sub-arctic water.

The Davidson Current flows over the slope and outer shelf in winter and early spring, bringing the same water characteristics as the California Current. The California Undercurrent flows northward along the upper slope at a depth of 660 ft (201.2 m), bringing with it warmer water with a lower salinity, low oxygen, and low phosphates. In winter, the Washington Undercurrent flows deeper (1,300 ft [396.2 m]) along the slope (NOAA 1993).

Activities

Currently, various deep water test activities are conducted offshore in the QUTR Site (Table 2-9). As at the other two range sites within the NAVSEA NUWC Keyport Range Complex, vehicle propulsion, systems and activities (including UUVs), Fleet activities, and launch systems are tested within the QUTR site for NUWC Keyport activities. To ensure oil and hazardous material spills and accidental discharges are kept to a minimum, NUWC Keyport follows procedures outlined in the shipboard oil/hazardous substance contingency plans (OPNAVINST 5090.1C, Chapter 22) and the Commander, Navy Region Northwest Oil and Hazardous Substance Integrated Contingency Plan (COMNAVREGNWINST 5090.1). Under naval regulations, each vessel carries spill response equipment and has a shipboard spill contingency plan including protocols for contacting and obtaining assistance from Navy, Coast Guard, or State organizations as may be warranted. In addition, in the event of a spill affecting the outer coastal waters, including outside 12 nm, the Naval Sea Systems Command, Supervisor of Salvage and Diving (SUPSALV) is designated by the Navy to provide technical support and resources immediately upon request as circumstances warrant. SUPSALV provides technical expertise and rapid spill response capability that includes spill management, equipment operations, on-site training of local labor, recovered oil storage and full logistics support.

NUWC Keyport vessel discharge policy is that no shipboard waste materials are disposed at sea. Occasional accidental discharges of materials (e.g., leak of oils, fuel from test components) do occur within QUTR Site boundaries; however, such discharges are minimal and disperse over large areas due to ocean mixing. Fuel can spread at rates of about 300 ft (91.4 m) per hour on a calm day on the ocean; on a turbulent day (which is much more common for open ocean areas of the QUTR Site), this dispersion rate increases notably. Therefore, a volume of water initially affected by a discharge quickly spreads into a much larger volume. If this occurs, impacts are minimal because the spills are small, ocean currents dilute hazardous constituent concentrations, and it is extremely unlikely that the same volume of water is affected by more than one occurrence. Even if two accidental discharges were to occur simultaneously, it is unlikely that the two events affect the same volume of water.

As at the other range sites, some expendable materials are not retrievable and settle to the bottom. The pieces typically spread over a relatively large area in the open ocean. Even larger pieces do not affect sediment stability on the ocean bottom and cause only minimal disturbance relative to natural ocean processes (e.g., sedimentation, currents). Some hazardous constituent residue may remain on some of the expendable materials when they settle onto ocean bottom sediments. However, resultant water quality and sediment concentrations are minor and fall below federal guidelines for marine water quality and sediment quality.

3.6.3.2 Environmental Consequences

Under all of the alternatives, the number of days for offshore activities would increase by 2 days (to 16) and there would be 30 days of surf-zone testing where none had occurred before. The number of activities would also increase for 8 of the 19 existing test activities, with UAS tests being introduced where they have not occurred before. Under any of the proposed alternatives, offshore impacts would be similar because the range extension is the same; this also holds true for the surf-zone operational impacts because the three sites support the same offshore and on-shore conditions due to their close proximity to each other. Therefore, the following environmental consequences analysis would apply under all three alternatives.

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Occasional offshore and nearshore accidental discharges of materials (e.g., leak of oils, fuel from test components) would likely occur; however, such discharges would be minimal and disperse over large areas due to ocean mixing. Crawler UUVs conducting test activities in the nearshore environment can cause short-term, temporary increases in turbidity. However, these disturbances do not permanently disrupt nearshore sediments, and hazardous constituents are not associated with these activities. Components currently in place at QUTR (e.g., cables, junction boxes) would not have adverse effects on water or sediment quality. Constituents analyzed in the report for the DBRC Site (Battelle 2001) are the same types of constituents currently used and proposed for use at the QUTR Site. Concentrations of copper as well as other metals tested (Cd, Li, Pb, Zn, and Zr) were all below Washington State SQS criteria (Navy 2002a). Historically, once cables and other materials are in place, they are not expected to move and would essentially become a new substrate. The cables consist of metallic and synthetic materials that are essentially inert (glass fibers, plastic, waterproof nylon yarn) that, based on observations of submarine cables on the seabed (e.g., Monterey Bay Aquarium Research Institute 2003; Ocean City Reef Foundation 2004), would become encrusted with organisms and would not break down for a very long period of time, if at all. Ultimately, as these components disintegrate, decompose, or corrode, the constituent elements would be dispersed into surrounding media, with no detectable impact on sediment or water quality. Therefore, impacts to sediments and water quality under Alternative 1 would be minimal.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Occasional offshore and nearshore accidental discharges of materials (e.g., leak of oils, fuel from test components) would likely occur; however, such discharges would be minimal and disperse over large areas due to ocean mixing. Crawler UUVs conducting test activities within the nearshore environment can cause short-term, temporary increases in turbidity. However, these disturbances do not permanently disrupt nearshore sediments, and hazardous constituents are not associated with these activities. Components currently in place at QUTR (e.g., cables, junction boxes) would not have adverse effects on water or sediment quality. Constituents analyzed in the report for the DBRC Site (Battelle 2001) are the same types of constituents currently used and proposed for use at the QUTR Site. Concentrations of copper as well as other metals tested (Cd, Li, Pb, Zn, and Zr) were all below Washington State SQS criteria (Navy 2002a). Historically, once cables and other materials are in place, they are not expected to move and would essentially become part of the substrate. The cables consist of metallic and synthetic materials that are essentially inert (glass fibers, plastic, waterproof nylon yarn) that, based on observations of submarine cables on the seabed (e.g., Monterey Bay Aquarium Research Institute 2003; Ocean City Reef Foundation 2004), would become encrusted with organisms and would not break down for a very long period of time, if at all. Ultimately, as these components disintegrate, decompose, or corrode, the constituent elements would be dispersed into surrounding media, with no detectable impact on sediment or water quality. Therefore, impacts of Alternative 2 to sediments and water quality would be minimal.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Occasional offshore and nearshore accidental discharges of materials (e.g., leak of oils, fuel from test components) would likely occur; however, such discharges would be minimal and disperse over large areas due to ocean mixing. Crawler UUVs conducting test activities within the nearshore environment can cause short-term, temporary increases in turbidity. However, these disturbances do not permanently disrupt nearshore sediments, and hazardous constituents are not associated with these activities. Components currently in place at QUTR (e.g., cables, junction boxes) would not have adverse effects on water or sediment quality. Constituents analyzed in the report for the DBRC Site (Battelle 2001) are the same types of constituents currently used and proposed for use at the QUTR Site. Concentrations of copper as well as other metals tested (Cd, Li, Pb, Zn, and Zr) were all below Washington State SQS criteria (Navy 2002a). Historically, once cables and other materials are in place, they are not expected to move and would essentially become part of the substrate. The cables consist of metallic and synthetic materials that are essentially inert (glass fibers, plastic, waterproof nylon yarn) that, based on observations of submarine cables on the seabed (e.g., Monterey Bay Aquarium Research Institute 2003; Ocean City Reef Foundation 2004), would become encrusted with organisms and would not break down for a very long period of time, if at all. Ultimately, as these components disintegrate, decompose, or corrode, the constituent elements would be dispersed into surrounding media, with no detectable impact on sediment or water quality. Therefore, impacts of Alternative 3 to sediments and water quality would be minimal.

No-Action Alternative

Implementation of the No-Action Alternative would result in minimal impacts to sediment and water quality at the QUTR Site. The range would continue to be used for Navy activities within the existing QUTR Site boundaries, with no change in activities or equipment used. No increased use of the surf zone would occur, though monitoring and maintenance of the cabling and equipment at Kalaloch would continue.

3.6.3.3 Mitigation Measures

Since there would be minimal impacts to sediments and water quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.7 CULTURAL RESOURCES

Cultural resources are defined as any prehistoric or historic sites, buildings, districts, structures, traditional use areas, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. Cultural resources are generally divided into three groups: archaeological resources (both historic and prehistoric), architectural resources, and traditional cultural resources. Since there would be no construction and all proposed activities would occur either within the offshore (i.e., underwater or on the water's surface) or nearshore (i.e., beach, intertidal) environment, the following discussion focuses on those cultural resources that occur either in the marine or nearshore environment. These resources include submerged sites, shipwrecks, shell middens, and other beach-oriented sites, and traditional resources related to fishing and other marine or nearshore resources.

Archaeological Resources

Prehistoric and historic archaeological resources are locations (sites) where human activity measurably altered the earth or left deposits of physical remains. Prehistoric sites consist of various forms of evidence indicative of human activities that spanned the time from about 9,000 years ago until the time of the first European contact in 1635. Most frequently, such sites contain both surface and subsurface elements.

Underwater archaeological resources are defined as submerged sites having some cultural affiliation. These can take the form of prehistoric sites or isolated prehistoric artifacts; or can be submerged historic shipwrecks or pieces of ship components, such as cannons or guns.

Traditional Cultural Resources

Traditional cultural resources are resources associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Traditional cultural resources may include archaeological sites, locations of historic events, sacred areas, sources of raw materials used to produce tools and sacred objects, traditional hunting or gathering areas, and usual and accustomed Tribal fishing grounds. The community may consider these resources essential for the persistence of their traditional culture.

A federal court ruling on February 12, 1974 granted Western Washington Native American Indian Tribes and Nations access to "usual and accustomed fishing grounds and stations" (U.S. District Court 1974). The "Boldt Decision" reaffirmed the fishing rights stated in the treaties with the U.S. Government in the 1850s. The decision further affirmed that treaty tribes have the right to an equal share of the annual catch, thus allowing Western Washington tribes the right to fish at usual and accustomed grounds and stations. These types of fishing activities are addressed in this section under the Traditional Cultural Resources heading for each range site.

Research Methodology

Under federal laws and regulations, only significant cultural resources warrant consideration with regard to adverse impacts resulting from federal activities. Significant archaeological and architectural resources include those that are listed, eligible, or are recommended as eligible for inclusion in the National Register of Historic Places (NRHP). The significance of cultural resources is evaluated according to the NRHP eligibility criteria (36 CFR 60.4), in consultation with the State Historic Preservation Officer (SHPO). According to these criteria, "significance" is present in districts, sites, buildings, structures, and objects that:

- are associated with events that have made a significant contribution to the broad patterns of history;
- are associated with the lives of persons significant to the past;
- embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history.

There are no legally-established criteria for assessing the importance of a traditional cultural resource. These criteria must be established primarily through consultation with Native American Indian Tribes and Nations. When applicable, consultation with other affected groups provides the means to establish the importance of their traditional resources. They may also be derived from 36 CFR 60.4 and from the Advisory Council on Historic Preservation guidelines. Information on the locations of resources, the probability of affecting currently unknown resources, and the general prehistory and history of the area was derived from the State of Washington Office of Archaeology and Historic Preservation site files, the *Integrated Cultural Resources Management Plan* for NUWC Keyport, other environmental documents from the area, and the *Northern Shipwrecks Database* (Northern Maritime Research 2002).

<u>Government-to-Government Consultations</u>

NUWC Keyport held a number of Government-to-Government consultations between November 5 and December 1, 2003. The purpose was to present the Proposed Action and alternatives of the EIS/OEIS and to initiate consultations. The following Native American Indian Tribes and Nations were involved in these consultations (listed in alphabetical order): Hoh Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Port Gamble S'Kallam Tribe, Quileute Tribe, Quinault Nation, Skokomish Tribe, and Suquamish Tribe. The Makah Tribe was sent a letter discussing the proposed project; however, no meeting was requested by the tribe. Additionally, Point No Point Treaty Council was notified. Some of the main concerns of the Native American Indian Tribes and Nations included potential restricted access to beach areas and usual and accustomed fishing (e.g., shellfish) grounds, potential damage to fishing gear, and effects to returning salmon in the streams.

3.7.1 Keyport Range Site

3.7.1.1 Existing Conditions

<u>Background</u>

Native American Indian History

The northern portions of the Kitsap Peninsula, including NUWC Keyport, were within the traditional territories of the Suquamish Tribe. Suquamish villages were most often located at protected bays with sources of fresh water. The Native Americans built cedar plank houses that were home to several related families. Basic food sources for the Suquamish included salmon, shellfish, land mammals, berries, freshwater fish, and a variety of wild plants. With the Europeans' arrival in the 1840s, the Suquamish and several other tribes negotiated a treaty creating reservations in 1855, including the Port Madison Indian Reservation across Liberty Bay from NUWC Keyport. There are various Suquamish cultural resource sites, mainly small shell middens, on the beaches surrounding the Keyport Range Site (OAHP [Office of Archeology and Historic Preservation] 2005a).

European-American History

During the 1840s and 1850s, settlement of the area by Europeans and Americans began to increase. The first homesteaders in the future Keyport town site settled in the area in 1880. Consisting mostly of poultry farmers, cattle ranchers, and fisherman, the town was named Keyport in 1900 because of its location as the "key" to the rest of the bay. The Navy selected Keyport as the site for a new Pacific Coast Naval Station in 1910, with the mission to store, modify, repair, and test torpedoes. Through various name changes and wars, the base, now named NUWC Keyport, continues to perform its original and revised missions of underwater weapon proofing and testing.

Archaeological Resources

No prehistoric archaeological resources have been identified in the offshore areas (including the lagoon) and proposed extension; however, shell midden sites are found on the beaches surrounding the Keyport Range Site. For historic archaeological resources, four shipwrecks are located within or in the vicinity of the Keyport Range Site and the proposed extension (Navy 2003b, Northern Maritime Research 2002). Although not listed on the NRHP, these shipwrecks are potentially eligible for the NRHP. They are shown on Figure 3.7-1. A description of the ships and their fate is listed in Table 3.7-1.

Table 3.7-1 Known Shipwrecks within or Adjacent to Keyport Range Site

Ship Name	*Location*	*Description*
Laurel	Off Port Orchard Reach at the southeastern beach of NUWC Keyport	16-ton wooden fishing boat that burned and sank in 1906.
Elk	Off Port Orchard Reach at the southeastern beach of NUWC Keyport	25-ton wooden towing vessel that burned and sank in 1911.
A.R. Robinson	Off Port Orchard Reach near Burke Bay	36-ton wooden towing vessel that burned and sank in 1911.
R.M. Hasty	Off Port Orchard Reach near the mouth of Fletcher Bay	11-ton wooden passenger ship that burned and sank in 1921.

Source: Navy 2003b, Northern Maritime Research 2002.

Traditional Cultural Resources

The Suquamish Tribe has usual and accustomed fishing rights near the Keyport Range Site as part of their "usual and accustomed fishing places" rights established by the Point No Point Treaty. More information on fish is presented in Section 3.4.

3.7.1.2 Environmental Consequences

A proposed action or alternative affects a significant cultural resource if it alters the property's characteristics. These characteristics include relevant features of its environment or use that qualify it as significant according to NRHP criteria or, in the case of traditional cultural properties, to Tribal sources. Effects may include physical destruction, damage, or alteration of all or part of the resource; alteration of the character of the surrounding environment that contributes to the resource's qualifications for the NRHP; introduction of visual, audible, or atmospheric elements that are out of character with the resource or alter its setting; or neglect of the resource resulting in its deterioration or destruction. Effects to traditional cultural properties may include visual or audible intrusions or disruption of the setting of culturally significant locations or resources.

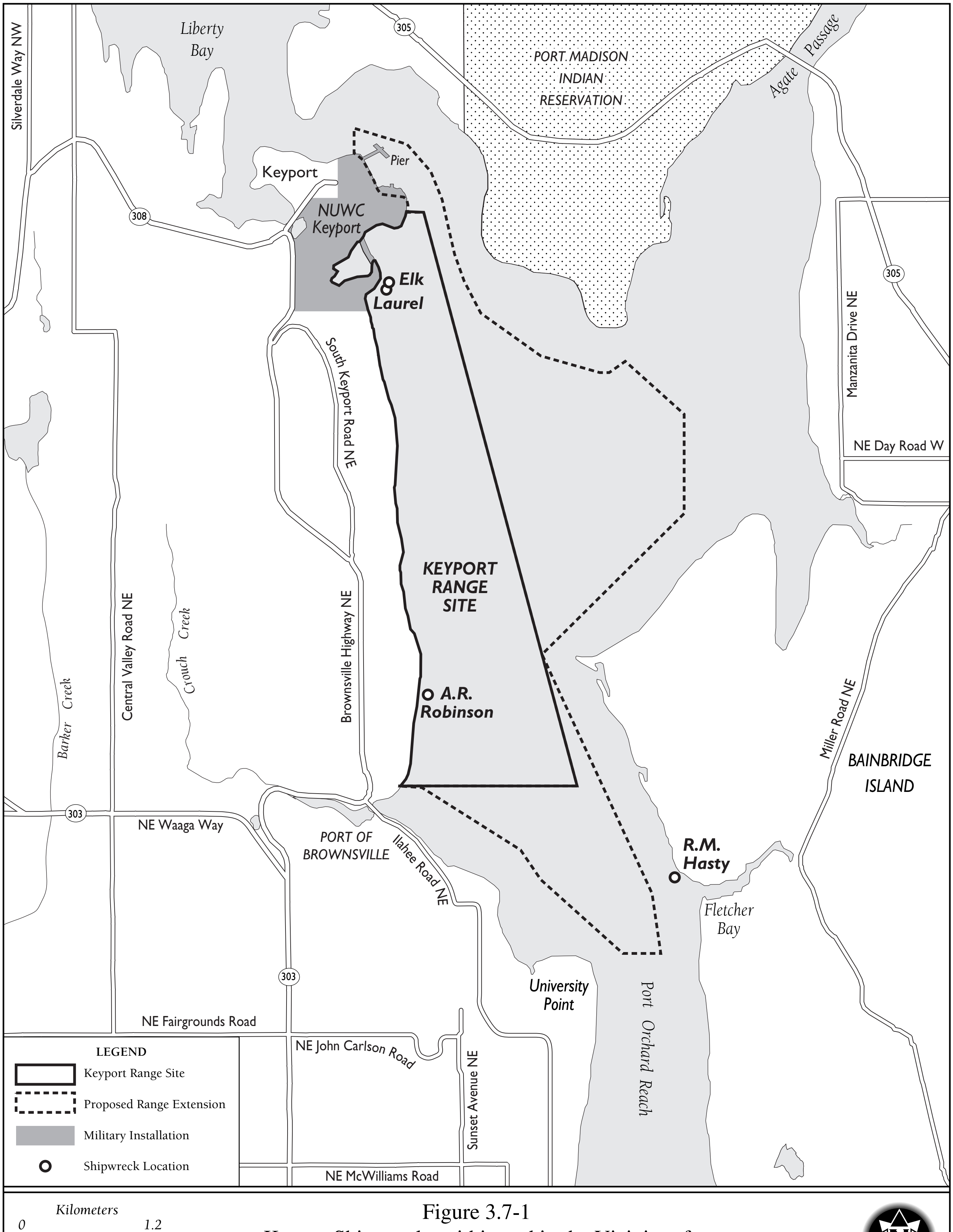


Figure 3.7-1
Known Shipwrecks within and in the Vicinity of the Keyport Range Action Area

Keyport Range Alternative 1 – Preferred Alternative

Activities within the Keyport Range Site and extension areas include mine hunting and clearing exercises and UUV testing. Mine hunting and clearing involves placing a series of inert mine shape targets made from plastic, metal, or concrete measuring about 10 by 1.75 ft (3 by 0.5 m) and weighing about 800 lbs (362 kg) on the bottom in offshore areas of the range. UUVs are small, remotely operated vehicles that are operated either in the offshore (swimmer UUV) or nearshore (crawler UUV) areas.

All proposed activities would be conducted in accordance with the provisions of the NUWC Keyport *Integrated Cultural Resources Management Plan* (Navy 2003a), which includes procedures for avoiding known resources and dealing with unanticipated discoveries of cultural resources. Most activities would be confined within the center portions of the range, with the exception of the beaches on Navy property at NUWC Keyport (Figure 2-4a). With implementation of Alternative 1, crawler UUVs would conduct test activities within the nearshore environment and up onto the beach at various locations, including the lagoon. Archaeological sites, such as the shell middens, would be avoided (as is currently done) during testing activities and would not be disturbed. Furthermore, since the crawler UUVs are small remotely operated vehicles, any accidental disturbance by the UUVs would not be likely to result in physical destruction, damage, or alteration of the sites. Therefore, no impacts to archaeological resources would occur.

The three shipwrecks located within the current and proposed range boundaries are potentially eligible for the NRHP. However, they are unlikely to be affected during normal activities as proposed underwater vehicle testing would avoid the area around shipwrecks. Therefore, implementation of Alternative 1 would have no effects on NRHP listed or eligible properties (including shipwrecks) and would be in compliance with Section 106 of the National Historic Preservation Act.

Communications have been initiated between Navy representatives from NUWC Keyport and representatives of the Suquamish Tribe as part of the EIS/OEIS process for the Keyport Range Site. NUWC Keyport representatives met with the Suquamish Tribe on November 5, 2003 to initiate Government-to-Government consultation. Issues discussed at the meeting included access to fishing grounds, potential damage to fishing gear, sediment disturbance, communications, and information sharing. Communications currently occur between NUWC Keyport and the Suquamish Tribe, but no formal process has been established for activities at the Keyport Range Site. NUWC Keyport would establish a communication process with the Suquamish Tribe similar to the process established with affected tribes for the DBRC Site. This would establish points of contact to exchange information on NUWC Keyport testing activity and Suquamish Tribe fishing regulations in order to avoid disruption of Tribal usual and accustomed fishing patterns. Therefore, implementation of Alternative 1 would not result in adverse effects to historic resources, cultural resources, or to "usual and accustomed fishing places" rights.

No-Action Alternative

Implementation of the No-Action Alternative would have no effects to historic or cultural resources as existing activities would continue and the range boundaries would not be extended. Under the No-Action Alternative, NUWC Keyport would establish a communication process with the Suquamish Tribe similar to the process established with affected tribes for the DBRC Site. This would establish points of contact to exchange information on NUWC Keyport testing activity and Suquamish Tribe fishing regulations in order to avoid disruption of Tribal usual and accustomed fishing patterns. Therefore, implementation of the No-Action Alternative would not result in adverse effects to historic or cultural resources.

3.7.1.3 Mitigation Measures

Mitigation measures to ensure no impacts to cultural and historical resources would include: 1) avoidance of structural remnants of shipwrecks; 2) exchange of information with the Suquamish Tribe on activities to avoid disruption of Tribal usual and accustomed fishing patterns; and 3) avoidance of archaeological sites. NUWC Keyport would notify the affected Tribe when NUWC Keyport activities are scheduled on the range site. If unknown cultural resources are found, the Navy would coordinate with the Suquamish Tribe and with SHPO to determine the appropriate course of action.

3.7.2 DBRC Site

3.7.2.1 Existing Conditions

Background

Native American Indian History

Review of previous archaeological studies, ethnographic data (i.e., information about human life and traditions), and project area landforms noted on NOAA chart 18007 indicate a moderate probability for hunter-fisher-gatherer and historic archaeological resources at the Range Control Center at Zelatched Point, the Whitney Point land-based facility, and the warning light locations at Zelatched Point, tower and van at Whitney Point, Pulali Point, Sylopash Point, and the southeast edge of Bolton Peninsula (Navy 2002a).

The DBRC Site and the proposed extension areas are within the territory of the Twana people, who had winter villages on both sides of Hood Canal, including the Quilcene and Dabob grounds near the waters of the Dabob Bay. They frequented Dabob Bay and surrounding beaches for seasonal salmon fishing and clam digging. The Twana, whose descendents now comprise the Skokomish Tribe, assigned place names to four shoreline areas in the DBRC Site:

- Whitney Point was a summer campsite;
- “Pulali”, as in Pulali Point, was probably derived from the native name of a wild cherry, *Pulela*;
- Zelatched Point was a summer campsite; and
- Sylopash Point was likely named for a probable mythological site.

Neighboring tribes, including the Chemakum (now diminished to the point that it is no longer considered a surviving tribe), Klallam, and Suquamish people, also used Hood Canal for summer fishing and gathering. Descendants of the Klallam are currently members of the Jamestown S’Klallam Tribe, Lower Elwha Klallam Tribe, and Port Gamble S’Klallam Tribe (in alphabetical order). The Suquamish are members of the contemporary Suquamish Tribe (Navy 2002a).

Shell midden sites and historic deposits demonstrate the types of archaeological materials that can occur on the shoreline access areas of the DBRC Site, including the shores of Naval Base Kitsap-Bangor. Shell middens tend to be associated with sandspits and near streams adjacent to DBRC Site, which means that shoreline areas designated for project activity and access have a moderate probability for hunter-fisher-gatherer shell middens.

Government-to-Government Consultation

During Government-to-Government consultation for the DBRC EA and FONSI (Navy 2002a), NUWC Keyport representatives coordinated with the chairs, cultural representatives, and fisheries representatives of each of the Tribal governments with documented presence in Hood Canal. These included (in alphabetical order): the Jamestown S'Klallam Tribe, the Lower Elwha Klallam Tribe, the Port Gamble S'Klallam Tribe, and the Skokomish Tribe. Government-to-Government consultation was conducted to discuss potential conflicts between Tribal usual and accustomed fishing and NUWC Keyport's activities in the DBRC Site. The Point No Point Treaty Council was also included in the discussions. After some information exchange, a draft communication protocol was provided to the Tribes and comments were incorporated. Finalization of the DBRC EA and FONSI established an information exchange between the Tribes and the Navy; the Tribes send fishing regulations to NUWC Keyport each year, and NUWC Keyport maintains communications about upcoming testing activities.

Euroamerican History

The first Euroamericans to inhabit this area worked in logging camps and sawmills. The waters of Hood Canal were used to transport lumber to outside markets. Families arrived by boat to establish ranches on cleared timber forests. Oyster farms were established on Quilcene Bay in the 1930s and became an important industry. The naval facility at Whitney Point was built in the mid 1950s and then replaced by the Zelatched Point facility 10 years later. Shoreline access areas also have a moderate probability for historic period resources (Navy 2002a).

Archaeological Resources

No prehistoric archaeological resources have been identified in the waterways of the DBRC. However, there are shell midden sites, some potentially eligible or eligible for listing on the NRHP, on the beaches surrounding the DBRC Site (Navy 2002a). For historic archaeological resources, six possible shipwrecks are located within the vicinity of the DBRC Site (Figure 3.7-2). Although not listed on the NRHP, these shipwrecks are potentially eligible for the NRHP. A description of the ships and their fate is in Table 3.7-2.

Maps at the University of Washington Libraries as well as the *Northern Shipwrecks Database* provide fixed locations within the DBRC for the *Curlew*, *Nokomis*, and *Orion* (Northern Maritime Research 2002). The fixed location of the steamer *Union* is just outside the DBRC Site in Thorndyke Bay. The reported, but not confirmed, location for the shipwreck BC Company No. 4 is also shown. An unknown shipwreck lies west of Naval Base Kitsap-Bangor. It is important to note that shipwreck locations are influenced by tides and storms and can shift up to 1 mi (1.6 km) in any direction from the location shown (Navy 2002a).

Table 3.7-2 Known Shipwrecks within or Adjacent to DBRC Site

Ship Name	*Location*	*Description*
Orion	Off Pulali Point in Dabob Bay MOA	11-ton vessel burned and sunk
BC Company No. 4	Off southern point of Toandos Peninsula within Connecting Waters	12-ton vessel lost and exact location unknown
Union	In Thorndyke Bay outside of Hood Canal North MOA	31-ton vessel burned and sunk
Curlew	Off Vinland on Hood Canal in Hood Canal North MOA	11-ton vessel burned and sunk
Nokomis	Off Lofall on Hood Canal in Hood Canal North MOA	Namesake of famous wreck in Mexico
Unknown	Off Naval Base Kitsap-Bangor in Hood Canal South	Unknown

Sources: Navy 2002a; Northern Maritime Research 2002.

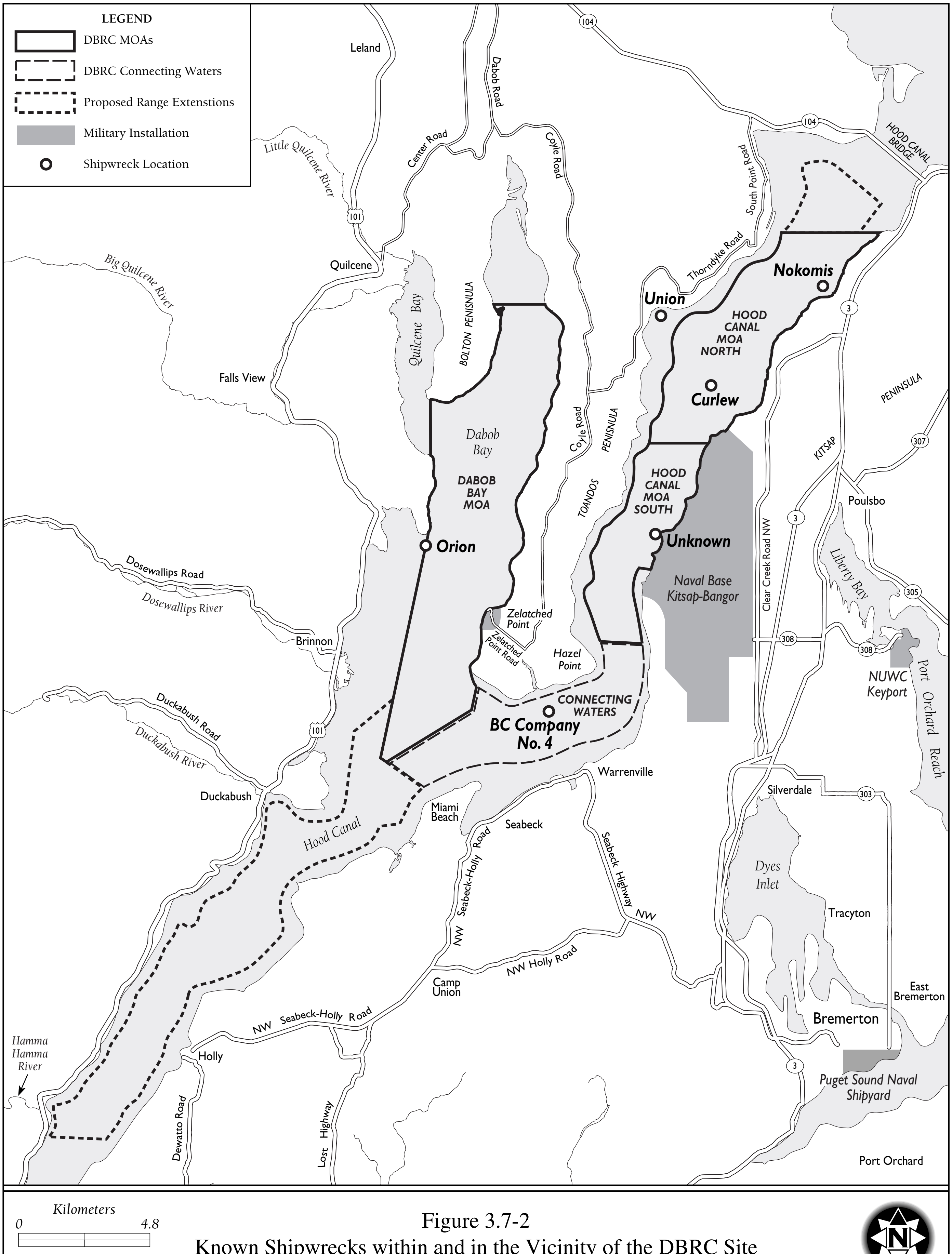


Figure 3.7-2
Known Shipwrecks within and in the Vicinity of the DBRC Site

Traditional Cultural Resources

The following Native American Indian Tribes and Nations (listed in alphabetical order) have primary usual and accustomed fishing rights on Dabob Bay and Hood Canal as part of their "usual and accustomed fishing places" rights established by the Point No Point Treaty: Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Port Gamble S'Klallam Tribe, and Skokomish Tribe. The Suquamish Tribe has secondary rights (i.e., members may fish only by invitation from the Tribe with primary rights). These Tribes fish regularly in the area of activities for salmon, geoduck, crab, shrimp, and other shellfish. In particular, there are rich beds of shellfish along the shores of Dabob Bay and Hood Canal that form the basis for important Tribal usual and accustomed fishing practices. More information on fish in the Hood Canal is presented in Section 3.4.

3.7.2.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension)

Activities at the DBRC Site Alternative 1 would be similar to those discussed under the Keyport Range Site including mine hunting and clearing and UUV testing. All proposed activities would be conducted in accordance with the provisions of the NUWC Keyport *Integrated Cultural Resources Management Plan* (ICRMP) (Navy 2003a), which includes procedures for avoiding known resources and dealing with unanticipated discoveries of cultural resources. Most RDT&E and other NUWC Keyport test and training activities would continue to be confined within the boundaries of the range and would primarily occur in the water in the center portions of the range. However, crawler UUVs would continue to conduct test activities within the nearshore environment at various locations in the DBRC Site. Archaeological sites, such as the shell middens, would be avoided during testing activities and would not be disturbed. Furthermore, since the crawler UUVs are small remotely operated vehicles, any accidental disturbance by the UUVs would not be likely to result in physical destruction, damage, or alteration of the sites. Therefore, no impacts to archaeological resources would occur. The five shipwrecks located within the range boundaries are potentially eligible for the NRHP. Therefore, implementation of DBRC Alternative 1 would have no effects on NRHP listed or eligible properties (including shipwrecks) and would be in compliance with Section 106 of the NHPA.

Communications have been initiated between Navy representatives from NUWC Keyport and Tribal representatives as part of the EIS/OEIS process for the DBRC Site. NUWC Keyport representatives met with the representatives from the following tribes on November 5, 2003 (in alphabetical order): Jamestown S'Klallam Tribe, the Lower Elwha Klallam Tribe, the Port Gamble S'Klallam Tribe, and the Skokomish Tribe. The Point No Point Treaty Council was also included in the discussions. The purpose was to present the Proposed Action and alternatives of the EIS/OEIS and to initiate consultations. Issues discussed at the meeting included access to fishing grounds. NUWC Keyport would continue established communication protocols. Therefore, implementation of Alternative 1 would not result in adverse effects to historic resources, archaeological resources, or to "usual and accustomed fishing places" rights.

DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)

Implementation of Alternative 2 would result in the same effects to historic and archaeological resources as previously described under Alternative 1, although it includes an additional extension to the north of the Hood Canal MOA North. Crawler UUVs would continue to conduct test activities within the nearshore environment and up onto the beach at various locations in the DBRC Site. Archaeological sites, such as the shell middens, would be avoided during testing activities and would not be disturbed. Furthermore, since the crawler UUVs are small remotely operated vehicles, any accidental disturbance by the UUVs would not be likely to result in physical destruction, damage, or alteration of the sites. Since most RDT&E and other NUWC Keyport managed activities would continue to be confined within the boundaries of the range and would primarily occur in the water in the center portions of the range, these tests would avoid known archaeological sites. All activities would continue to be conducted in accordance with the provisions of the NUWC Keyport ICRMP (NUWC Keyport 2003). Therefore, implementation of Alternative 2 would have no effects on NRHP listed or eligible properties (including shipwrecks) and would be in compliance with Section 106 of the NHPA.

Communications have been initiated between Navy representatives from NUWC Keyport and Tribal representatives as part of the EIS/OEIS process for the DBRC Site. NUWC Keyport representatives met with the following tribes on November 5, 2003 (in alphabetical order): Jamestown S'Klallam Tribe, the Lower Elwha Klallam Tribe, the Port Gamble S'Klallam Tribe, and the Skokomish Tribe. The Point No Point Treaty Council was also included in the discussions. The purpose was to present the Proposed Action and alternatives of the EIS/OEIS and to initiate consultations. Issues discussed at the meeting included access to fishing grounds. NUWC Keyport would continue established communication protocols. Therefore, implementation of Alternative 2 would not result in adverse effects to historic resources, archaeological resources, or to "usual and accustomed fishing places" rights.

<u>No-Action Alternative</u>

Implementation of the No-Action Alternative would have no effects to historic resources, cultural resources, or to "usual and accustomed fishing places" rights as existing activities would continue and the range boundaries would not be extended. NUWC Keyport would continue the established information exchange with the affected Tribes. Therefore, implementation of the No-Action Alternative would not result in adverse effects to historic or cultural resources.

3.7.2.3 Mitigation Measures

Mitigation measures to ensure no impacts to cultural and historic resources would include: 1) avoidance of structural remnants of shipwrecks; and 2) avoidance of archaeological sites. If unknown cultural resources are found, the Navy would coordinate with the Tribal governments and with SHPO to determine the appropriate course of action.

3.7.3 QUTR Site

3.7.3.1 Existing Conditions

<u>Background</u>

Native American Indian History

Part of the northern shoreline facing the QUTR Site comprises the coastal land of the Quinault Indian Nation, consisting of the Quinault and Queets tribes and descendants of five other coastal tribes, the Chehalis, Chinook, Cowlitz, Hoh, and Quileute peoples (listed alphabetically) (Quinault Indian Nation 2003). The people known as the Quinault lived on the entire Olympic Peninsula before European contact occurred around 1775, when the first recorded Spanish ship landed at Point Grenville. Fishing was the main resource for the Quinault, with nets made from cedar fibers and the nettle plant. Five species of salmon, razor clams, mussels, oysters, mud clams, sea anemones, smelts, crab, and halibut were collected (Chubby 2002). In addition, the Hoh Tribe, neighbors and those ancestrally connected to the Quinault consider Destruction Island, underlying the northern portion of W-237, to be spiritually important to their people.

Euroamerican History

The first recorded Spaniards landed a ship, commanded by Bruno Meceta and Bodega Y. Quandra, on July 14, 1775. They were followed later by the English and other European nationalities.

Archaeological Resources

No prehistoric archaeological resources have been identified in the offshore areas of the QUTR Site and proposed extension. However, nine shell midden sites are located on the beaches near the QUTR alternative surf-zone access areas. There are identified archaeological sites at Ocean City and at Pacific Beach, which are two of the options for surf zones. However, these sites are not near the beach access roads that would be used by any vehicles proposed for testing on QUTR Site (OAHP 2005b).

Four shipwrecks are within the vicinity of QUTR Site and are shown on Figure 3.7-3. In addition, 14 possible unconfirmed shipwrecks also lie within the vicinity of QUTR Site. Although not listed on the NRHP, these shipwrecks are potentially eligible for the NRHP. A description of the ships and their fate is in Table 3.7-3. The *Northern Shipwrecks Database* provides locations for the *Skagit Chief, Ferndale, John C. Kirkpatrick,* and *Emily Farnum*. The reported but not confirmed locations for the shipwrecks *Abercorn, Zinita, Courser, Pinmore, Falls of Dee, Lilly Grace, Emma Claudina, Mary Ann, Lake Gebhart*, *Halco, Janet Carruthers, Tellus,* and two other unknown ships are not shown but are described in the table (USACE 1986; Northern Maritime Research 2002). It is important to note that shipwreck locations are influenced by tides and storms and can shift in any direction from the location shown.

There are also four naval aircraft wrecks known to be in the vicinity of QUTR Site, as shown in Figure 3.7-3. A description of these aircraft is also in Table 3.7-3. These locations are approximate, as tides and storms can also shift wreckage in any direction from the original confirmed location (OAHP 1996). Although not listed on the NRHP, the aircraft wrecks are potentially eligible for the NRHP.

One NRHP-eligible site lies in the vicinity of QUTR Site (OAHP 2005a). The Destruction Island Light Station, located on Destruction Island to the northeast of the range, is a functioning light station that was finished and put into service in November 1891. A first-order Fresnel lens warns mariners from the rocky and dangerous island coast, the operation of which was automated in 1963. The masonry tower is 94-ft (29-m) high, sheathed in curved iron plates painted white (Gibbs 1997).

Traditional Cultural Resources

Both the Hoh Tribe and the Quinault Nation have usual and accustomed fishing rights within the existing QUTR Site boundaries. For the proposed QUTR Site extension, the Hoh Tribe, Quileute Tribe, and the Quinault Nation have usual and accustomed fishing rights. More information on fish is presented in Section 3.4.

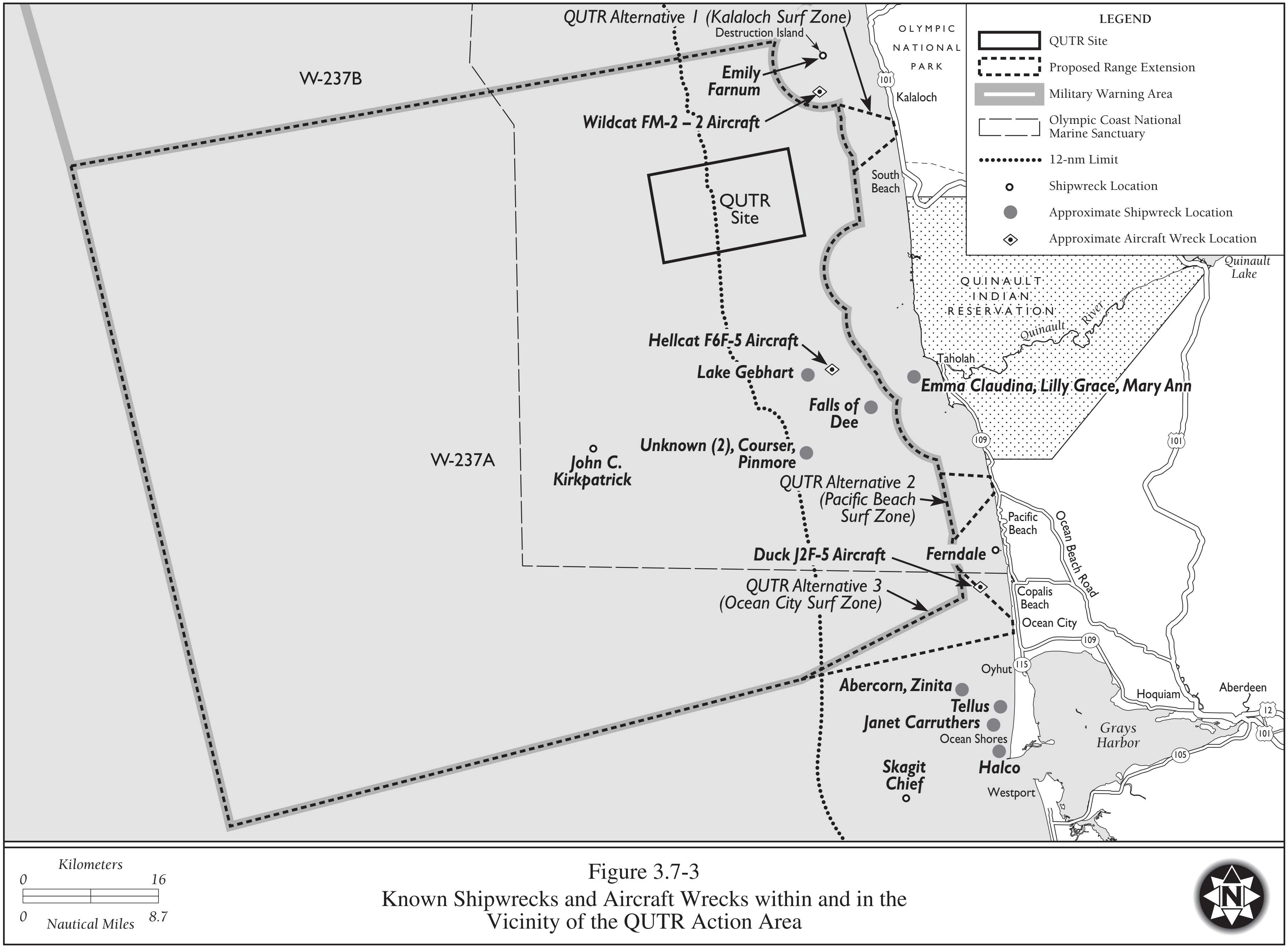


Figure 3.7-3
Known Shipwrecks and Aircraft Wrecks within and in the Vicinity of the QUTR Action Area

Table 3.7-3 Known Shipwrecks and Aircraft Wrecks within or Adjacent to QUTR Site

Name or Type	*Description*
Ships	
Skagit Chief	A side-wheeler vessel foundered near Grays Harbor
Ferndale	A barq that stranded in fog north of Grays Harbor
John C. Kirkpatrick	A freighter that went missing and apparently sank northwest of Grays Harbor
Emily Farnum	A clipper that was stranded and wrecked due to a storm, near Destruction Island
Abercorn	An iron barq that stranded and wrecked due to fog, north of Ocean Shores
Zinita	A steel barq that stranded north of Grays Harbor, with partial loss
Courser	A wrecked schooner north of Point Grenville
Pinmore	An abandoned barq north of Point Grenville
Falls of Dee	A damaged iron sailing ship north of Point Grenville
Lilly Grace	A stranded wooden barq off Santiago Beach
Emma Claudina	A schooner that foundered in a gale off Cape Elizabeth
Mary Ann	Sank of unknown causes west-southwest of Cape Elizabeth
Lake Gebhart	A steel steamship that was stranded and abandoned in fog off Johnson's Reef
Halco	A steamship with unknown cargo
Janet Carruthers	A Canadian schooner with unknown cargo
Tellus	A Norwegian steamship with unknown cargo
Aircraft	
Wildcat FM-2	A naval fighter, collided with another FM-2 and sank 3 mi south of Destruction Island
Wildcat FM-2	See previous
Hellcat F6F-2	A naval fighter
Duck J2F-5	A utility amphibious aircraft, sank 2 mi off Copalis Beach; the fuselage was recovered but the wings and floats were lost at sea.

Sources: USACE 1986; OAHP 1996; Northern Maritime Research 2002; Global Aircraft 2005.

3.7.3.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Though various cultural resource sites lie on the beaches facing QUTR Site, no range activities involve using beach land except at the Kalaloch surf zone. Under Alternative 1, crawler UUVs would conduct test activities in the nearshore environment and up onto the beach. However, there are no known cultural resources at that beach area. All other activities are confined within the boundaries of the range offshore. Therefore, these resources would not be disturbed and impacts would not occur.

The aircraft wrecks and shipwrecks physically within the proposed range boundaries are potentially eligible for the NRHP. However, they are unlikely to be affected during normal activities as the proposed underwater vehicle testing would avoid the areas around the wrecks. Also, proposed range site activities would not occur at the Destruction Island Light Station. Therefore, Alternative 1 would have no effects on NRHP listed or eligible properties (including aircraft wrecks and shipwrecks) and would be in compliance with Section 106 of the National Historic Preservation Act.

Communications were initiated between Navy representatives from NUWC Keyport and representatives of the affected Tribes and Nation for the QUTR Site. Navy representatives met with the Hoh Tribe on November 6, 2003, the Quileute Tribe on November 12, 2003, and the Quinault Nation on November 8, 2003 to initiate Government-to-Government consultation. Issues discussed with the Hoh Tribe included impacts to nearshore habitat and questions about various testing activities. With the Quileute Tribe, issues centered on access to fishing grounds in the extended operating areas, electronic interference with navigation gear, effects on usual and accustomed fishing, communications, sonar use, alternatives, and information sharing. With the Quinault Nation, issues centered on the location of surf-zone access, the timing of the various fishing seasons, information sharing, retrieval of equipment, sonar use, and development of a Memorandum of Understanding. NUWC Keyport would establish a communication process with the Hoh Tribe, Quileute Tribe, and Quinault Nation similar to the process established with affected tribes for the DBRC Site. This would establish points of contact to exchange information on NUWC Keyport testing activity and Tribal fishing regulations in order to avoid disruption of Tribal usual and accustomed fishing patterns. Therefore, implementation of Alternative 1 would not result in adverse effects to historic resources, cultural resources, or to "usual and accustomed fishing places" rights.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Though various cultural resource sites lie on the beaches facing the QUTR Site, no range activities involve using beach land except at the Pacific Beach surf zone. With implementation of Alternative 2, crawler UUVs would conduct test activities within the nearshore environment and up onto the beach. Although there are archaeological sites within 1 mi (1.6 km) of Pacific Beach, there are no known archaeological resources at that location. The known cultural resources at Pacific Beach are not on the beach or along the beach access road that would be used by range vehicles to get to the beach. All other activities are confined within the boundaries of the range offshore. Therefore, with implementation of Alternative 2, these resources would not be disturbed and impacts would not occur.

The aircraft wrecks and shipwrecks physically within the proposed range boundaries are potentially eligible for the NRHP. However, they are unlikely to be affected during normal activities since proposed underwater vehicle testing would avoid the areas around the wrecks. Also, proposed range site activities would not occur at the Destruction Island Light Station. Therefore, implementation of Alternative 2 would have no effects on NRHP listed or eligible properties (including aircraft wrecks and shipwrecks) and would be in compliance with Section 106 of the NHPA.

Communications were initiated between Navy representatives from NUWC Keyport and representatives of the affected Tribes and Nation for the QUTR Site. Navy representatives met with the Hoh Tribe on November 6, 2003, the Quileute Tribe on November 12, 2003, and the Quinault Nation on November 8, 2003 to initiate Government-to-Government consultation. Issues discussed with the Hoh Tribe included impacts to nearshore habitat and questions about various components of the proposed testing activities. With the Quileute Tribe, issues centered on access to fishing grounds in the extended operating areas, electronic interference with navigation gear, effects on usual and accustomed fishing, communications, sonar use, alternatives, and information sharing. With the Quinault Nation, issues centered on the location of surf-zone access, the timing of the various fishing seasons, information sharing, retrieval of equipment, sonar use, and development of a Memorandum of Understanding. NUWC Keyport would establish a communication process with the Hoh Tribe, Quileute Tribe, and Quinault Nation similar to the process established with affected tribes for the DBRC Site. This would establish points of contact to exchange information on NUWC Keyport testing activity and Tribal fishing regulations in order to avoid disruption of Tribal usual and accustomed fishing patterns. Therefore, Alternative 2 would not result in adverse effects to historic or cultural resources, or to "usual and accustomed fishing places" rights.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of Alternative 3 would result in the same effects to historic and cultural resources as previously described under Alternative 1 and 2. Though various cultural resource sites lie on the beaches facing the QUTR Site, no range activities involve using beach land except at the Ocean City surf zone.

With implementation of Alternative 3, crawler UUVs would conduct test activities in the nearshore environment and up onto the beach. However, there are no known cultural resources at that beach area. The known cultural resources at Ocean City are not at the beach or along the beach access road that would be used by range vehicles to get to the beach. All other activities are confined within the boundaries of the range offshore. Therefore, under Alternative 3 these resources would not be disturbed and impacts would not occur.

The aircraft wrecks and shipwrecks physically within the proposed range boundaries are potentially eligible for the NRHP. However, they are unlikely to be affected during normal activities as proposed underwater vehicle testing would avoid the areas around the wrecks. Also, proposed range site activities would not occur at the Destruction Island Light Station. Therefore, Alternative 3 would have no effects on NRHP listed or eligible properties (including aircraft wrecks and shipwrecks) and would be in compliance with Section 106 of the NHPA.

Communications were initiated between Navy representatives from NUWC Keyport and representatives of the affected Tribes and Nation for the QUTR Site. Navy representatives met with the Hoh Tribe on November 6, 2003, the Quileute Tribe on November 12, 2003, and the Quinault Nation on November 8, 2003 to initiate Government-to-Government consultation. Issues discussed with the Hoh Tribe included impacts to nearshore habitat and questions about various components of the proposed testing activities. With the Quileute Tribe, issues centered on access to fishing grounds in the extended operating areas, electronic interference with navigation gear, effects on usual and accustomed fishing, communications, sonar use, alternatives, and information sharing. With the Quinault Nation, issues centered on the location of surf-zone access, the timing of the various fishing seasons, information sharing, retrieval of equipment, sonar use, and development of a Memorandum of Understanding. NUWC Keyport would establish a communication process with the Hoh Tribe, Quileute Tribe, and Quinault Nation similar to the process established with affected tribes for the DBRC Site. This would establish points of contact to exchange information on NUWC Keyport testing activity and Tribal fishing regulations in order to avoid disruption of Tribal usual and accustomed fishing patterns. Therefore, Alternative 3 would not result in adverse effects to historic or cultural resources, or to "usual and accustomed fishing places" rights.

<u>No-Action Alternative</u>

Implementation of the No-Action Alternative would have no effects to historic or cultural resources as activities would continue as existing and the range boundaries would not be extended. Under the No-Action Alternative, NUWC Keyport would establish a communication process as described for Alternatives 1, 2, and 3. Therefore, implementation of the No-Action Alternative would not result in adverse effect to historic resources, cultural resources, or to "usual and accustomed fishing places" rights.

3.7.3.3 Mitigation Measures

Mitigation measures to reduce impacts would include: 1) avoidance of shipwrecks; 2) exchange of information with the Tribal governments to avoid disruption of Tribal usual and accustomed fishing patterns; and 3) avoidance of archaeological sites. NUWC Keyport would update the ROP to include shipwreck and aircraft wreck avoidance procedures. NUWC Keyport would notify affected Tribes and Nations when NUWC Keyport activities are scheduled on the range site. If unknown cultural resources are found, work in the area would be halted and any discovery would be protected from potential damage. Appropriate authorities would be notified, including the NPS Department Consulting Archaeologist, interested Native American Tribes and Nations, OCNMS, and the SHPO.

3.8 RECREATION

Recreational uses of an area for the purposes of this EIS/OEIS may include any type of outdoor activity in which area residents, visitors, or tourists may participate. Typically (though not exclusively) focused on weekends or vacation periods, such activities may include sightseeing, camping, hiking, biking, fishing, boating, etc. Recreational opportunities and resources can be a very important component of an area's economy and the lifestyle of its residents. Land-based recreational facilities may include state, regional, or local parks, sports fields, beaches, lakes and other bodies of water, and public or private campgrounds.

3.8.1 Keyport Range Site

3.8.1.1 Existing Conditions

Recreational opportunities in the vicinity of the Keyport Range Site include sport fishing, recreational boating and boat races, sailing, and beach access for residents and visitors to the area. Recreational aircraft activities also occur in the vicinity, but these do not commonly occur over the Keyport Range Site and do not interfere with Navy activities. There is a moorage (marina) near the northern portion of the proposed range extension, and there is also one near the southern portion of the proposed range extension. There are scuba diving spots in the general area as well. In addition, a shallow lagoon on the NUWC Keyport base is used for row and paddle boating and picnicking along its shore. There are no state parks or forests bordering the site and, therefore, little open camping or hiking on the surrounding land.

Recreational boating in Port Orchard Reach is a large part of the boat traffic on and around the Keyport Range Site and the local marinas are used on a continuous basis. In addition, several yacht clubs operate around the Keyport Range Site, including the Poulsbo Yacht Club, Port Orchard Yacht Club and the Bremerton Yacht Club, all of which sponsor boating events in Port Orchard Reach. Boating and boat races occur year-round; for example the International Power Boating Association sponsors a Queen City 1st of the Season Race in January and an Annual Fall Roundup at the Bremerton Marina in October. While some of these races might not occur within the Keyport Range Site, boats from area marinas transit Port Orchard Reach to attend them. Specific races that do transit Port Orchard Reach include the Annual Fall Roundup and the Annual Stimson Trophy Race, both in October (Bremerton Yacht Club 2006; International Power Boat Association 2006; Port of Bremerton 2006). The Poulsbo Yacht Club also sponsors sailboat activities throughout the year in Liberty Bay, northwest of Keyport (Poulsbo Yacht Club 2006).

Scuba diving is an activity that occurs year-round in Port Orchard Reach. Shipwreck sites are popular diving locations, and there are several known shipwrecks in the vicinity of the Keyport Range Site.

Sport and recreational fishing occurs throughout Port Orchard Reach. Fishing is open year-round, though each species of fish has a particular open season during the year. The marinas and public boat launches shown on Figure 3.8-1 serve as origination points for boats conducting fishing trips in the area.

The current Keyport Range Site is charted as a Restricted Area on NOAA Navigation Chart 18446 (NOAA 2007b). On average, testing activities on the Keyport Range Site occur about 55 days per year (Table 2-2). A small portion of Keyport Range Site tests can involve a navigational obstruction; in these cases, a NOTMAR is issued. This allows water users (including boaters going to and from the moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities.

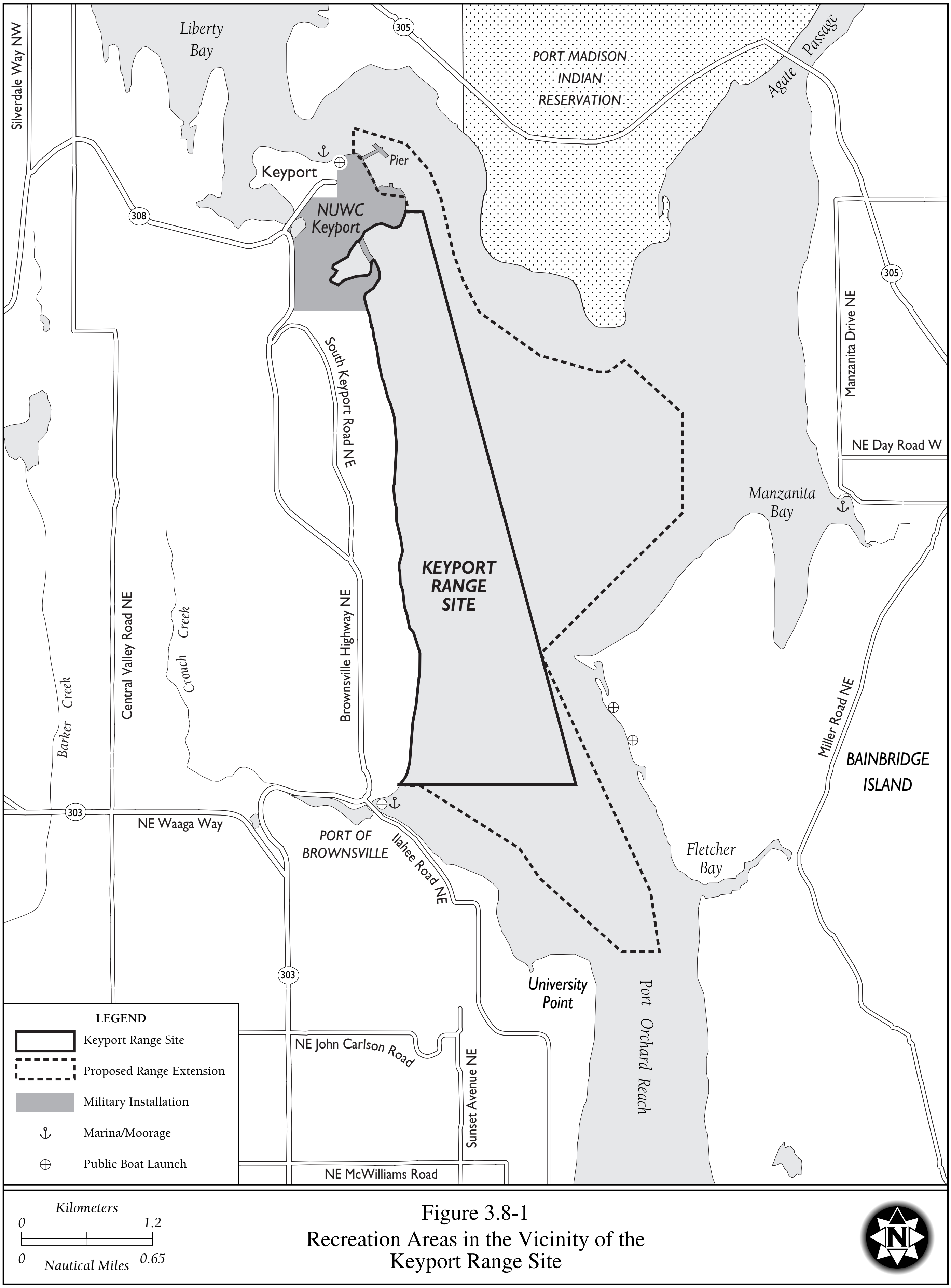


Figure 3.8-1
Recreation Areas in the Vicinity of the Keyport Range Site

When these types of testing activities are underway at Keyport Range Site, mariners are temporarily restricted from the specific area of the test for safety. If boats are in the area, NUWC Keyport directs them to proceed outside the test area to ensure safe passage. Although the recreational boaters have to travel a longer distance if they are transiting the area, they are allowed to pass outside the extended range boundaries (to the north, east, and south of the proposed extended range boundaries) during range activities which take place on 60 days per year on average.

3.8.1.2 Environmental Consequences

Keyport Range Alternative 1 – Preferred Alternative

Implementation of Alternative 1 would have little if any appreciable effect on recreation in and around the Keyport Range Site. The operational tempo for NUWC Keyport activities on the range would increase only marginally (by 5 days to a total of 60 per year on average). This increase would not be noticeable to recreational boaters, divers, fishermen, or recreational aircraft pilots, as it would average less than 1 additional day of activity every two months. In addition, test activities on the range would not necessarily preclude the use of recreational resources in the area, except in the immediate vicinity of and for the duration of the test. The range extension would extend the area within Port Orchard Reach to which temporary and intermittent interruptions or restrictions on recreational activities may apply. Occasionally boaters and divers would be temporarily restricted from the specific area of certain types of test for safety reasons. They would be directed by NUWC Keyport to proceed outside the test area to ensure safe passage. However, normal periods of activity for Keyport Range Site occur during daylight hours on weekdays; testing activities occur much less frequently on weekends when boating and other recreational activities are more common. Although they may be required to travel a longer distance, recreational boats would be allowed to pass outside the extended range boundaries (to the north, east, and south of the proposed extended range boundaries) during range activities (Figure 3.8-1).

With implementation of Alternative 1, crawler UUVs could conduct test activities within the nearshore environment and up onto the beach. This would not occur on beaches regularly used by the public. The overall types and numbers of support craft used under Alternative 1 would be consistent with existing activities in the open waters of Keyport Range Site. A small portion of Keyport Range Site tests can involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow water users (including boaters going to and from the moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities. NUWC Keyport would continue to approach vessels as needed for safety and security purposes. By implementing these procedures, impacts to recreation within and in the vicinity of Keyport Range Site would be negligible under Alternative 1.

No-Action Alternative

Implementation of the No-Action Alternative would maintain current levels of use within the existing Keyport Range Site boundaries, thereby causing no additive effect in terms of any impacts to recreational land uses and activities that may stem from current test activities. For the same reasons noted above, the effects of current activities under the No-Action Alternative would be expected to have negligible effects on recreation.

3.8.1.3 Mitigation Measures

Since there would be minimal impacts to recreation with implementation of the Proposed Action or Alternatives, no mitigation measures would be necessary.

3.8.2 DBRC Site

3.8.2.1 Existing Conditions

Recreation areas in the vicinity of the DBRC Site are shown in Figure 3.8-2. The DBRC MOA and the Hood Canal North and South MOAs are identified on NOAA navigation charts as military restricted areas. Water recreational opportunities in the area include sport and recreational fishing, boating, sailing, beaches, scuba diving, and charter cruises for both fishing and sightseeing in the canal. Recreational aircraft activities also occur in the vicinity, but these do not commonly occur over the DBRC Site and do not interfere with Navy activities. The surrounding areas are considered rural, and towns are small, so there are fewer marinas. Two marinas operate out of Brinnon and one out of Quilcene. Yacht owners have also organized a Pleasant Harbor Yacht Club that is based at the Pleasant Harbor Marina in Brinnon. The area is known for its rugged beauty and boaters frequent these waters. There are no organized boat races that occur through the Hood Canal or Dabob Bay (Rudick 2006).

Hood Canal offers some of the best sport diving in the Pacific Northwest and there are many popular diving spots in the vicinity of the DBRC Site advertised by local dive shops and dive clubs. These include Jorsted Creek near Hamma Hamma, Mike's Beach between the communities of Eldon and Triton, Octopus Hole between the communities of Lilliwaup and Hoodsport, Point Whitney in Dabob Bay, and Sund Rock by Hoodsport. Some of these dive spots are only accessible by boat, not by shore access. Diving occurs year-round in the canal and bay (Pacific Adventure 2006).

Dabob Bay and Hood Canal have an active shrimping season typically commencing the third Saturday in May and continuing every Wednesday and Saturday for 2 weeks. This 4-day season is an extremely popular regional activity and stimulates heavy boating traffic. The actual length of the season is determined by a pre-evaluation of the health of the local shrimp population conducted annually by the Point Whitney Shellfish Lab. Sport and recreational fishing is also very prevalent along the canal and bay. Though fishing is open year-round in the area, each species of fish has a particular season during the year.

There are 6 recreation areas and 8 marinas/moorages and boat launch locations in the vicinity of the proposed southern range extension. There are 3 recreation areas and 3 boat launch locations in the vicinity of the proposed northern range extension. The land-based recreation facilities in the vicinity of the DBRC Site (including both the proposed southern and northern range extensions) include state parks, county facilities, and national forest campgrounds (Navy 2002a). These include:

Proposed northern range extension:

Shine Tidelands State Park is located just north of the Hood Canal Bridge on the Olympic Peninsula (west end), off of Highway 104. The area receives heavy seasonal use by clam diggers and crabbers. Other popular activities are beachcombing, hiking, camping, diving, and wind surfing.

Salisbury Point County Park is a 6.5-acre (2.6-ha) county park with boat launch facilities located a short distance north of the Hood Canal Bridge, near the entrance to Port Gamble Bay. A public boat launch facility is located at Stavis Bay 1 mi (1.6 km) south of Scenic Beach State Park.

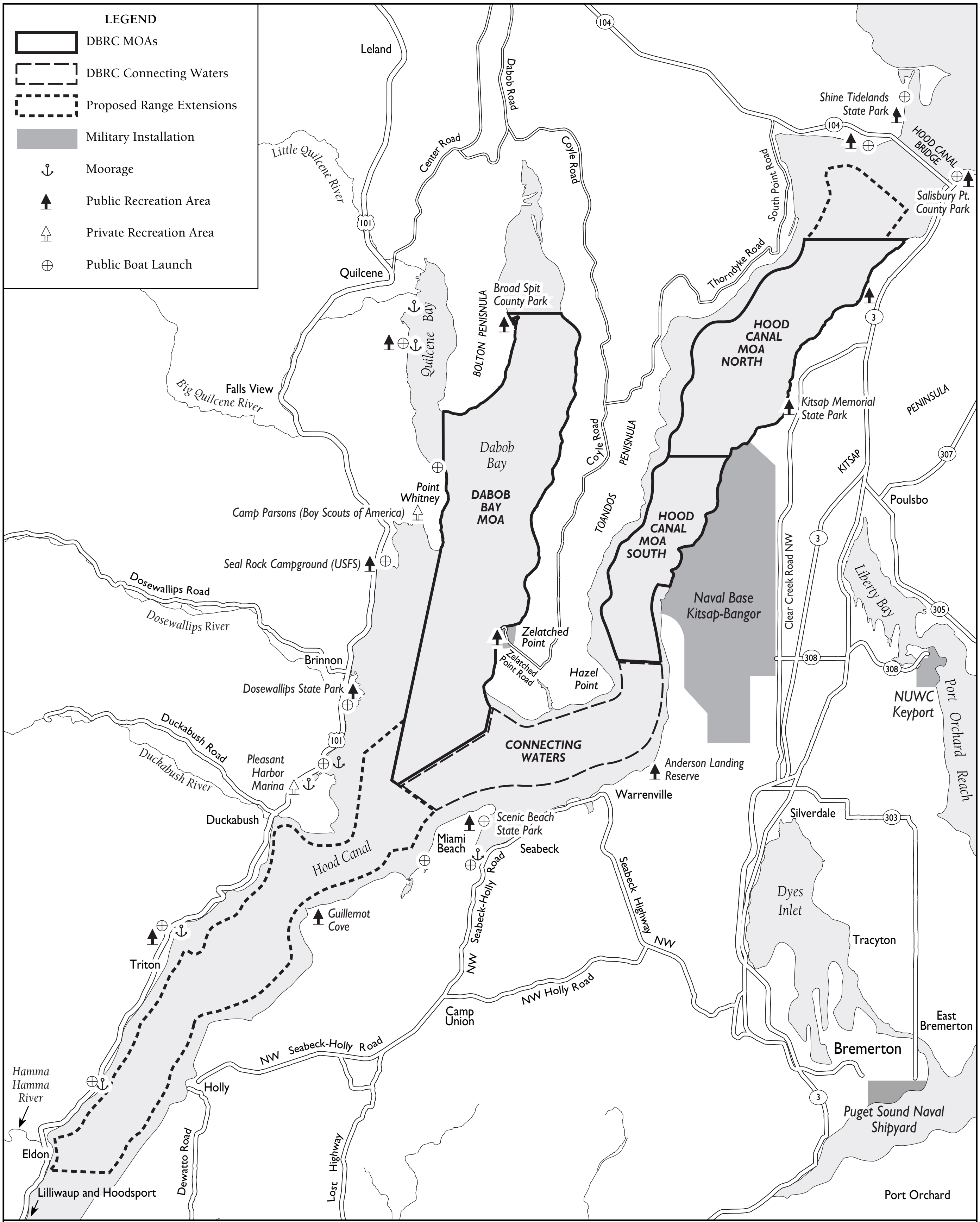


Figure 3.8-2
Recreation Areas in the Vicinity of the DBRC Site

Hood Canal MOA North:

Kitsap Memorial State Park is on State Route (SR) 3, about 3 mi (4.8 km) south of the Hood Canal Bridge on the Kitsap Peninsula in Kitsap County. Activities at the park include camping, picnicking, hiking, volleyball, fishing, marine recreation, oyster and clam harvesting, and group gatherings.

Connecting waters:

Scenic Beach State Park is located in Kitsap County, 12 mi (19.3 km) northwest of Bremerton and 1 mi (1.6 km) southwest of Seabeck on Hood Canal. Activities at the park include picnicking, camping, hiking, boating, fishing, and oyster harvesting in season.

Dabob Bay MOA:

The Port of Port Townsend's public boat launch ramp is located just south of Quilcene.

The public boat launch site on Whitney Point is located at the Whitney Point Fisheries Lab.

Broad Spit Park is a 44-acre (17.8-ha) county facility located on the eastern edge of the Bolton Peninsula, at the north end of the DBRC Site at Dabob Bay. It is an open space park with saltwater access only and an undeveloped beach front.

Camp Parsons is a facility owned and operated by the Boy Scouts of America, located just south of Whitney Point on approximately 240 acres (97 ha) with full camp facilities, including barracks and water facilities.

Seal Rock National Forest campground is located just north of Brinnon. The park has salt water frontage and provides basic camping facilities but no boat launching.

Dosewallips State Park is located 1 mi (1.6 km) south of Brinnon and 40 mi (64 km) north of Shelton on the western shore of Hood Canal, at the mouth of Dabob Bay. There is also a boat launch ramp. Activities at the park include picnicking, hiking, fishing, oyster harvesting and clamming (when water quality conditions permit), camping, shrimping, and wildlife watching.

Proposed southern range extension:

Pleasant Harbor State Park is a satellite park to Dosewallips State Park and is located 2 mi (3.3 km) south of Brinnon. Activities include beachcombing, fishing, motor boating, and scuba diving. It is a marine moorage facility only.

Camp Robbinswold is a Girl Scout camp located 10 mi (16 km) north of Lilliwaup on Hood Canal. It is used in June through August for overnight and day camping. Weekend camping activities occur throughout the spring, fall, and winter.

On average, testing activities at various locations throughout the DBRC Site occur about 200 days per year (Table 2-2). A small portion of DBRC Site tests can involve a navigational obstruction; in these cases, a NOTMAR is issued. NUWC Keyport also notifies the tribes with usual and accustomed fishing rights in Hood Canal of a testing activity. This allows water users (including boaters going to and from the moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities. When these types of testing activities are underway at the DBRC Site, mariners are temporarily restricted from the specific area of the test for safety reasons. If boats are in the area, NUWC Keyport directs them to proceed outside the test area to ensure safe passage. Although the recreational boaters may have to travel a longer distance if they are transiting the area, they are allowed to pass outside the range boundaries during range activities.

3.8.2.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension)

Under DBRC Alternative 1, the range boundary would be extended to the south while the operational tempo would remain unchanged at an average of 200 days of use per year (Table 2-2). The number and frequency of interruptions or restrictions on public recreation activities would be expected to remain about the same as under current conditions; however, under Alternative 1 such interruptions or restrictions would periodically occur in areas not currently exposed to NUWC Keyport activities.

In the area of the proposed range extension, where testing activities are not presently conducted, the western shore includes the area between Dosewallips State Park and the Hamma Hamma River, while the eastern shore includes the area between Scenic Beach State Park and the Hamma Hamma River. Since the proposed range extension and associated RDT&E and other NUWC Keyport managed activities would occur offshore, onshore and nearshore activities at the 6 recreation areas and 8 marinas/moorages and boat launch locations in this area would not be affected. Boating and fishing activities farther offshore could be affected at certain times when the proposed southern range extension is in use. However, these impacts would be minimized since restrictions would be imposed only in the immediate vicinity of the test vessel or test systems (either to maintain quiet or to provide a safety buffer) and not over the entire range area. Normal hours of activity for the DBRC Site would be during daylight hours on weekdays; testing activities rarely occur on weekends when recreational boating activities are more common. Although recreational boaters may need to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 3.8-2) during range activities and could then transit the canal once range activities were completed. A small number of DBRC Site tests can involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow water users (including boaters going to and from the marinas and moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities. NUWC Keyport would continue to notify the tribes with usual and accustomed fishing rights in Hood Canal when a test activity is set to occur.

Therefore, although the southern range extension may occasionally and intermittently expose recreational water users to temporary and very localized inconveniences, recreational resources and activities within and in the vicinity of DBRC Site would not be substantially, consistently, or permanently affected. In portions of the range that do currently experience test activities, no appreciable change in operational tempo would occur and recreation is not expected to be affected any more than the minimal extent to which it may be currently affected. Overall, impacts to recreation associated with implementation of DBRC Alternative 1 would be negligible.

DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)

Under DBRC Alternative 2, the range boundary would be extended both to the south (in the same footprint as DBRC Alternative 1) and a relatively short distance to the north. The operational tempo would remain unchanged at an average of 200 days per year (Table 2-2). The number and frequency of interruptions or restrictions on public recreation activities would be expected to remain about the same as under current conditions; however, under Alternative 2 such interruptions or restrictions would periodically occur in areas not currently exposed to NUWC Keyport activities.

In the area of the proposed southern extension, where testing activities are not presently conducted, the western shore includes the area between Dosewallips State Park and the Hamma Hamma River, while the eastern shore includes the area between Scenic Beach State Park and the Hamma Hamma River. Since the proposed range extension and associated test activities would occur offshore, onshore and nearshore activities at the 6 recreation areas and 8 marinas/moorages and boat launch locations in this area would not be affected. Boating and fishing activities farther offshore could be affected at certain times when the area of the southern range extension is in use. However, these impacts would be minimized since any restrictions would be imposed only in the immediate vicinity of the test vessel or test systems (either to maintain quiet or to provide a safety buffer) and not over the entire range area. Normal hours of activity for the DBRC Site would be during daylight hours on weekdays; testing activities rarely occur on weekends when recreational boating activities are more common. Although recreational boaters may need to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 3.8-2) during range activities and could then transit the canal once range activities were completed. A small number of DBRC Site tests may involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow water users (including boaters going to and from the marinas and moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities. NUWC Keyport would continue to notify the tribes with usual and accustomed fishing rights in Hood Canal when a test is planned for a specific time and place.

In the area of the proposed northern extension, the new range boundary would be positioned even further offshore than it would be in the southern extension. Consequently, onshore and nearshore activities at the three recreation areas and three boat launch locations in this area would likely not be affected by the Proposed Action. Boating and fishing activities farther offshore could periodically and temporarily be affected when the area of the northern range extension is in use. However, these impacts would be minimized since any interruptions or restrictions on local recreational activities would be highly localized and short term in nature. Normal hours of activity for the DBRC Site would be during daylight hours on weekdays, when recreational activities are not as prevalent. And although recreational boaters may have to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 3.8-2) during range activities and could then transit the canal once range activities were completed. A small portion of DBRC Site tests may involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow water users (including boaters going to and from the marinas and moorages) to select an alternate destination or timing for fishing, boating, or diving on a given day without substantially affecting their activities. NUWC Keyport would continue to notify the tribes with usual and accustomed fishing rights in Hood Canal when tests are going to occur.

Therefore, although both the southern and the northern DBRC range extensions may occasionally and intermittently expose recreational water users to temporary and very localized inconveniences, recreational resources and activities within and in the vicinity of the DBRC Site would not be substantially, consistently, or permanently affected. In other areas of the range that do currently experience test activities, no appreciable change in operational tempo would occur and recreation is not expected to be affected any more than the minimal extent to which it may be currently affected. Overall, impacts to recreation associated with implementation of DBRC Alternative 2 would be negligible.

No-Action Alternative

Implementation of the No-Action Alternative would maintain current levels of use within the existing DBRC Site boundaries, thereby causing no additive effect in terms of any impacts to recreational land uses and activities that may stem from current test activities. For the same reasons noted above, the effects of current activities under the No-Action Alternative would be expected to have negligible effects on recreation.

3.8.2.3 Mitigation Measures

Since there would be minimal impacts to recreation with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.8.3 QUTR Site

3.8.3.1 Existing Conditions

Recreation areas along the shoreline of the proposed surf-zone locations are shown in Figure 3.8-3. The onshore area east of the QUTR Site is primarily rural and uninhabited, with small communities located along the coast. The coastline is popular for hiking, biking, and camping, and the wide sandy beaches themselves are used extensively for recreational harvesting of shellfish and crabs. Birdwatching for the many protected species is also popular. The waters are recreationally fished year-round, and surfing, kayaking, and diving enthusiasts frequent the waters (OCNMS 2006). Recreational aircraft activities also occur in the vicinity of the proposed surf-zone locations.

The resort community of Ocean Shores south of the proposed Ocean City surf-zone access area is a major recreational and tourist destination. Recreational harvesters comb the beach and fish the adjacent waters (USACE 2000).

Some diving charter operators serve the Olympic coast. Sport fishing charters for salmon, halibut, ling cod, and occasionally albacore tuna are available from the marinas at Neah Bay, Sekiu, La Push, and Westport.

The land-based recreation facilities in the vicinity of the QUTR Site include national parks, community facilities, and state parks, as detailed below.

- Olympic National Park encompasses nearly a million acres and preserves myriad natural landscapes, including Pacific beaches, rainforest valleys, glaciers, and mountains. The park includes approximately 73 mi (117.5 km) of Washington coastline, the southernmost part of which is the northeastern section of the QUTR Site (near Kalaloch off Highway 101). Kalaloch is known for its wide sandy beaches, and includes two campgrounds adjacent to the beach open year-round, a lodge, picnic areas, and self-guided nature trails. Seven of those nature trails border the beach (National Park Service 2006).
- Pacific Beach State Park is a 10-acre (4.0-ha) camping park open year-round with 2,300 ft (700 m) of shoreline. The park supports the Pacific Beach Resort and Conference Center, a Navy Morale, Welfare, and Recreation-managed facility for DoD personnel and retirees. It is located on the bluffs overlooking the proposed surf-zone location, and visitors (including the general public) can access the beach from this location. There are also campsites and former Navy housing areas that are rented by military personnel, retirees, and civilians.
- Griffiths-Priday Ocean State Park is a 364-acre (147.3-ha) marine park with 8,316 ft (2,534.7 m) of shoreline. The park is open year-round and is located 21 mi (33.8 km) northwest of Hoquiam off of State Route (SR) 109 (Washington State Parks 2006).

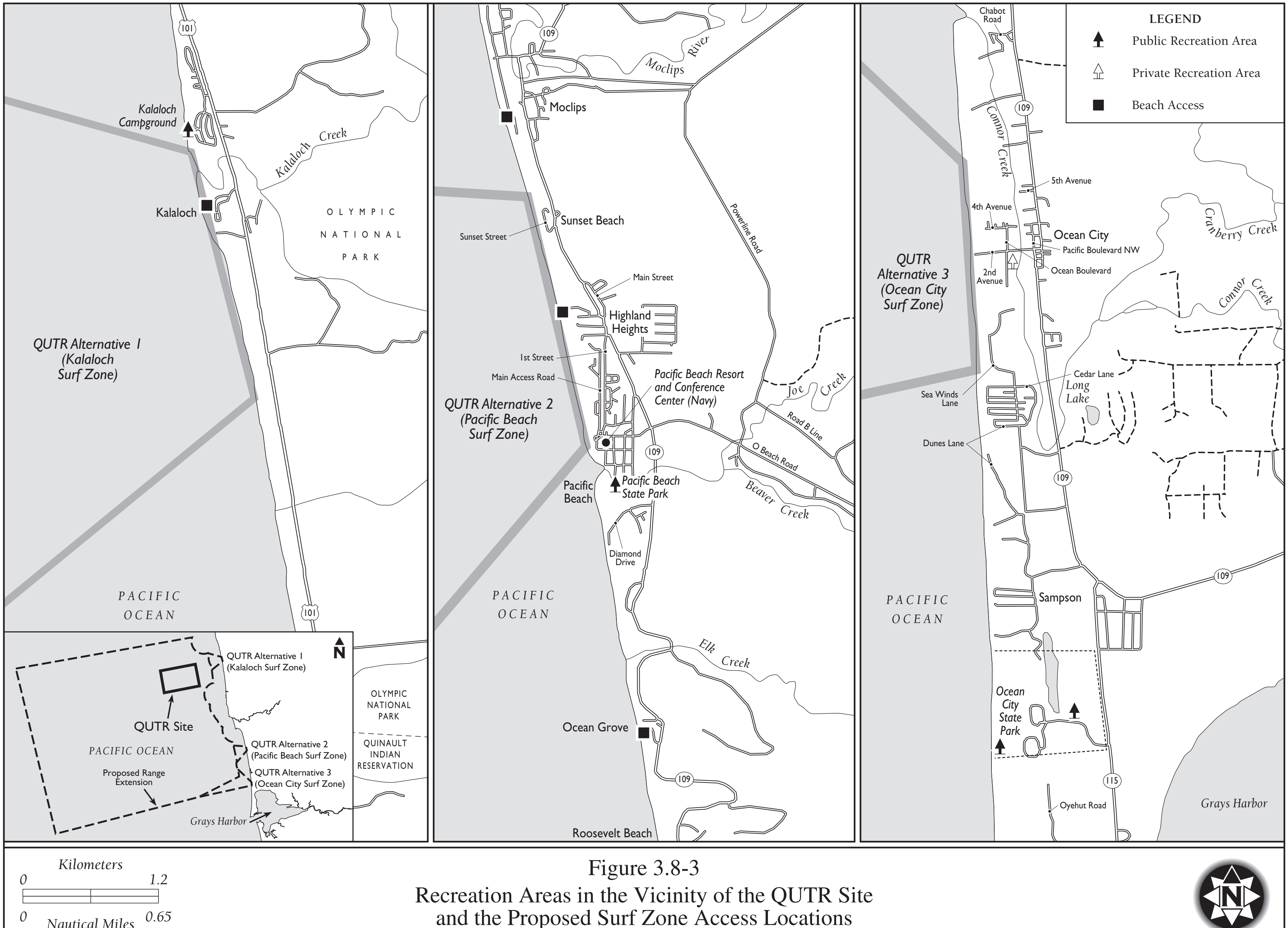


Figure 3.8-3
Recreation Areas in the Vicinity of the QUTR Site and the Proposed Surf Zone Access Locations

- Ocean City State Park is a 170-acre (68.8-ha) camping park open year-round. The park lies 1.5 mi (2.4 km) north of Ocean Shores off of Highway 115. The park also has an amphitheater for public events (Washington State Parks 2006).
- QUTR Site is situated entirely within the boundaries of W-237A, the military Warning Area that lies 3 mi (4.8 km) off the coast and stretches from just north of Kalaloch south to Ocean City. W-237A is used throughout the year for a variety of military activities. These include aircraft, surface, and subsurface testing and training activities. However, open-ocean recreation activities (e.g., sportfishing, boating) also occur in the QUTR site and W-237A.

3.8.3.2 Environmental Consequences

<u>QUTR Alternative 1 (Kalaloch Surf Zone Access Area)</u>

Implementation of QUTR Alternative 1 would extend the existing QUTR Site to the boundaries of W-237A (Figure 2-6a). In general, open ocean recreational activities (sport fishing, boating) would be unaffected by the proposed extension as there would be a very large area within which to continue conducting these activities and the proposed offshore use by NUWC Keyport is an average of only 16 days per year (only 2 more days than current use in the much smaller existing range area [refer to Table 2-2]). Boating and fishing activities in localized areas could be affected at certain times when proposed QUTR site test activities occur. However, boating and sportfishing activities are more dispersed farther offshore and are not likely to occur in the same areas as the proposed activities at the same time as the tests. In addition, potential conflicts would be minimized since restrictions would not be in place over the entire W-237A area during the test, but only around the test vessel or test systems (either to maintain quiet or to provide a safety buffer). Furthermore, the operational tempo for most types of QUTR Site activities within the W-237A area would increase only minimally; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to recreational boaters, divers, fishermen, or recreational aircraft pilots as it would be an average of 1 additional day of activity every 6 months and could occur in various locations within the entire W-237A area.

The Kalaloch surf-zone option would be used under Alternative 1 (Figure 3.8-3). This surf-zone option is located within the Olympic National Park and the OCNMS. The onshore QUTR Site support facilities were established in 1981 prior to establishment of the OCNMS. Since that time, this site has been used periodically in support of Navy activities in the existing QUTR Site and would, in essence, represent a continuation of Navy activities at this location. Beach access for proposed surf-zone activities would occur at the Kalaloch campground or from one of the existing beach trails. Vehicles cannot be driven down to the beach from these access points because of the bluff leading down to the beach, so equipment delivered by land would need to be lowered to and raised from the beach at these locations. Thus, proposed activities on the beach would not involve vehicles, just personnel and equipment. Proposed Navy activities within and in the vicinity of the surf-zone access area would not preclude recreational use of the beach, and general public access to the beach would not be restricted during Navy activities. Campground use and general beach access would remain the same. Safety and security around shore equipment would be maintained throughout the test. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than once a week. Only localized and temporary impacts to recreation within and in the vicinity of Kalaloch would occur. Therefore, although the proposed surf zone use may inconvenience recreational activities occasionally, impacts to recreation within and in the vicinity of Kalaloch would be negligible with implementation of QUTR Alternative 1.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of QUTR Alternative 2 would extend the existing QUTR Site to the boundaries of W-237A (Figure 2-6a). In general, open ocean recreational activities (sport fishing, boating) would be unaffected by the proposed extension as there would be a very large area within which to continue conducting these activities and the proposed offshore use by NUWC Keyport is an average of only 16 days per year (only 2 more days than current use in the much smaller existing range area [refer to Table 2-2]). Boating and fishing activities farther offshore could be affected at certain times when proposed QUTR Site test activities occur. However, boating and sportfishing activities are more dispersed farther offshore and are not likely to occur in the same areas as the proposed activities at the same time as the tests. In addition, potential conflicts would be minimized since restrictions would not be in place over the entire W-237A area during the test, but only around the test vessel or test systems (either to maintain quiet or to provide a safety buffer). Furthermore, the operational tempo for most types of QUTR Site activities within the W-237A area would increase only minimally; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to recreational boaters, divers, fishermen, or recreational aircraft pilots as it would be an average of 1 additional day of activity every 6 months and could occur in various locations within the entire W-237A area.

The Pacific Beach surf-zone option would be used under Alternative 2 (Figure 3.8-3). The beach location is below a high bluff above the shoreline near State Highway 109. Although this surf-zone option is located within OCNMS, the beach is on designated state highway property managed by the Washington State Parks and Recreation Commission. The beach is wide enough to allow general public use near and around the proposed Navy activities. Ease of access would be dependent upon factors such as fluctuations in seasonal use by the general public, but access would still be possible year-round. The Pacific Beach facility would be used as a support site to accommodate test personnel, and the fenced area and staff buildings would be used to support equipment staging, keeping much of the staging away from the public beach. Proposed Navy activities within and in the vicinity of the surf-zone access area would not preclude recreational use of the beach, and public access to the beach would not be restricted during NUWC Keyport activities. Safety and security around shore equipment would be maintained throughout the test. The surf-zone activities would not prevent use of the Navy MWR facility, nor beach access for its guests. Usual hours of activity for surf-zone activities would be during daylight hours on weekdays; testing activities would occur less frequently on weekends when recreational beach activities are more common. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than once a week. Only localized and temporary impacts to recreation within and in the vicinity of Pacific Beach would occur. Therefore, although the proposed surf-zone use may inconvenience recreational activities occasionally, impacts to recreation within and in the vicinity of Pacific Beach would be negligible with implementation of QUTR Alternative 2.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of QUTR Alternative 3 would extend the existing QUTR Site to the boundaries of W-237A (Figure 2-6a). In general, open ocean recreational activities (sport fishing, boating) would be unaffected by the proposed extension as there would be a very large area within which to continue conducting these activities and the proposed offshore use by NUWC Keyport is an average of only 16 days per year (only 2 more days than current use in the much smaller existing range area [refer to Table 2-2]). Boating and fishing activities in localized areas could be affected at certain times when proposed QUTR site test activities occur. However, boating and sportfishing activities are more dispersed farther offshore and are not likely to occur in the same areas as the proposed activities at the same time as the tests. In addition, potential conflicts would be minimized since restrictions would not be in place over the entire W-237A area during the test, but only around the test vessel or test systems (either to maintain quiet or to provide a safety buffer). Furthermore, the operational tempo for most types of QUTR Site activities within the W-237A area would increase only minimally; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to recreational boaters, divers, fishermen, or recreational aircraft pilots as it would be an average of 1 additional day of activity every 6 months and could occur in various locations within the entire W-237A area.

The Ocean City surf-zone option would be used under Alternative 3 (Figure 3.8-3). This surf-zone option is located on a wide beach outside the OCNMS on designated state highway property managed by the Washington State Parks and Recreation Commission. The beach is wide enough to allow general public use near and around Navy activities as they occur. Ease of access would be dependent upon factors such as fluctuations in seasonal use by the general public, but access would still be possible year-round. Navy activities on the shoreline would not preclude recreational use of the beach, nor would it adversely affect tourism-related activities nearby; public access to the beach would not be restricted during Navy activities. Usual hours of activity for surf-zone activities would be during daylight hours on weekdays; testing activities would occur less frequently on weekends when recreational beach activities are more frequent. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than once a week. Only localized and temporary impacts to recreation within and in the vicinity of Ocean City would occur. Therefore, although the proposed surf-zone use may inconvenience recreational activities occasionally, impacts to recreation within and in the vicinity of Ocean City would be minimal with implementation of QUTR Alternative 3.

No-Action Alternative

Implementation of the No-Action Alternative would maintain current levels of use within the existing QUTR Site boundaries, thereby causing no additive effect in terms of any impacts to recreational land uses and activities that may stem from current test activities. For the same reasons noted above, the effects of current activities under the No-Action Alternative would be expected to have negligible effects on recreation.

3.8.3.3 Mitigation Measures

Since there would be minimal impacts to recreation with implementation of the Proposed Action or Alternatives, no mitigation measures would be necessary.

3.9 LAND AND SHORELINE USE

Land use classifications typically fall into two major categories: naturally occurring land cover and human-modified land use. Natural land cover includes areas of unaltered vegetation, rangeland, and other open or undeveloped areas. Human-modified land use includes residential, commercial, industrial, transportation, communications, utilities, agricultural, institutional, and other developed use areas. Land use is regulated by management plans, policies, regulations, and ordinances (e.g., zoning) that determine the type and extent of land use allowable in specific areas (both under natural land cover and human modified) and that also protect specially designated or environmentally sensitive areas. Examples of land use in an ocean environment include offshore activities such as shipping, military uses, research and exploration (e.g., oil and gas activities), scientific research, and commercial fishing. Types of offshore activities suitable for given areas are addressed in state coastal management programs which have been established to comply with the Coastal Zone Management Act (CZMA) of 1972, as amended (16 USC § 1451 *et seq*.).

3.9.1 Regulatory Setting

3.9.1.1 CZMA

The CZMA was passed by Congress to encourage the appropriate development and protection of the nation's coastal and shoreline resources. The Act gives states the primary role in managing shoreline areas. Washington State developed its Coastal Zone Management Program in 1976. The WDOE's Shorelands and Environmental Assistance Program is responsible for implementing the coastal zone program (WDOE 2000). Pursuant to the CZMA, federal activities are required to be consistent with the Washington State Shoreline Management Act (SMA) and the CZMA to the maximum extent practicable. The Proposed Action alternatives at each of the three range sites involve Navy activities within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of the Proposed Action, and as required by the federal implementing regulations, the Navy has prepared and submitted to the WDOE a Coastal Consistency Determination (CCD) for new activities that would occur on the shoreline or in-water. The WDOE has concurred with this determination (Appendix H).

3.9.1.2 Washington SMA

The Washington SMA of 1971 (Regulatory Code of Washington (RCW) 90.58) establishes a broad policy giving preference to uses that support the goal "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines" (WDOE 1999). Cities and counties have the primary responsibility for implementing the Washington SMA, but the state, through WDOE, has authority to review local programs and permit decisions. Under the SMA, each city and county adopts a shoreline master program, based on state guidelines but tailored to their specific jurisdiction. Local shoreline master programs incorporate both planning and regulations for the shoreline environment.

3.9.2 Keyport Range Site

3.9.2.1 Existing Conditions

Upland and intertidal portions of the Keyport Range Site are located on property acquired by the U.S. Navy in 1913. NUWC Keyport occupies 340 acres (137.6 ha) adjacent to the town of Keyport in Kitsap County. The Keyport Range Site provides approximately 1.5 nm^2 (5.1 km^2) of littoral and mid-depth underwater testing areas, including in-shore shallow water sites to support integrated undersea warfare systems and undersea vehicle maintenance and engineering activities. The portions of the in-water structures at the Keyport Range Site extending beyond the extreme low tide line are located on submerged aquatic lands, owned by the State of Washington and managed by WDNR. The Keyport Range Site is listed as a Restricted Area on NOAA Navigation Chart 18446 (NOAA 2007b). The Coast Guard has jurisdiction over vessel traffic in the Restricted Area (NOAA 2006a).

The Keyport Range Site is bounded on the north by Liberty Bay, on the east and south by Port Orchard Reach extends, and on the west by largely rural areas and some small residential communities. Land use in the vicinity of the range is rural/agricultural, residential, or light industrial. Undeveloped areas (e.g., forests) are interspersed with low-density residential areas located mainly along the Port Orchard Reach shoreline. Across Liberty Bay to the north and east are areas classified as semi-rural and rural residential. Land uses at NUWC Keyport include industrial facilities, operation support areas, on-base residential areas, forest lands, wetlands, and tidal flats. Activities in the industrial area include maintenance and production, testing and analysis, waterfront activities, and base administration. The waters of Port Orchard Narrows are used by Tribal, recreational, and NUWC Keyport vessels.

Kitsap County has prepared its Final Comprehensive Plan (Kitsap County 2006). The shoreline management program outlines the county's goals of protecting and preserving saltwater and freshwater shorelines throughout the county by directing development suitable for this environment. The Kitsap County Comprehensive plan describes goals and policies that give direction for managing physical, economic, and community development for the next 20 years that will ensure future growth is consistent with quality of life objectives. The established goals and policies pertain to urban growth, reducing sprawl, efficient transportation, affordable housing, economic development, protection of property rights, timely permit processing, enhancement of natural resource industries, retention and enhancement of open space and recreation, environmental protection, citizen participation and coordination, and sufficient public facilities and services.

3.9.2.2 Environmental Consequences

In general, a Proposed Action would have an adverse impact on land use in a coastal or marine environment if it were inconsistent or incompatible with the goals, objectives, or guidelines of a community or regional comprehensive plan or applicable coastal zone management programs.

<u>Keyport Range Alternative 1 – Preferred Alternative</u>

NUWC Keyport has been testing in this marine area since 1914, so the Proposed Action does not represent a new type of activity. The operational tempo for most types of activities would remain the same; the total increase would consist of 5 additional days of testing annually (Table 2-2). This operational tempo increase would not be noticeable to the general public, as it would be an average of less than one additional day of activity every two months. In addition, land and shoreline use surrounding the Keyport Range Site and the proposed range extension would not be affected by the additional activities. Conflicts arising as a consequence of growth and development are not expected as population densities are expected to remain low. No construction of facilities or improvements/alterations to existing facilities is proposed. The Navy's proposed test activities do not conflict with the shoreline management goals outlined in Kitsap County's Comprehensive Plan (Kitsap County 2006). Thus, activities within the proposed range extension would be consistent with existing land and shoreline use in the area. Furthermore, proposed activities would not change the status of submerged aquatic lands owned by the State of Washington and managed by WDNR.

The Proposed Action would extend the operating area used for Navy activities within Port Orchard Reach. Private/commercial boat use of these waters would be periodically and temporarily restricted from crossing the proposed extended range during some range activities. However, these would be only short-term, periodic interruptions to these activities; the boats would be allowed to pass to the north, east, and south of the proposed extended range boundaries during range activities.

With implementation of Alternative 1, crawler UUVs would conduct test activities within the nearshore environment and up onto the beach that would cause short-term, temporary increases in turbidity in the nearshore environment. However, this would not occur on beaches used by the public. The overall types and numbers of support craft used under Alternative 1 would be consistent with current activities in the open waters of the existing Keyport Range Site. A small portion of tests would involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow boaters to select an alternate destination or timing for a given day without substantially affecting their activities. Therefore, impacts to land and shoreline use (and associated open waters) within and in the vicinity of Keyport Range Site would be negligible with implementation of Alternative 1.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The entire Keyport Range Site is within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of Keyport Range Alternative 1, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

<u>No-Action Alternative</u>

Implementation of the No-Action Alternative would have no effect on land use in and around the Keyport Range Site. The range would continue to be used for Navy test activities within the existing Keyport Range Site boundaries, with no change in activities or equipment used.

3.9.2.3 Mitigation Measures

Since there would be negligible impacts to land and shoreline use with implementation of the Proposed Action or Alternatives, no mitigation measures would be necessary.

3.9.3 DBRC Site

3.9.3.1 Existing Conditions

The DBRC Site is composed of four connected areas: Dabob Bay MOA, Hood Canal MOA North, Hood Canal MOA South, and the Connecting Waters. The Dabob Bay MOA encompasses all waters of Dabob Bay, except for the navigable waters along the western shoreline. The two Hood Canal MOAs are located immediately offshore from Naval Base Kitsap-Bangor. The Connecting Waters refer to that portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs, along the southern edge of the Toandos Peninsula. Current activities necessitate periodic range restrictions for private/commercial vessels, as described in Section 1.3. The portions of the in-water structures at the DBRC Site extending beyond the extreme-low-tide line are located on submerged aquatic lands, owned by the State of Washington and managed by WDNR. The Dabob Bay MOA and the Hood Canal MOAs are listed as Naval Operations Areas on NOAA Navigation Chart 18458 (NOAA 2007a). The Navy has jurisdiction over vessel traffic in these Operations Areas when active testing is undertaken (NOAA 2006a).

The DBRC Site is located in the open waters of Hood Canal and the surrounding shoreline consists largely of forested hillsides and limited residential development. The only settlements in the area consist of two small towns: Quilcene is located at the head of Quilcene Bay and separated from Dabob Bay by the Bolton Peninsula; and Brinnon, is located at the mouth of the Dosewallips River across Dabob Bay from Zelatched Point. With these exceptions (and the Hood Canal Bridge), existing land uses along the shoreline and on the Toandos Peninsula consist of public and private timberlands, shellfish farms, and rural residential lots. In addition, four state parks (Dosewallips, Pleasant Harbor, Scenic Beach, and Kitsap Memorial) and the Olympic National Forest are located in the area. Overland vehicle traffic to Zelatched Point on the Toandos Peninsula (the support facility for DBRC Site activities) consists mostly of passenger vehicles via SR 308, SR 3, SR 104, and Coyle Road. Trucks bearing NUWC Keyport test units primarily travel the SR 308 corridor. The open waters of the DBRC Site are used year-round by private and commercial fishing, state and federal agencies, and U.S. Navy vessels.

Kitsap, Jefferson, and Mason Counties have recently prepared completed and updated Comprehensive Plans (Kitsap County 2006, Jefferson County 2006, Mason County 2005). The Shoreline Management Program component of each Comprehensive Plan outlines regulations and policies intended to protect against adverse effects on public health, on land and its vegetation and wildlife, and waters and their aquatic life, with the ultimate goal of protecting and preserving shoreline resources throughout the county by directing development suitable for the environment. Current NUWC Keyport activities at the DBRC Site are consistent with land use guidelines outlined in the Comprehensive Plans for Kitsap, Mason, and Jefferson Counties (Kitsap County 2006; Mason County 2005; Jefferson County 2006).

3.9.3.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension)

Implementation of Alternative 1 would not change the land use of the DBRC Site, but would extend the range to the south. The operational tempo would remain unchanged and the number and frequency of any public usage restrictions would also remain the same. Conflicts arising as a consequence of growth and development in this portion of Hood Canal are not expected as population densities are expected to remain low. No construction of facilities or improvements/alterations to existing facilities is planned as part of the Proposed Action. Land and shoreline use along the proposed southern range extension would not be affected by proposed testing activities that would occur farther offshore. Thus, land and shoreline use at the DBRC Site and proposed southern range extension down to the Hamma Hamma River would not be affected. Furthermore, the Navy has been conducting ocean activities in this area since 1956. Consequently, the Proposed Action does not represent a new type of activity, and activities within the proposed range extension would be consistent with existing land and shoreline use in the area.

The proposed southern range extension would extend the operating area used by the Navy for testing, but the total number of activities would not increase. The southern extension would be within 100 ft (30 m) of shore at its nearest point. Existing land uses surrounding the range would not be impacted by the range extension, with the exception of shellfish farming and commercial vessel use in the southern extension. Shellfish farmers rely on boats to care for their shellfish stock. Shellfish farmers along the shoreline bordered by the proposed southern extension of the DBRC Site would temporarily be unable to transit portions of Hood Canal during the times when the range is closed. Private/commercial boat use of these waters would be affected the same way. Although they may need to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 2-5a) during range activities and could then transit the canal once range activities were completed. Mariners are informed to monitor channel 16 which would allow boats to select an alternate destination or timing for a given day without substantially affecting their activities. A small portion of tests would involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow boaters to select an alternate destination or timing for a given day without substantially affecting their activities. Therefore, although the southern range extension would constitute an inconvenience for shellfish farmers and boaters, advance coordination would allow them to plan for the range closures in advance. Overland vehicle traffic to Zelatched Point by way of SR 308, SR 3, SR 104, and Coyle Road is associated with current Navy activities at DBRC Site and consists mostly of passenger vehicles. Since operational tempo would remain unchanged, traffic to and from Zelatched Point is expected to remain at current low levels, and no noticeable increase in traffic on state or local roads is anticipated. In addition, DBRC Alternative 1 activities would be consistent with land use guidelines outlined in the Comprehensive Plans for Kitsap, Mason, and Jefferson Counties (Kitsap County 2006, Mason County 2005, Jefferson County 2006). Furthermore, proposed activities would not change the status of submerged aquatic lands owned by the State of Washington and managed by WDNR. Therefore, impacts to land and shoreline use (and associated open waters) within and in the vicinity of the DBRC Site would be minimal with implementation of Alternative 1.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The entire DBRC Site is within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of DBRC Alternative 1, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

<u>DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Implementation of Alternative 2 would not change the land use of DBRC Site, but would extend the boundaries to the north and south of the existing DBRC Site (Alternative 1 would extend it to the south only). The operational tempo would remain unchanged (Table 2-8), and the number and frequency of public usage restrictions would also remain the same. In addition, land and shoreline use at the DBRC Site and the proposed southern range extension down to the Hamma Hamma River would not be affected by the additional activities. Conflicts arising as a consequence of growth and development in this portion of Hood Canal are not expected as population densities are expected to remain low. No construction of facilities or improvements/alterations to existing facilities is planned as part of the Proposed Action. Furthermore, the Navy has been conducting ocean activities in this area since 1956. Consequently, the Proposed Action does not represent a new type of activity, and activities within the proposed range extension would be consistent with existing land and shoreline use in the area.

The proposed southern range extension would extend the operating area used by the Navy for testing, but the total number of activities would not increase. The southern extension would be within 100 ft (30 m) of shore at its nearest point. Existing land uses surrounding the range would not be impacted by the range extension, with the exception of shellfish farming and commercial vessel use in the southern extension. Shellfish farmers rely on boats to care for their shellfish stock. Shellfish farmers along the shoreline bordered by the proposed southern extension of the DBRC Site would temporarily be unable to transit portions of Hood Canal during the times when the range is closed. Private/commercial boat use of these waters would be affected the same way. Although they may need to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 2-5a) during range activities and could then transit the canal once range activities were completed. Mariners are informed to monitor channel 16 which would allow boats to select an alternate destination or timing for a given day without substantially affecting their activities. A small portion of tests may involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow boaters to select an alternate destination or timing for a given day without substantially affecting their activities. Therefore, although the southern range extension would constitute an inconvenience for shellfish farmers and boaters, advance coordination would allow them to plan for the range closures in advance. Overland vehicle traffic to Zelatched Point by way of SR 308, SR 3, SR 104, and Coyle Road is associated with current Navy activities at the DBRC Site and consists mostly of passenger vehicles. Since operational tempo would remain unchanged, traffic to and from Zelatched Point is expected to remain at current low levels, and no noticeable increase in traffic on state or local roads is anticipated. In addition, DBRC Alternative 2 activities would be consistent with land use guidelines outlined in the Comprehensive Plans for Kitsap, Mason, and Jefferson Counties (Kitsap County 2006, Mason County 2005, Jefferson County 2006). Furthermore, proposed activities would not change the status of submerged aquatic lands owned by the State of Washington and managed by WDNR.

The northern extension would extend the operating area to 1 mi (1.6 km) south of Hood Canal Bridge and would be within 800 ft (250 m) of shore at its nearest point. Existing land uses surrounding the northern extension would not be noticeably impacted by this range extension. Hood Canal North MOA (immediately south of the proposed extension, refer to Figure 2-5a) is already part of the DBRC Site and is currently used for Navy activities. Since the proposed range extension boundaries occur offshore, onshore and nearshore activities at the three recreation areas and three boat launch locations in the vicinity of the proposed northern range extension would not be affected at all. Boating and fishing activities farther offshore could be affected at certain times when the proposed northern range extension was in use. However, these impacts would be minimized since restrictions would not be in place over the entire area but only around the test vessel or test systems. Mariners are informed to monitor channel 16 which would allow boats to select an alternate destination or timing for a given day without substantially affecting their activities. A small portion of tests would involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR would be issued. This would allow boaters to select an alternate destination or timing for a given day without substantially affecting their activities. Overland vehicle traffic to Zelatched Point by way of SR 308, SR 3, SR 104, and Coyle Road is associated with current Navy activities at the DBRC Site and consists mostly of passenger vehicles. Since operational tempo would remain unchanged, traffic to and from Zelatched Point is expected to remain at current low levels, and no noticeable increase in traffic on state or local roads is anticipated. In addition, DBRC Alternative 2 activities would be consistent with land use guidelines outlined in the Comprehensive Plans for Kitsap, Mason, and Jefferson Counties (Kitsap County 2006, Mason County 2005, Jefferson County 2006). Furthermore, proposed activities would not change the status of submerged aquatic lands owned by the State of Washington and managed by WDNR. Therefore, although the southern and northern range extensions may have some effects on nearby activities, impacts to land and shoreline use would be negligible with implementation of Alternative 2.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The entire DBRC Site is within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of DBRC Alternative 2, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

No-Action Alternative

The current range would continue to be used for Navy test activities, with no change in activities or equipment used. Impacts of the No-Action Alternative were addressed previously in the DBRC EA and FONSI (Navy 2002a); impacts to land and shoreline use were found to be minimal. The WDOE concurred with the CCD for activities occurring in the DBRC site (Navy 2002a). The previous conclusions are applicable to the No-Action alternative because baseline conditions and continuing activities remain essentially similar to those previously addressed, and as noted above, Navy activities at the DBRC site are consistent with the updated local land use guidelines and planning. Therefore, the No-Action Alternative would not adversely impact land and shoreline use.

3.9.3.3 Mitigation Measures

Since there would be negligible impacts to land and shoreline use with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.9.4 QUTR Site

3.9.4.1 Existing Conditions

Located within the southern portion of the OCNMS (Figure 1-5), the QUTR Site provides approximately 52 nm^2 (178 km^2) of littoral and mid-depth underwater testing areas, including in-shore shallow water sites, surf-zone access, and large distances with multiple depths. The OCNMS covers approximately 2,655 nm^2 (9,106 km^2) of marine waters off the rugged Olympic Peninsula coastline and extends 135 mi (217.3 km) along the Washington Coast from about Cape Flattery in the north to the mouth of the Copalis River in the south (OCNMS 2004). OCNMS is administered by NOAA and was designated in 1994 as the first National Marine Sanctuary in the Pacific Northwest. The Sanctuary shares 65 mi (105.0 km) of coastline with Olympic National Park. Olympic National Park and the Sanctuary share resource management jurisdiction in the intertidal zone (OCNMS 2004). In addition, USFWS manages the Flattery Rocks NWR, Quillayute Needles NWR, and Copalis NWR located along 100 mi (160.9 km) of the outer coast of the Olympic Peninsula. Encompassing more than 600 islands, sea stacks, rocks, and reefs totaling 486 acres (196.7 ha) of land area above mean high water, they are collectively managed as the Washington Islands NWRs. The Flattery Rocks and Quillayute Needles NWRs are located within the boundary of the Olympic National Park. Management of these NWRs is through an MOU between the NPS and the USFWS (USFWS 2005b). The coastal tribes co-manage the resources of the Olympic coast north of Grays Harbor with WDFW and the agencies noted above. Tribal co-management jurisdiction extends to habitat as well as fisheries-related resources.

Land use in the vicinity of the QUTR Site can be described as semi-rural coastal communities. The QUTR Site also lies entirely within the boundaries of W-237A, the Military Warning Area that lies 3 mi (4.8 km) off the coast and stretches from just north of Kalaloch south to Ocean City. W-237A is used throughout the year for a variety of military activities. These include aircraft, surface, and subsurface testing and training activities. Land use along the shoreline facing W-237A also includes small rural coastal communities, namely Taholah, a primarily Quinault Nation community, and the towns of Moclips, Copalis Beach, and Ocean City. Due to the lack of harbors along the west coast of Washington and the OCNMS, regular commercial shipping activity through the QUTR Site is not as busy as it is farther north into the Strait of San Juan de Fuca. However, Grays Harbor operates three marine terminals, so commercial shipping into and out of the harbor occurs regularly. Ocean Shores, at the entrance to Grays Harbor, has a population of approximately 3,836 persons (U.S. Census Bureau [USCB] 2000). Olympic

National Park and three state parks (Griffiths-Priday Ocean, Pacific Beach, and Ocean City) lie along this shoreline. In addition, the Quinault Indian Nation encompasses 23 mi (37.0 km) of this shoreline, primarily undeveloped land considered historically and economically significant to the tribe (Quinault Indian Nation 2003). Agricultural land uses, primarily logging operations, encompass much of the undeveloped land along the coast.

Land use associated with the three proposed surf-zone access areas is considered open space and is open to the public. The Pacific Beach and Ocean City surf-zone access areas also allow motorized vehicle access. Kalaloch is part of the Olympic National Park and includes two campgrounds adjacent to the beach, a lodge, picnic areas, and self-guided nature trails. This site has historically been used by the Navy for QUTR Site range support activities since 1981. It was in place when OCNMS was developed in 1994 and is included in the 1993 OCNMS EIS. Pacific Beach is the location of a Navy MWR facility on a high bluff above the shoreline near State Highway 109. The Pacific Beach Navy regional facility also includes buildings, a fenced area from the more public area, and a helicopter landing pad.

The Shoreline Management Program component of the Comprehensive Plans for both Grays Harbor County and Jefferson County outline regulations and policies intended to protect against adverse effects on the public health, on the land and its vegetation and wildlife, and on the waters and their aquatic life. The ultimate goal is to protect and preserve shoreline resources throughout the county by directing development suitable for the environment.

3.9.4.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Implementation of Alternative 1 would extend the QUTR Site operating area to the boundaries of W-237A (Figure 2-6a). In general, open ocean activities (e.g., ship vessel transit, aircraft transit) would be unaffected as there would be a large area to conduct these activities. The operational tempo for most types of activities would remain the same; the total increase would be 2 additional days of testing annually (Table 2-2). This change in tempo would have virtually no effect on regular shipping traffic. The NUWC Keyport activities are a small percentage of Navy activity in the W-237A area and of the overall tempo off the western coast of Washington. Furthermore, this operational tempo increase would not be noticeable to the general public, as it would be an average of 1 additional day of activity every 6 months, and it would be on the open ocean. In addition, this would be dispersed over a much larger area (the proposed extension increases the underwater operating area to the full extent of W-237A, approximately 1,832 nm^2 [6,284 km^2]).

The Kalaloch surf-zone option associated with Alternative 1 (Figure 3.8-3) is within the Olympic National Park and the OCNMS. Although this surf-zone option is located within OCNMS, this site has historically been used for QUTR Site range support activities since 1981 and would in essence represent a continuation of Navy activities at this location. It was in place when OCNMS was developed in 1994 and is included in the 1993 OCNMS EIS. Beach access for proposed surf-zone activities would occur at the Kalaloch campground or from one of the existing beach trails. Use of a specific portion of the campground or trail would be limited during that time, but this would only be temporary and would prohibit the general public from using these areas. Vehicles cannot be driven down to the beach from these access points because of the bluff leading down to the beach, so equipment delivered by land would need to be lowered to and raised from the beach at these locations. Thus, proposed activities on the beach would not involve vehicles, just personnel and equipment. Proposed Navy activities within and in the vicinity of the surf-zone access area would not preclude recreational use of the beach, and general public access to the beach would not be restricted during Navy activities. Campground use and general beach access would remain the same. Safety and security around shore equipment would be maintained throughout the test. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than once a week. Only localized and temporary impacts to recreation within and in the vicinity of Kalaloch would occur, and this would not adversely affect the overall land use of the area. The Navy would also coordinate with the appropriate federal and state agencies as part of the EIS/OEIS process. In addition, QUTR Alternative 1 activities would be consistent with land use guidelines outlined in the Comprehensive Plan for Jefferson County (Jefferson County 2006). Therefore, impacts to land and shoreline use (and associated open waters) within and in the vicinity of QUTR Site would be minimal with implementation of Alternative 1.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The beach at Kalaloch and the nearshore portion of the proposed surf zone are within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of QUTR Alternative 1, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of Alternative 2 would have the same offshore impacts as Alternative 1. The Pacific Beach surf-zone option would be used under Alternative 2 (Figure 3.8-3). The beach location is below a high bluff above the shoreline near State Highway 109. Although this surf-zone option is located within OCNMS, the beach is on designated state highway property managed by the Washington State Parks and Recreation Commission. The beach is wide enough to allow general public use near and around Navy activities as they occur. Ease of access would be dependent on factors such as fluctuations in seasonal use by the general public, but access would still be possible year-round. The Navy's Pacific Beach Resort and Conference Center facilities would be used as a support site, not only to house test personnel but the fenced area and staff buildings could be used to support equipment staging. This would keep much of the staging away from the public beach. Proposed Navy activities within and in the vicinity of the surf-zone access area would not restrict public access to the beach during Navy activities. The proposed surf-zone activities would have no effect on use of Pacific Beach Resort and Conference Center nearby, which would continue to be used year-round. General beach access and use would remain the same. Safety and security around shore equipment would be maintained throughout the test. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than one time per week. Thus, only localized and temporary impacts to recreation within and in the vicinity of Pacific Beach would occur, and this would not adversely affect the overall land use of the area. The Navy would also coordinate with the appropriate federal and state agencies as part of the EIS/OEIS process. In addition, QUTR Alternative 2 activities would be consistent with land use guidelines outlined in the Comprehensive Plan for Grays Harbor County (Grays Harbor County 1999). Therefore, impacts to land and shoreline use would be minimal with implementation of Alternative 2.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The beach at Pacific Beach and the nearshore portion of the proposed surf zone are within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of QUTR Alternative 2, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of Alternative 3 would have the same offshore impacts as Alternative 1. The Ocean City surf-zone option would be used under Alternative 3 (Figure 3.8-3). This surf-zone option is located outside the OCNMS on a wide beach on designated state highway property managed by the Washington State Parks and Recreation Commission. The beach is wide enough to allow general public use near and around Navy activities as they occur. Ease of access would be dependent on factors such as fluctuations in seasonal use by the general public, but access would still be possible year-round. Navy activities on the shoreline would not restrict public access to the beach during Navy activities, nor would it adversely affect tourism-related activities nearby. General beach access and use would remain the same. Safety and security around shore equipment would be maintained throughout the test. In addition, the proposed surf-zone location would be used 30 days per year, or an average of less than once a week. Thus, only localized and temporary impacts to recreation within and in the vicinity of Ocean City would occur, and this would not adversely affect the overall land use of the area. The Navy would also coordinate with the appropriate federal and state agencies as part of the EIS/OEIS process. In addition, QUTR Alternative 3 activities would be consistent with land use guidelines outlined in the Comprehensive Plan for Grays Harbor County. Therefore, impacts to land and shoreline use would be minimal with implementation of Alternative 3.

Pursuant to the CZMA, federal activities are required to be consistent with the Washington State SMA and the CZMA to the maximum extent practicable. The beach at Ocean City and the nearshore portion of the proposed surf zone are within 0 to 3 nm (0 to 5.6 km) from shore. Therefore, as part of the QUTR Alternative 3, the Navy has prepared and submitted to the WDOE a CCD for new activities that would occur on the shoreline or in-water, as required by the federal implementing regulations. The WDOE has concurred with this determination (Appendix H).

No-Action Alternative

Implementation of the No-Action Alternative would not result in any impacts to land and shoreline use at QUTR Site. The range would continue to be used for Navy activities within the existing QUTR Site boundaries, with no change in activities or equipment used. The van and tower at Kalaloch and the cabling and instrumentation would continue to be monitored and maintained. However, use of the surf zone would not be extended for NUWC Keyport activities.

3.9.4.3 Mitigation Measures

Since there would be minimal impacts to land and shoreline use with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.10 PUBLIC HEALTH AND SAFETY AND ENVIRONMENTAL HAZARDS TO CHILDREN

Public health and safety issues include potential hazards inherent in operation of Navy vessels and testing activities. This section also addresses the potential to impact the health and safety of children. EO 13045, *Protection of Children from Environmental Health R isks and Safety Risks,* requires all federal agencies to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Issues of public proximity and access, as well as potential ordnance and fuel hazards are also examined.

3.10.1 Keyport Range Site

3.10.1.1 Existing Conditions

NUWC Keyport's safety policy is to observe every reasonable precaution in the planning and execution of all activities that occur on the range to prevent injury to people and damage to property. Testing activities at NUWC Keyport are restricted to the waters of the Keyport Range Site. Access to the shoreline and pier at NUWC Keyport is heavily restricted and security police personnel are posted at the main gate for additional security. Guards patrol the perimeter of the base including the shoreline. A small portion of Keyport Range Site tests can involve a navigational obstruction; in these cases (as is done for current activities), a NOTMAR is issued. As described in Section 1.3.4, precautions are taken to ensure that divers or swimmers are not exposed to sonar.

Children reside in residential areas located in the north-central and south east areas of NUWC Keyport. The nearest schools to the Keyport Range Site and the proposed extended operating area are Hilder Pearson Elementary School in the North Kitsap School District, located at the intersection of SR 308 and Central Valley Road in Poulsbo, approximately 2 mi (3.2 km) west of NUWC Keyport, and Brownsville Elementary School, located just south of Brownsville (Central Kitsap School District 2006), approximately 6 miles south of NUWC Keyport. While children may be present in the vicinity of the Keyport Range Site on boats, boat traffic in the area is transitory and intermittent.

As mentioned in Section 3.9, the Keyport Range Site is shown as a Restricted Area on NOAA navigational charts. This designation helps ensure public safety. In addition, the U.S. Coast Guard has published a final rule establishing Protection Zones extending 500 yards (457.2 m) around all Navy vessels in navigable waters of the U.S. and within the boundaries of Coast Guard Pacific Area (32 CFR Part 761). All vessels must proceed at a no-wake speed when within a Protection Zone. Non-military vessels are not allowed to enter within 100 yards (91.4 m) of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol.

3.10.1.2 Environmental Consequences

Impacts would be considered adverse (for any of the Proposed Action components) if the health and safety of children are threatened and/or the public is exposed to activities that could affect their health and safety.

<u>Keyport Range Alternative 1 – Preferred Alternative</u>

Implementation of Alternative 1 would extend the operating area of the range by 1.6 nm^2 (5.5 km^2). The types of support craft used under Alternative 1 would be consistent with existing activities in the open waters of the Keyport Range Site. The operational tempo for most types of activities would remain the same; the total increase would consist of 5 additional days of testing annually (Table 2-2). This operational tempo increase would not be noticeable to the general public, as it would be an average of less than 1 additional day of activity per month. The range extension would increase the area used for Navy activities within Port Orchard Reach. Private/commercial boat use of these waters may be temporarily restricted from crossing the test area within the proposed extended range during some range activities. However, the basic public safety measures already in use at the range would continue, including all systems undergoing a thorough environmental and safety review before the tests. Expended components are reviewed, and modifications are made to the tests as needed. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Test vehicles would be tracked/trailed and the area around them would be monitored by surface craft. These vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, preventing them from striking vessels or running on to the shore. In addition, explosive warheads are not placed on test units, nor do they contain fuels that would be capable of exploding under conditions encountered in routine use. Sonar would not be used when swimmers or divers are less than safe standoff distances (Navy 2008c) from active sources. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

The majority of activities at the Keyport Range Site occurs within the marine waters, where children on the beach or in boats usually have adult supervision. The safety measures that protect private or commercial craft from any impact from test vehicles would also protect any children that may be present on those boats. Therefore, implementation of Alternative 1 would not have adverse impacts to public health and safety nor pose disproportionate environmental hazards to children in the area.

No-Action Alternative

Implementation of the No-Action Alternative would not result in impacts to public health and safety and environmental hazards to children at the Keyport Range Site. The range would continue to be used for Navy activities within the existing Keyport Range Site boundaries, with no change in activities or equipment used.

3.10.1.3 Mitigation Measures

Since there would be no adverse impacts to public health and safety with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.10.2 DBRC Site

3.10.2.1 Existing Conditions

DBRC Site is operated by the Navy. The proposed operating area extension and subsequent testing activities would be within the waters of Hood Canal and Dabob Bay. Areas of onshore activity are located in or near military areas with restricted access. These are generally the waterfront along Naval Base Kitsap-Bangor, and the waterfront at Zelatched Point. Children are not allowed near these areas, except occasionally as part of specific tours during which special safety precautions are taken. Boy Scout and Girl Scout activities occur south of Whitney Point and north of Lilliwaup. The nearest school to the DBRC Site is Seabeck Elementary School, located approximately 0.25 mi (0.4 km) inland from Hood Canal in Seabeck (Central Kitsap County School District 2004). This school was closed in 2007.

During any activities, the NUWC Keyport-maintained yellow, white, and red warning lights located at Sylopash Point, Pulali Point, Whitney Point, Zelatched Point, and the southeast end of Bolton Peninsula warn non-military craft of the status of range use. Descriptions of these lights are posted at local boat ramps and marinas. Marine radio channels 12 and 16 are also monitored during activities. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Guard boats may also be used to require non-military craft in the DBRC Site to stop engines for the duration of activities. The purpose of halting marine traffic is to eliminate acoustic interference during noise-sensitive testing and to keep mariners from approaching within 100 yards (91.4 m) of a Navy vessel (including submerged submarines). Test units are run at a sufficient depth and have no warheads such that surface vessels are not at risk. Typically, boat passage is allowed between tests when the yellow beacons are operating. Usual hours of activity for the DBRC Site are during daylight hours on weekdays. Normally, tests and torpedo runs are completed in periods of less than an hour; submarine activities can occur for longer periods of 8 to 16 hours (Navy 2002a).

As mentioned in Section 3.9, the DBRC MOAs are shown as Navy Operating Areas on NOAA navigational charts. This designation helps ensure public safety by providing separation between military and non-military activities. In addition, the U.S. Coast Guard has published a final rule establishing Protection Zones extending 500 yards (457.2 m) around all U.S. Navy vessels in navigable waters of the U.S. and within the boundaries of Coast Guard Pacific Area (32 CFR Part 761). All vessels must proceed at a no-wake speed when within a Protection Zone. Non-military vessels are not allowed to enter within 100 yards (91.4 m) of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol. As described in Section 1.3.4, precautions are taken to ensure that divers or swimmers are not exposed to sonar.

3.10.2.2 Environmental Consequences

<u>DBRC Alternative 1 (Southern Extension)</u>

Implementation of Alternative 1 would extend the existing DBRC Site south to the Hamma Hamma River. The types of support craft used under Alternative 1 would be consistent with existing activities in the open waters of the DBRC Site. Some of the proposed activities would be duration tests where various system components may be operational for endurance runs of 24 hours or longer. However, this is consistent with current activities, and standard operating procedures would not need to be changed to ensure public safety. The basic public safety measures already in use at the range would continue. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Many test vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, allowing positive operational control to reduce the risk of collision with another vessel or running on shore. In addition, explosive warheads are not placed on test units, nor do test units contain fuels that would be capable of exploding under conditions encountered in routine use.

The operational tempo would remain unchanged at an average of 200 days per year (Table 2-2), and the number and frequency of public use restrictions would also remain the same (discussion in Section 3.11, Socioeconomics and Environmental Justice). The type of activities would not change. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. In addition, all systems tested at the DBRC Site by NUWC Keyport undergo a thorough environmental and safety review before the test commences. Potential expended components are reviewed and modifications are made to the tests as needed to minimize the amount of expended material and for risk reduction. Sonar would not be used when swimmers or divers are less than safe standoff distances (Navy 2008c) from active sources. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

The majority of activities at the DBRC Site occurs within the marine waters, where children are on the beach or boats, usually with adult supervision. Proposed activities would not affect children in these or other areas (e.g., schools and Boy and Girl Scout camps). The safety measures that protect non-Navy mariners from any impact from test vehicles would also protect any children that may be present on those boats. Therefore, implementation of Alternative 1 would not have adverse impacts to public health and safety nor pose cumulative environmental hazards to children in the area.

<u>DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)</u>

Implementation of Alternative 2 would not change DBRC Site land use, but would extend the boundaries to the north and south of the existing DBRC Site. The types of support craft used under Alternative 2 would be consistent with existing activities in the open waters of the DBRC Site. Some of the proposed activities would be duration tests where various system components may be operational for endurance runs of 24 hours or longer. However, this is consistent with current activities, and standard operating procedures would not need to be changed to ensure public safety. The basic public safety measures already in use at the range would continue. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Many test vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, allowing positive operational control to reduce the risk of collision with another vessel or running on shore. In addition, explosive warheads are not placed on test units, nor do test units contain fuels that would be capable of exploding under conditions encountered in routine use.

The operational tempo would remain unchanged at an average of 200 days per year (Table 2-2), and the number and frequency of public use restrictions would also remain the same (discussion in Section 3.11, Socioeconomics and Environmental Justice). The type of activities would not change. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. In addition, all systems tested at the DBRC Site by NUWC Keyport undergo a thorough environmental and safety review before the test commences. Expended components are reviewed and modifications are made to the tests as needed to minimize the amount of expended material and the potential for effects to public safety. Sonar would not be used when swimmers or divers are less than safe standoff distances (Navy 2008c) from active sources. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

The majority of activities at the DBRC Site occurs within the marine waters, where children are on the beach or boats, usually with adult supervision. Proposed activities would not affect children in these or other areas. The safety measures that protect non-Navy mariners from any impact from test vehicles would also protect any children that may be present on those boats.

The northern extension would extend to 1 mi (1.6 km) south of Hood Canal Bridge. Hood Canal MOA North (immediately south of the proposed extension, refer to Figure 2-5a) is already part of the DBRC Site and is an area currently used for Navy RDT&E and other NUWC Keyport managed activities. The basic public safety measures already in use at the range would continue. Therefore, implementation of Alternative 2 would not have adverse impacts to public health and safety nor pose disproportionate environmental hazards to children in the area.

No-Action Alternative

Implementation of the No-Action Alternative would not result in any impacts to public safety or children at the DBRC Site. The range would continue to be used for Navy activities within the existing DBRC Site boundaries, with no change in activities or equipment used. Impacts of the No-Action Alternative would be the same as were identified previously in the DBRC EA and FONSI (Navy 2002a), representing minimal risks to the civilian population because of standard precautionary measures taken and the low overlap between Navy and civilian activities. The No-Action Alternative would not have impacts to public health and safety nor pose disproportionate environmental hazards to children in the area.

3.10.2.3 Mitigation Measures

Since there would be no adverse impacts to public health and safety with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.10.3 QUTR Site

3.10.3.1 Existing Conditions

The QUTR Site is operated by the Navy and access is controlled for public safety purposes during Navy testing activities. Children reside in rural residential areas located along the coast adjacent to QUTR Site—the nearest elementary/middle school is in Taholah. For the three surf-zone alternative locations, there are no schools in Kalaloch (Alternative 1), one elementary school in Pacific Beach (less than 1 mi (1.6 km), and several schools and one day-care center about 2 mi (3.2 km) south of the Ocean City site. There are no known National Priorities List sites at or in the vicinity of the QUTR Site (USEPA 2004).

3.10.3.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Implementation of Alternative 1 would extend the existing QUTR Site to the boundaries of the W-237A Military Warning Area (Figure 2-6a). In general, open ocean activities (e.g., ship vessel transit, aircraft transit) would be unaffected as there would be a large area to conduct these activities. The operational tempo for most types of activities would remain the same; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to the general public, as it would be an average of 1 additional day of activity every 6 months. In addition, this would be dispersed over a much larger area (the proposed extension increases the underwater operating area to the full extent of W-237A, approximately 1,832 nm^2 [6,284 km^2]). Safety procedures are in place for the entire NAVSEA NUWC Keyport Range Complex and are similar among the various range sites (i.e., procedures at the QUTR Site are similar to those for the Keyport Range Site and the DBRC Site). Basic public safety measures already in use at the range would continue. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Some test vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, preventing them from striking vessels or running on to the shore. Explosive warheads are not placed on test units, nor do the units contain fuels that would be capable of exploding under conditions encountered in routine use. In addition, all systems tested at the QUTR Site by NUWC Keyport undergo a thorough environmental and safety review before the tests. Expended components are reviewed and modifications are made to the tests as needed to minimize the amount of expended material and the potential for effects to public safety. As described in Section 1.3.4, precautions are taken to ensure that divers or swimmers are not exposed to sonar, and sonar would not be used when swimmers or divers are less than safe standoff distances (Navy 2008c) from active sources. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

Activities at the QUTR Site would occur well offshore where children on the beach or in boats usually have adult supervision. The safety measures that protect the boats from any impact from test vehicles would also protect any children that may be present on those boats. In addition, there would be restricted access around the on-shore test site monitoring area to ensure the safety of the public, personnel and equipment. Therefore, implementation of Alternative 1 would not have adverse impacts to public safety.

The Kalaloch surf-zone option would be used under Alternative 1 (Figure 3.8-3). While children use the beach, the surf zone would be kept clear of non-participants prior to, during, and immediately after each test to avoid potential safety issues. Therefore, implementation of Alternative 1, within and in the vicinity of the QUTR Site and Kalaloch, would not pose disproportionate environmental hazards to children in the area.

<u>QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)</u>

Implementation of Alternative 2 would extend the existing QUTR Site to the boundaries of the W-237A Military Warning Area (Figure 2-6a). In general, open ocean activities (e.g., ship vessel transit, aircraft transit) would be unaffected as there would be a large area to conduct these activities. The operational tempo for most types of activities would remain the same; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to the general public, as it would be an average of 1 additional day of activity every 6 months. In addition, this would be dispersed over a much larger area (the proposed extension increases the underwater operating area to the full extent of W-237A, approximately 1,832 nm^2 [6,284 km^2]). Safety procedures are in place for the entire NAVSEA NUWC Keyport Range Complex and are similar among the various range sites (i.e., procedures at the QUTR Site are similar to those for the Keyport Range Site and the DBRC Site). Basic public safety measures already in use at the range would continue. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Some test vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, preventing them from striking vessels or running on to the shore. Explosive warheads are not placed on test units, nor do the units contain fuels that would be capable of exploding under conditions encountered in routine use. In addition, all systems tested at the QUTR Site by NUWC Keyport undergo a thorough environmental and safety review before the tests. Expended components are reviewed and modifications are made to the tests as needed to minimize the amount of expended material and the potential for effects to public safety. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

Activities at the QUTR Site would occur well offshore where children on the beach or in boats usually have adult supervision. The safety measures that protect the boats from any impact from test vehicles would also protect any children that may be present on those boats. In addition, there would be restricted access around the on-shore test site monitoring area to ensure the safety of the public, personnel and equipment. Therefore, implementation of Alternative 2 would not have adverse impacts on public safety.

The Pacific Beach surf-zone option would be used under Alternative 2 (Figure 3.8-3). While children use the beach, the surf zone would be kept clear of non-participants prior to, during, and immediately after each test to avoid potential safety issues. Therefore, implementation of Alternative 2, within and in the vicinity of the QUTR Site and Pacific Beach, would not pose disproportionate environmental hazards to children in the area.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of Alternative 3 would extend the existing QUTR Site to the boundaries of the W-237A Military Warning Area (Figure 2-6a). In general, open ocean activities (e.g., ship vessel transit, aircraft transit) would be unaffected as there would be a large area to conduct these activities. The operational tempo for most types of activities would remain the same; the total increase would be 2 additional days of testing annually. This operational tempo increase would not be noticeable to the general public, as it would be an average of 1 additional day of activity every 6 months. In addition, this would be dispersed over a much larger area (the proposed extension increases the underwater operating area to the full extent of W-237A, approximately 2,655 nm^2 [9,106.4 km^2]). Safety procedures are in place for the entire NAVSEA NUWC Keyport Range Complex and are similar among the various range sites (i.e., procedures at the QUTR site are similar to those for the Keyport Range Site and the DBRC Site). Basic public safety measures already in use at the range would continue. To further ensure public safety, minimum separation distances as specified in 32 CFR Part 761 must be maintained between non-military vessels and Navy vessels. Some test vehicles are equipped with redundant safety features programmed to shutdown the units should they malfunction, preventing them from striking vessels or running on to the shore. Explosive warheads are not placed on test units, nor do the units contain fuels that would be capable of exploding under conditions encountered in routine use. In addition, all systems tested at the QUTR Site by NUWC Keyport undergo a thorough environmental and safety review before the tests. Expended components are reviewed, and modifications are made to the tests as needed to minimize the amount of expended material and the potential for effects to public safety. Given the Navy's comprehensive suite of established safety measures to protect the public, and excellent track record of effectively implementing safety procedures, impacts to public health and safety would be negligible.

Activities at the QUTR Site would occur well offshore where children on the beach or in boats usually have adult supervision. The safety measures that protect the boats from any impact from test vehicles would also protect any children that may be present on those boats. In addition, there would be restricted access around the on-shore test site monitoring area to ensure the safety of the public, personnel and equipment. Therefore, implementation of Alternative 3 would not have adverse impacts on public safety.

The Ocean City surf-zone option would be used under Alternative 3 (Figure 3.8-3). While children use the beach, the surf zone would be kept clear of non-participants prior to, during, and immediately after each test to avoid potential safety issues. Therefore, implementation of Alternative 3, within and in the vicinity of the QUTR Site and Ocean City, would not pose disproportionate environmental hazards to children in the area.

No-Action Alternative

Implementation of the No-Action Alternative would not result in any safety impacts to children or the public at QUTR Site. The range would continue to be used for Navy activities within the existing QUTR Site boundaries, with no change in activities or equipment used. The van and tower at Kalaloch and the cabling and instrumentation would continue to be monitored and maintained. However, use of the surf zone would not be extended for NUWC Keyport activities.

3.10.3.3 Mitigation Measures

Since there would be no adverse impacts to public health and safety with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.11 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Socioeconomics comprise the basic attributes and resources associated with the human environment, particularly population and economic activity. Economic activity typically encompasses employment, personal income, and industrial growth. Impacts on these fundamental socioeconomic components influence other issues such as housing availability and provision of public services.

Socioeconomic data herein are presented at the county, state, and national level to analyze baseline socioeconomic conditions in the context of local, state, and national trends. Data have been collected from previously published documents issued by federal, state, and local agencies.

In 1994, EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (EO 12898, 59 Federal Register 7629 [section 1-101]), was issued to focus attention of federal agencies on human health and environmental conditions in minority and low-income communities and to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. For impacts to minority or low income communities to be considered adverse three criteria must be met: 1) there must be one or more populations within the affected counties; 2) there must be adverse (or significant) impacts from the Proposed Action; and 3) the environmental justice populations within the affected counties must bear a disproportionate burden of those adverse impacts. Thus, if any of the above criteria are not met, impacts with respect to environmental justice would not be adverse.

Data used for the environmental justice analysis were collected primarily from the *2000 Census of Population and Housing*; although these data are now several years old, they represent the most complete, detailed, and accurate statistics available addressing population distribution and income.

3.11.1 Keyport Range Site

3.11.1.1 Existing Conditions

Population

Kitsap County's population in 2000 was 231,969, an increase of approximately 22 percent from 1990 (Washington State Office of Financial Management 2004a). Kitsap County has the sixth largest population in the state and is the second-most densely populated county in Washington (Washington State Office of Financial Management 2004a). Major communities located within the vicinity of the Keyport Range Site include Bainbridge Island (population 20,308), Silverdale (population 15,816), Poulsbo (population 6,813), and Port Madison Indian Reservation (population 6,536).

Employment

Federal government spending underlies virtually all aspects of Kitsap County's economy, and federal employment dwarfs that of all other economic sectors (Washington State Employment Security 2001). In Kitsap County, DoD employs approximately 13,000 civilians at the various military installations. In addition, approximately 10,500 military personnel are stationed in Kitsap County. The County's non-military economy is also related to military activity, since the retail trade and service sectors largely cater to active-duty and retired military personnel, current and retired federal civilian employees, current and retired defense contractors, and their respective families (Washington State Employment Security 2001). In 2002, the government sector accounted for 35.93 percent of earnings, followed by the service industry at 26.03 percent and retail trade at 20.43 percent (Washington State Office of Financial Management 2004b).

The fastest growing economic sector in the county is retail trade. Except for manufacturing, the government sector has had the slowest employment growth of any sector in the county's economy. Proportionally, government employment decreased over the period between 1970 and 1999 from 62 percent to 37 percent of total employment in the county. Even so, the federal government (civilian and military) remains the dominant sector in Kitsap County's economy (Washington State Employment Security 2001).

The civilian labor force grew from 37,730 in 1970 to 93,000 in 1999. This equates to an increase of 147 percent compared with the state's civilian labor force growth of 117 percent (Washington State Employment Security 2001). As of May 2004, the unemployment rate for Kitsap County stood at 5.1 percent (Washington State Employment Security 2004). In 2000, the unemployment rate in the communities within the vicinity of the Keyport Range Site ranged from 2.6 percent (Bainbridge Island) to 5.9 percent (Silverdale) (Washington State Office of Financial Management 2004a).

Income

Kitsap County's per capita personal income in 2002 was $31,740, the third highest among Washington's 39 counties. This represents approximately 97 percent of the state average income of $32,638, and 103 percent of the national average income of $30,906 (Bureau of Economic Analysis 2003a).

According to Census 2000 results, per capita personal income within the vicinity of the Keyport Range Site and the proposed extended operating area ranged from $25,960 (Poulsbo) to $47,858 (Bainbridge Island) (Washington State Office of Financial Management 2004a).

Ocean-Related Industries

Puget Sound supports several industry sectors that are integrally linked to the marine environment. These include commercial fishing, sportfishing, and recreational activities that involve sailing and power boating. Washington's commercial fishing industry is the second largest seafood producer in the U.S. after Alaska (Washington State Marine Services 2006). Washington fishermen catch more than 60 percent of the edible seafood harvested in the U.S. (Washington State University 2006). The state is the largest producer of farmed shellfish in the nation and a leading producer of naturally-growing shellfish, a majority of which come from Puget Sound.

Salmon support a variety of fisheries in the Puget Sound region. These include sport, commercial, and Tribal usual and accustomed fisheries. Recreational fishing typically occurs throughout the inlets of Puget Sound and Hood Canal, while commercial and Tribal usual and accustomed fisheries are conducted with purse seine or gill nets primarily in the open waterways of Puget Sound and Hood Canal (WDFW 2006b). Though a relatively small part of the overall state economy, salmon fishing is the mainstay of several Native American villages as well as for segments of the population residing in a number of shoreline cities and towns.

The commercial fishing sector provides approximately 10,000 jobs in the Greater Seattle area and accounts for gross annual sales of more than $3.5 billion (Washington State Business and Project Development [WSBPD] 2006). Commercial fishing harvests nearly three billion pounds of fish and shellfish annually, worth more than $1.6 billion at the wholesale level (WSBPD 2006). Few commercial fisheries remain in Puget Sound due to overfishing and urbanization, so the Sound-based fishing fleets depend largely on offshore saltwater resources (Sommers and Canzoneri 1996).

Recreational sportfishing in Puget Sound has been conservatively estimated to contribute $117 million per year to the regional economy (Washington Department of Ecology 2006). In 2004, an estimated

438,000 marine angler trips were taken (WDFW 2006c) and over 175,000 pounds of fish (not counting shellfish) were caught by sportfishermen (WDFW 2006d).

In 2004, the average monthly employment and wages for the agriculture, forestry, fishing, and hunting industries combined was 54 employers, 218 employees, and $7.3 million in wages paid in Kitsap County. This represents 0.27 percent of the total employment in Kitsap County (State of Washington Office of Financial Management 2005).

Recreational boating and ocean-related tourism activities also contribute to the regional economy of Puget Sound. The Sound has 244 marinas with 39,400 moorage slips and another 331 launch sites for smaller boats (Washington Department of Ecology 2006). Statewide, approximately 180,000 boats are registered, not counting thousands more small boats and watercraft that do not require registration. An estimated $464 million in combined boat, motor, and related purchases ranks Washington tenth highest in the nation for boating-related expenditures (Washington Department of Ecology 2006). An estimated 390,000 people participate in recreational activities in the waters and on the beaches of Puget Sound at least once a year (Washington Department of Ecology 2006).

Environmental Justice

Ethnicity and poverty status have been examined for the counties in compliance with EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. As shown in Table 3.11-1, in 2000 the population of Kitsap County had a higher percentage of whites and Native American Indians than Washington State and the U.S. Conversely, the county had a lower population percentage of all other minority groups than the state and the country, except for Asian/Pacific Islanders, which represent a slightly higher percentage of the population in Kitsap County than in the U.S. (USCB 2000).

Table 3.11-1 Population Ethnicity (2000): Kitsap County, Washington, and United States (Percent of Population)

Ethnicity	*Kitsap County*	*Washington State*	*United States*
White (non-Hispanic)	82.2	78.9	69.1
Black	2.9	3.2	12.3
Native American Indians	1.6	1.6	0.9
Asian/Pacific Islander	5.2	5.9	3.7
Hispanic	4.1	7.5	12.5
Other	4.0	2.9	1.5

Source: USCB 2000.

As shown in Table 3.11-2, in 1999 Kitsap County had a lower percentage of population living below the poverty level as compared to Washington and the U.S.

Table 3.11-2 Percent of Population below Poverty (1999): Kitsap County, Washington, and United States

	Kitsap County	*Washington State*	*United States*
Percentage Below Poverty	8.8	10.6	12.4

Source: USCB 2000.

3.11.1.2 Environmental Consequences

Impacts would be considered adverse if there were an unusual population growth (or reduction) and if there were the potential to substantially increase/decrease employment and income opportunities as a result of implementing the Proposed Action or alternatives. As stated earlier, impacts to minority or low income populations are considered adverse if these environmental justice populations are disproportionately affected by the Proposed Action or alternatives.

Keyport Range Alternative 1 – Preferred Alternative

Alternative 1 would have no direct effect on population, employment, or income in Kitsap County since no change in permanent personnel would occur at NUWC Keyport, and no construction activities or increased local expenditures are planned as part of the proposed Keyport Range Site extension. Indirect effects to the regional economy would occur if the proposed range extension and increased operational tempo were to adversely impact the fishing or boating industries. Such impacts would potentially occur in the fishing industry if the action reduced fishing stocks in Puget Sound or substantially restricted the ability of fishing boats to access fishing areas.

Impacts to the boating industry would be even less likely and would also be related to restricted access to boaters. As discussed in Section 3.4, Alternative 1 would not adversely affect fish, shellfish, or EFH; therefore, no impacts to the size, distribution, or health of fishery stocks are expected. Implementation of Alternative 1 would result in an extension of the Keyport Range Site boundaries and a slight increase in operational tempo. As shown in Table 3.11-3, annual days of use of Keyport Range Site would increase under Alternative 1 from an average of 55 days per year to an average of 60 days per year. However, the number of days of predicted restricted public use within the range boundaries would not change. There would continue to be an average of 7 days per year in which public use restrictions of less than an hour would occur, and 15 days in which restrictions would be greater than an hour. In addition, public use within the range boundaries would only be restricted within the immediate operational area, and would not affect the entire range. Consequently, there would be sufficient opportunity for fishing boats and recreational boaters to circumvent any restricted areas, and the periods of restriction would be relatively short and infrequent. Accordingly, indirect impacts of Alternative 1 to local industries and the regional economy, population, and workforce would be negligible or nonexistent.

Table 3.11-3 Average Annual Days of Public Use Restrictions at Keyport Range Site

	Keyport Range Site
Total Days of Use	
Existing	55
Proposed	60
Days Restricted for < 1 Hour	
Existing	7
Proposed	7
Days Restricted for 1-12 Hours	
Existing	15
Proposed	15
Unrestricted Days	
Existing	343
Proposed	343

The potential impacts associated with Alternative 1 would not be adverse. No appreciable increases in pollution or health risks are anticipated as a result of this alternative. No adverse impacts to employment, income distribution, or the economy are anticipated. Proposed activities under Alternative 1 would not disrupt Tribal usual and accustomed fishing patterns of the Suquamish Tribe at or around Keyport Range Site (Section 3.7). Consequently, no disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS. In accordance with environmental justice assessment Criterion 2 (described in the introduction to Section 3.11), since Alternative 1 would result in minimal effects, environmental justice impacts would not occur.

No-Action Alternative

Implementation of the No-Action Alternative would not result in any impacts to socioeconomics and environmental justice at the Keyport Range Site. The range would continue to be used for Navy activities within the existing Keyport Range Site boundaries, with no change in activities or equipment used. Impacts to socioeconomics and environmental justice would not occur with implementation of the No-Action Alternative.

3.11.1.3 Mitigation Measures

Since there would be no adverse impacts to socioeconomics and environmental justice with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary. However, as described in Section 3.7, the Navy would implement a system to exchange information with the Suquamish Tribe on activities to avoid potential disruption of Tribal usual and accustomed fishing patterns.

3.11.2 DBRC Site

3.11.2.1 Existing Conditions

Population

The DBRC Site is located in Kitsap, Jefferson, and Mason Counties. For a discussion of Kitsap County population refer to Section 3.11.1, Keyport Range Site. Jefferson County's population in 2000 was 25,953, an increase of approximately 27 percent from 1990. Jefferson County has the 27th largest population and is also the 27th most densely populated county in Washington. Mason County's population in 2000 was 49,405, making it the 20th most populated county in the state. The population of Mason County increased approximately 29 percent from 1990 to 2000 (Washington State Office of Financial Management 2004a). In addition to Poulsbo and Silverdale (discussed in Section 3.11.1), communities located in the vicinity of DBRC Site also include Seabeck (population 2,555), Brinnon (803), and Quilcene (population 591).

Employment

Jefferson County's major economic sectors have historically been dominated by resource-based activities such as fishing, agriculture, and forestry. In recent years, there are signs of diversification to include manufacturing and marine trades. In addition, there has been a high rate of growth in the services sector, which increased from 32 to 55 percent of civilian employment between 1970 and 1999 (Washington State Employment Security 2000). In 2002, the service industry accounted for 24.68 percent of employment and wages in Jefferson County followed closely by government jobs at 24.32 percent, retail trade at 22.27 percent, and manufacturing at 10.20 percent (Washington State Office of Financial Management 2004c). The dominant industries in Mason County in 2002 were government jobs at 28.5 percent, wholesale and retail trade at 22 percent, and services at 19 percent. The resource-based activities sector in Washington is dominated by agriculture. In Mason County this sector comprises a very small fraction of the county's employment due to few crop production workers. Finance, insurance, and real estate; services; and government sectors are projected to increase in the upcoming years, while stagnation is expected in the manufacturing sector (Washington State Employment Security 2002b).

The civilian labor force in Jefferson County grew from 4,250 in 1970 to 10,700 in 1999. This equates to a 3.3 percent average annual growth rate over the 30-year period compared with a statewide annual growth rate of 2.7 percent during the same period (Washington State Employment Security 2000). Total nonagricultural employment rose at an average annual rate of 3.8 percent, compared to a statewide rate of 3.1 percent per year during the same period (Washington State Employment Security 2000). Mason County's total civilian labor force grew from 8,260 in 1970 to 19,660 in 2000, a 2.8 percent annual growth rate (Washington State Employment Security 2002b). Total nonagricultural employment in Mason County rose at an average annual rate of 2.9 percent during the same period (Washington State Employment Security 2002b).

As of November 2006, the unemployment rates for Jefferson and Mason Counties were 4.4 percent and 5.5 percent, respectively (Washington State Employment Security 2004). In 2000, the unemployment rate for Quilcene stood at 8.2 percent (Washington State Office of Financial Management 2004a).

Income

Jefferson County's per capita personal income in 2002 was $30,536, the sixth highest among Washington's 39 counties. This represented approximately 94 percent of the state average income of $32,549, and 102 percent of the national average income of $30,906 (Bureau of Economic Analysis 2004). Mason County's per capita personal income in 2002 was $24,072, the 19th highest in the state. This represented approximately 74 percent of the state average income, and 78 percent of the national average (Bureau of Economic Analysis 2006).

According to Census 2000 results, per capita personal income for Quilcene was $22,590 (Washington State Office of Financial Management 2004a).

Ocean-Related Industries

Refer to Section 3.11.1.1 for a summary of state and regional data regarding ocean-related industries in Puget Sound. In Jefferson County specifically, employment and wages attributed to the Agriculture, Forestry, Fishing, and Hunting sector in 2004 totaled 26 employers providing 127 jobs (1.4 percent of the county total) and paying $2.5 million in wages. In Mason County this sector totaled 58 employers providing 556 jobs (4.21 percent of the county total) and paying $17.1 million in wages in 2004 (Washington State Office of Financial Management 2005).

Sport and non-Tribal commercial fishing (except salmon and shellfish) in Hood Canal have been closed since August 2004 until DO levels improve. The ban extends from the Hood Canal floating bridge south throughout the length of Hood Canal. Native Americans are not bound by the closure; however, Tribal commercial fishermen currently fish within Hood Canal for fish other than salmon, including shellfish (Peninsula Daily News 2004).

Environmental Justice

Ethnicity and poverty status have been examined for the counties in the vicinity of the Proposed Action in compliance with EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. As shown in Table 3.11-4, in 2000 the population of Kitsap, Jefferson, and Mason

Counties had a higher percentage of whites and Native American Indians than Washington State and the U.S. Conversely, the three counties had a lower population percentage of all other minority groups than the state and the country, except for Asian/Pacific Islanders, which represent a slightly higher percentage of the population in Kitsap County than in the U.S. (USCB 2000).

Table 3.11-4 Population Ethnicity (2000): Kitsap, Jefferson, and Mason Counties; Washington; and United States (Percent of Population)

Ethnicity	*Kitsap County*	*Jefferson County*	*Mason County*	*Washington State*	*United States*
White (non-Hispanic)	82.2	91.0	88.5	78.9	69.1
Black	2.9	0.4	1.2	3.2	12.3
Native American Indians	1.6	2.3	3.7	1.6	0.9
Asian/Pacific Islander	5.2	1.3	1.5	5.9	3.7
Hispanic	4.1	2.1	4.8	7.5	12.5
Other	4.0	2.9	0.3	2.9	1.5

Source: USCB 2000.

As shown in Table 3.11-5, in 1999 Kitsap County had a lower percentage of population living below the poverty level as compared to Washington and the U.S. Jefferson and Mason Counties each had a lower percentage of people living below the poverty level than the U.S., but had a higher percentage of people living below the poverty level than Washington (USCB 2000).

Table 3.11-5 Percent of Population Below Poverty (1999): Kitsap, Jefferson, and Mason Counties; Washington; and United States

	Kitsap County	*Jefferson County*	*Mason County*	*Washington State*	*United States*
Percentage Below Poverty	8.8	11.3	12.2	10.6	12.4

Source: USCB 2000.

3.11.2.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension)

Alternative 1 would have no direct effect on population, employment, or income in Kitsap, Jefferson and Mason counties since no personnel change would occur and no construction activities are planned as part of the proposed range extension in this alternative. Implementation of Alternative 1 would not change the land use of the DBRC Site, but would extend the range to the south, thereby extending the area potentially affected by public use restrictions. The operational tempo would remain unchanged at an average of 200 days per year (Table 3.11-6), and the number and frequency of public use restrictions would also remain the same. Given the extension in range boundaries, public use restrictions could affect people in some areas that are not currently affected. But these impacts are minimized since restrictions are not in place over the whole area but around the test vessel or test systems, either to maintain quiet or to provide a safety buffer.

Table 3.11-6 Average Annual Days of Public Use Restrictions at DBRC Site

	DBRC Site
Total Days of Use	
Existing	200
Proposed	200
Days Restricted for < 1 Hour	
Existing	30
Proposed	30
Days Restricted for 1-12 Hours	
Existing	60
Proposed	60
Unrestricted Days	
Existing	275
Proposed	275

Shellfish farmers along the shoreline bordered by the proposed southern extension of the DBRC Site may temporarily be unable to transit Dabob Bay during the times when the range is closed. Private/commercial boat use of these waters would be affected in the same manner. Although they may have to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 2-5a) during range activities and could then transit the canal once range activities are completed. This would lessen the potential for negative socioeconomic effects to commercial and tourism-related interests in the Quilcene area and in the southern range extension. Therefore, although the southern range extension would constitute a periodic inconvenience for shellfish farmers and boaters, the periods of inconvenience would be infrequent in any one area. Therefore, direct and indirect impacts to socioeconomics within and in the vicinity of DBRC Site would not be adverse with implementation of Alternative 1.

No adverse impacts to employment, income distribution, or the economy are anticipated. Proposed activities under Alternative 1 would not disrupt Tribal usual and accustomed fishing patterns of the Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Port Gamble S'Klallam Tribe, and Skokomish Tribe (listed in alphabetical order) at or around the DBRC Site (Section 3.7). Scheduling of testing would be provided to Tribal representatives to ensure that the potential for disruption is minimized. Consequently, no disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS. In accordance with environmental justice assessment Criterion 2 (described in the introduction to Section 3.11), since Alternative 1 would cause no adverse environmental effects, environmental justice impacts would not occur.

DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)

Alternative 2 would have no direct effect on population, employment, or income in Kitsap, Jefferson and Mason counties since no personnel change would occur and no construction activities are planned as part of the proposed range extension in this alternative. The southern extension associated with Alternative 2 would not change the land use of the DBRC Site, but would extend the area potentially affected by public use restrictions. The operational tempo would remain unchanged at an average of 200 days per year (Table 3.11-6), and the number and frequency of public use restrictions would also remain the same. Given the extension in range boundaries, public use restrictions could affect people in some areas that are not currently affected since restrictions are not in place over the whole area but around the test vessel or test systems, either to maintain quiet or to provide a safety boundary.

Shellfish farmers along the shoreline bordered by the proposed southern extension of DBRC Site would temporarily be unable to transit Dabob Bay during the times when the range is closed. Private/commercial boat use of these waters would be affected in the same manner. Although they may have to travel a longer distance, they would be allowed to pass outside the extended range boundaries (primarily along the eastern and western shorelines of Hood Canal; refer to Figure 2-5a) during range activities and could then transit the canal once range activities are completed. This would lessen the potential for negative socioeconomic effects to commercial and tourism-related interests in the Quilcene area and in the southern range extension. Therefore, although the southern range extension would constitute a periodic inconvenience for shellfish farmers and boaters, the periods of inconvenience would be infrequent in any one area.

No adverse impacts to employment, income distribution, or the economy are anticipated. Proposed activities under Alternative 2 would not disrupt Tribal usual and accustomed fishing patterns of the Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, Port Gamble S'Klallam Tribe, and Skokomish Tribe (listed in alphabetical order) at or around the DBRC Site. Scheduling of testing has been provided to Tribal usual and accustomed fishing patterns to ensure that the potential for disruption is minimized. This coordination would continue under Alternative 2. Consequently, no disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS. In accordance with environmental justice assessment Criterion 2 (described in the introduction to Section 3.11), since Alternative 2 would cause no adverse environmental effects, environmental justice impacts would not occur.

The northern extension would go to 1 nm (1.9 km) south of Hood Canal Bridge. Existing socioeconomic activities surrounding the northern extension would not be noticeably impacted by this range extension. Hood Canal MOA North (immediately south of the proposed extension; refer to Figure 2-5a) is already part of the DBRC Site and is an area currently used for Navy activities. This would allow boats to select an alternate destination or timing for a given day without substantially affecting their activities. Therefore, no adverse impacts to socioeconomics would occur with implementation of Alternative 2. No disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS.

<u>No-Action Alternative</u>

Implementation of the No-Action Alternative would not result in any impacts to socioeconomics and environmental justice at the DBRC Site. The range would continue to be used for Navy activities within the existing DBRC Site boundaries, with no change in activities or equipment used.

3.11.2.3 Mitigation Measures

Since there would be no adverse impacts to socioeconomics and environmental justice with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary. However, as described in Section 3.7, the Navy would implement a system to exchange information with Tribal governments on activities to avoid disruption of Tribal usual and accustomed fishing patterns.

3.11.3 QUTR Site

3.11.3.1 Existing Conditions

Population

The QUTR Site is adjacent to Grays Harbor and Jefferson Counties. Grays Harbor County's population in 2000 was 67,194, an increase of only 4.7 percent from 1990. Grays Harbor County has the 16th largest population and is the 19th most densely populated county in Washington (Washington State Office of Financial Management 2004a). Refer to the above discussion on the DBRC Site for population data on Jefferson County.

Communities located within the vicinity of the QUTR Site area include Taholah (population 786), Copalis Beach (population 448), and Ocean City (population 179) (Washington State Office of Financial Management 2004a).

Employment

Grays Harbor County's major economic sectors have historically been dominated by resource-based activities such as fishing, agriculture, and forestry. In recent years, there has been strong growth in the trade and services sectors which has more than offset the decline in manufacturing employment. The tradeoff, however, has resulted in lower wages since, for example, a retail clerk typically does not earn as much income as a logger (Washington State Employment Security 2002a). In 2002, government jobs accounted for 26.64 percent of employment in Grays Harbor followed by the service industry at 20.69 percent, retail trade at 19.21 percent, and manufacturing at 17.25 percent (Washington State Office of Financial Management 2004d).

The civilian labor force in Grays Harbor County only grew by 1,210 people between 1970 and 2000. This equates to a 5-percent increase with an annual average of 0.2 percent per year. By comparison, during the same period, Washington's statewide labor force grew by 115 percent and 2.5 percent annually (Washington State Employment Security 2002a).

As of May 2004, the unemployment rate for Grays Harbor County was 7.9 percent (Washington State Employment Security 2004). In 2000, the unemployment rate in the communities within the vicinity of the QUTR Site ranged from 16.1 percent (Taholah) to 21.9 percent (Copalis Beach) (Washington State Office of Financial Management 2004a).

Income

Grays Harbor County's per capita personal income in 2002 was $22,986, which ranked 31st among Washington's 39 counties. This represents approximately 70 percent of the state average income of $32,638, and 74 percent of the national average income of $30,906 (Bureau of Economic Analysis 2003b).

According to Census 2000 results, per capita personal income for Taholah was $13,874, for Copalis Beach was $19,384, and for Ocean City was $18,215 (Washington State Office of Financial Management 2004d).

Ocean-Related Industries

Refer to Section 3.11.1.1 for an overview of ocean-related industries in Washington. In Grays Harbor County specifically, employment and wages attributed to the Agriculture, Forestry, Fishing, and Hunting sector in 2004 totaled 238 employers providing 1,086 jobs (4.5 percent of the county total) and paying over $36 million in wages (Washington State Office of Financial Management 2005).

One of the most important commercial fisheries in Washington is the Coastal Commercial Dungeness Crab industry, with an average commercial value of nearly $20 million per year (WDFW 2006e). There are 228 commercial license holders in this crab fishery, and the commercial fishing season typically runs from December 1st through September 15th. The main ports of landing are Ilwaco, Chinook, Westport, Tokeland, and La Push. The commercial crab grounds extend from the Columbia River to Cape Flattery and include the estuary of the Columbia River, Grays Harbor, and Willapa Bay (WDFW 2006e).

Environmental Justice

Ethnicity and poverty status have been examined for the counties in the vicinity of the Proposed Action in compliance with EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. As shown in Table 3.11-7, in 2000 the population of Jefferson and Grays Harbor Counties had a higher percentage of whites and Native American Indians than Washington State and the U.S. Conversely, the two counties had a lower population percentage of all other minority groups than the state and the country (USCB 2000).

Table 3.11-7 Population Ethnicity (2000): Jefferson and Grays Harbor Counties; Washington; and United States (Percent of Population)

Ethnicity	*Jefferson County*	*Grays Harbor County*	*Washington State*	*United States*
White (non-Hispanic)	91.0	86.5	78.9	69.1
Black	0.4	0.3	3.2	12.3
Native American Indians	2.3	4.7	1.6	0.9
Asian/Pacific Islander	1.3	1.3	5.9	3.7
Hispanic	2.1	4.8	7.5	12.5
Other	2.9	2.4	2.9	1.5

Source: USCB 2000.

As shown in Table 3.11-8, in 1999 Jefferson County had a lower percentage of people living below the poverty level than the U.S., but had a higher percentage of people living below the poverty level than Washington. Grays Harbor County had a higher percentage of people living below the poverty level compared with both Washington and the U.S. (USCB 2000).

Table 3.11-8 Percent of Population Below Poverty (1999): Jefferson and Grays Harbor Counties; Washington; and United States

Ethnicity	*Jefferson County*	*Grays Harbor County*	*Washington State*	*United States*
Percentage Below Poverty	11.3	16.1	10.6	12.4

Source: USCB 2000.

3.11.3.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

As discussed previously, the proposed range extension would have no direct effect on population, employment, or income in the region since there would be no change in personnel and no proposed construction activities. Deep water activities associated with Alternative 1 would occur in the extended QUTR Site, offshore from the coast of Washington. As discussed in Section 3.4, there would be no adverse effects to fish, shellfish, or EFH with Alternative 1. Therefore, no impacts on fishery stocks are expected. The potential for interaction with commercial fishing vessels would increase very slightly, as only two additional days of public use restrictions would occur each year (from 14 to 16 days per year; Table 3.11-9). However, use restrictions would be focused on a defined operational area and would not affect the entire extended range area. The van and tower at the range station would provide the Navy a place that is separate from the public area for set up and control, and would help minimize public access area use and effect on public activities. Therefore, Alternative 1 would result in minimal direct or indirect impacts to commercial fishing within the extended QUTR Site boundaries.

Table 3.11-9 Average Annual Days of Public Use Restrictions at QUTR Site

	QUTR Site – Offshore	*QUTR Site – Surf Zone*
Total Days of Use		
Existing	14	0
Proposed	16	30
Days Restricted for < 1 Hour		
Existing	0	0
Proposed	0	0
Days Restricted for 1-12 Hours		
Existing	0	0
Proposed	0	0
Unrestricted Days		
Existing	365	365
Proposed	365	365

Note: Anticipated worst case average annual days of public use restrictions at QUTR for all three alternatives.

Implementation of Alternative 1 would result in minor, short-term economic benefits to the local economy near the proposed surf zone at Kalaloch due to the temporary presence of Navy personnel during activities. The majority of teams participating in surf-zone activities would lodge in the local area, where their expenditures would make a minor contribution to the local economy. In addition, during the surf-zone activities (about 30 times per year), some participants and visitors would purchase food and drink at local establishments which would also result in a minor contribution to the local economy. However, these short-term beneficial effects would be negligible on a regional scale, and no long-term socioeconomic changes would occur with implementation of Alternative 1 as no new permanent jobs would be created. Therefore, implementation of Alternative 1 would result in minor beneficial economic effects to socioeconomic resources.

No adverse impacts to employment, income distribution, or the economy are anticipated. As described in Section 3.7, proposed activities under Alternative 1 would not disrupt Tribal usual and accustomed fishing patterns at or around QUTR Site. Consequently, no disproportionately high and adverse impacts to minority and low-income populations would be expected.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Implementation of Alternative 2 would have the same offshore impacts as Alternative 1 and similar temporary, short-term gains in the local economy as found under Alternative 1. Therefore, no adverse impacts to socioeconomics would occur with implementation of Alternative 2. No disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Implementation of Alternative 3 would have the same impacts as described under Alternative 1. Therefore, no adverse impacts to socioeconomics would occur with implementation of Alternative 3. No disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS.

No-Action Alternative

Implementation of the No-Action Alternative would not result any impacts to socioeconomics and environmental justice at the QUTR Site. The range would continue to be used for Navy activities within the existing QUTR Site boundaries; the van and tower at Kalaloch and the cabling and instrumentation would continue to be monitored and maintained.

3.11.3.3 Mitigation Measures

Since there would be no adverse impacts to socioeconomics and environmental justice with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary. However, as described in Section 3.7, the Navy would implement a system to exchange information with Tribal governments on activities to avoid disruption of Tribal usual and accustomed fishing patterns.

3.12 AIR QUALITY

For the purposes of this analysis, air quality is defined as the ambient air concentrations of specific pollutants determined by the USEPA to be of concern to the health and welfare of the general public. These seven pollutants (the criteria pollutants) include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). National Ambient Air Quality Standards (NAAQS) have been established by the USEPA for these criteria pollutants (USEPA 2007a). The NAAQS define the maximum concentrations of the criteria pollutants that are considered safe, with an additional adequate margin of safety, to protect human health and welfare. Washington has adopted the NAAQS for all criteria pollutants except for SO_2, for which the state has adopted slightly more stringent requirements (WDOE 2007). Figure 3.12-1 lists the NAAQS as well as applicable state and regional air quality standards. Depending on the type of pollutant, these maximum concentrations may not be exceeded at any time, or may not be exceeded more than once per year (USEPA 2007a, WDOE 2007).

As required by the Clean Air Act (CAA) Amendments of 1990, Washington has prepared a State Implementation Plan (SIP). The SIP is a compilation of goals, strategies, schedules, and enforcement actions that help lead a state into compliance with the NAAQS. Areas not in compliance with the NAAQS can be declared nonattainment areas by the USEPA or by the appropriate state or local agency. Areas in compliance with the NAAQS are defined as being in attainment. Areas that have been reclassified from nonattainment to attainment are designated as attainment/maintenance areas. Areas that lack the monitoring data to demonstrate attainment or nonattainment status are designated as unclassified and are treated as attainment areas for regulatory purposes.

As described in 40 CFR Part 51, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* (the "General Conformity Rule"), all federal actions occurring in air basins designated in nonattainment or in a maintenance area must conform to an applicable implementation plan. Should a proposed action result in emissions that exceed *de minimis* levels (based on the nonattainment status for each applicable criteria pollutant in the area of concern), a conformity determination would be required. All counties potentially affected by the Proposed Action are in attainment of the NAAQS as well as state and regional air quality standards. Since all three sites and their proposed extensions are in attainment areas the General Conformity Rule does not apply. Therefore, a CAA conformity determination is not required.

There are no stationary sources of emissions within the NUWC Keyport Range Complex. Potential air contaminating equipment used for ranging includes ships and other marine vessels, aircraft, and various weapon systems. All are properly maintained in accordance with applicable Navy requirements and meet Federal and State emission standards, where applicable.

The evaluation of potential air quality impacts includes estimating the emissions generated from the primary air contaminating sources associated with ranging; which are the range crafts. The data for the air quality analysis is based on ship logs, additional range data and interviews with range subject matter experts (SMEs).

Marine vessel traffic in the NUWC Keyport Range Complex is composed of military ship and boat traffic, including support vessels. A number of non-military commercial vessels and recreational vessels are also regularly present within the complex. These vessels were not evaluated in the air quality analysis as they are not part of the Navy's action.

POLLUTANT	AVERAGING TIME(1)	PUGET SOUND CLEAN AIR AGENCY (PSCAA) STANDARDS(2)	WASHINGTON STANDARDS (3)	NATIONAL STANDARDS (NAAQS)(3)	
				Primary	Secondary
Ozone (O_3)	8 Hour	0.08 ppm	•	0.08 ppm (157 μg/m^3)	Same as Primary Standards
	1 Hour	•	0.12 ppm	•	
Carbon Monoxide (CO)	8 Hour	9.4 ppm	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	•
	1 Hour	35 ppm	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm	0.05 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as Primary Standard
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	0.02 ppm	0.02 ppm	0.03 ppm (80 μg/m^3)	•
	24 Hour	0.1 ppm	0.1 ppm	0.14 ppm (365 μg/m^3)	•
	3 Hour	•	•	•	0.5 ppm (1300 μg/m^3)
	1 Hour 1 Hour(4)	0.4 ppm 0.25 ppm	0.4 ppm 0.25 ppm	•	•
Respirable Particulate Matter ≤ 10 Microns in Diameter (PM_{10})	Annual Arithmetic Mean	54 μg/m^3	50 μg/m^3 (60 μg/m^3 total PM)	•	Same as Primary Standards
	24 Hour	154 μg/m^3	150 μg/m^3 (total PM)	150 μg/m^3	
Respirable Particulate Matter ≤ 2.5 Microns in Diameter ($PM_{2.5}$)	Annual Arithmetic Mean	15 μg/m^3	15 μg/m^3	15 μg/m^3	Same as Primary Standards
	24 Hour	35 μg/m^3	35 μg/m^3	35 μg/m^3	
Lead (Pb)	Quarterly Average	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3	Same as Primary Standard

ppm – parts per million μg/m^3 – micrograms per cubic meter mg/m^3 – milligrams per cubic meter • – no standard established

Note: USEPA adopts rounding conventions; therefore, the values presented in this table may vary slightly.

(1) Pollutants typically have multiple standards with different averaging times. For a complete description of standards measuring criteria, refer to the sources below.

(2) Applicable for Kitsap County.

(3) Olympic Region Clean Air Agency (ORCAA) standards comply with the NAAQS and Washington State Standards – applicable for Grays Harbor, Jefferson and Mason Counties.

(4) Not to be exceeded more than twice in 7-day period.

Sources: USEPA 2007a, WDOE 2007, ORCAA 2007, PSCAA 2007.

Figure 3.12-1
Regional, State, and National Ambient Air Quality Standards

The methodology for estimating marine vessel emissions involves evaluating each type of vessel, the number of hours of operation for each vessel type, the type of propulsion engines and generators onboard each type of vessel. The types and number of range crafts used vary with the nature of the activities performed. The data presented in Table 3.12-1 is based on 2007 use and is adjusted to account for the proportion of time that the crafts are used supporting activities within the NUWC Keyport Range Complex. NUWC Keyport has six primary range craft types: two Yard Torpedo Test (YTT) Crafts, two Yard Patrol Boats (YPB), two Torpedo Weapon Retrieval (TWR) Boats, one Yard Cargo (YC) Barge and three small support boats (one SEAARK and two Boston Whalers). Vessel use can vary greatly. In 2007, YPB 697 and neither of the Boston Whalers were used for ranging. Craft time may also support activities outside the scope of the EIS/OEIS, such as ranging in Canada, and those hours of use were not used in the emission calculations. Emission factors were established for each vessel type based on the typical operational mode (i.e., power level). The emission factors (in pounds [lb] of pollutant per hour) are the combined emissions for the propulsion engines and generators.

The increase in tempo for the range craft is a total of seven days for the combined alternatives. The 30 days of surf zone activities for the QUTR site alternatives were not calculated since no emission data is available based on the specific support crafts (Jet Ski, rigid inflatable boat or local contracted boats) are not identifiable at this time. The emission associated with the surf zone activities would be consistent with that of one more personal watercraft user or local fishing boat and would not result in an adverse impact on the air quality.

Table 3.12-1. Range Craft Air Emissions (based on 2007 data)

Ship/Boat	Sources	Max Hrs/yr[2]	Emission Factors (lb/hr) & Total pounds per year CO	NOx	HC	SOx	PM_{10}/ $PM_{2.5}$
Yard Torpedo Test (YTT) Crafts (50% - both boats[1])	(1) Cummins KTA 50M & (3) Cummins VTA28 395kW	805	(0.38) 306	(3.4) 2,737	(0.35) 282	(0.62) 499	(0.15) 121
Yard Patrol Boat (YPB) (90% - 701 only[1])	(2) GM Detroit V12-71N & (2) 3-71 GM Detroit, 40kW	526	(6.21) 3,266	(14.95) 7,864	(1.52) 800	(3.11) 1,636	(0.57) 300
Torpedo Weapon Retrieval Boat (TWR) (40% - both boats[1])	(2) 2900 HP, 1450 HP & (2) Caterpillar 3054T or C4.4 DITA	388	(7.64) 2,964	(16.22) 6,293	(1.59) 617	(3.40) 1,319	(1.18) 458
Yard Cargo Barge (YC) (40% - 1 only[1])	(2) GM Detroit V12-71N & (1) Northern Light, M844 16kW	60	(6.50) 390	(12.46) 748	(1.05) 63	(2.51) 151	(0.35) 21
SEAARK	(2) Mercury 225 HP Outboard	12		(0.26) 3	(26.3) 316		
Boston Whaler	(1) Mercury 225 HP Outboard	0		(0.08) 0	(9.02) 0		
Current Totals			6,926	17,645	2,078	3,605	900
Tempo Increase Totals (existing crafts) 7 additional days			180	459	54	94	23
Alternate's Totals			7,106	18,104	2,132	3,699	923

1. In Washington waters. 2. Based on highest hrs of use of any source.

3.12.1 Keyport Range Site

3.12.1.1 Existing Conditions

Conformity Status

The Keyport Range Site is located within the jurisdiction of the Puget Sound Clear Air Agency (PSCAA), which includes Kitsap, King, Pierce, and Snohomish Counties. Kitsap County is in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (PSCAA 2007; USEPA 2007b). Since Kitsap County is in attainment of the NAAQS, the General Conformity Rule does not apply.

Climate

The Keyport Range Site is situated in a maritime temperate subtropical climate regime. The average annual high temperature is approximately 60 °F (15.6 °C), ranging between an average summer maximum of 75°F (23.9°C) and an average winter maximum of 45°F (7.2°C) (Western Regional Climate Center [WRCC] 2006). The average annual low temperature is approximately 43°F (6.1°C), ranging between an average summer minimum of 53°F (11.7°C) and an average winter minimum of 34°F (1.1°C). Subfreezing temperatures and snow are rare. The area averages approximately 54 inches (137.2 cm) of rain a year, with the majority of precipitation in the late fall and winter months. Winds in the area are most frequent and strongest from the south-southwest, followed by winds from the south. Average wind speed is approximately 7 mph (11.2 kph); however, during intense storm events winds can gust in excess of 30 mph (48.3 kph) for intense storms (WRCC 2006).

Emission Sources

There are no major air pollution sources in the immediate vicinity of NUWC Keyport or the Keyport Range Site. Emission sources at NUWC Keyport include boilers, generators, boats, and personal and government-owned vehicles. Emissions sources associated with existing NUWC Keyport RDT&E and training activities include support craft, special purpose barges, pier-side crane, helicopters, and vehicles used to transport material and people.

3.12.1.2 Environmental Consequences

Keyport Range Alternative 1 – Preferred Alternative

Implementation of Alternative 1 would result in small temporary emissions from Fleet activities, launch systems (i.e., launch craft, barges, Fleet vessels), and vehicles used to transport equipment and teams to NUWC Keyport. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. RDT&E testing activities, duration, and range use would increase; however, the proposed underwater testing vehicles are electrically or chemically powered, and would not produce emissions. Kitsap County is in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (PSCAA 2007; USEPA 2007b). Implementation of Alternative 1 would have minimal impacts to air quality.

Federal agencies are, on a national scale, addressing emissions of greenhouse gases by reductions mandated in federal laws and Executive Orders, most recently, EO 13423. There would be no appreciable increase in greenhouse gas emissions with the implementation of the Proposed Action at the

Keyport Site; therefore, the Proposed Action would have no effect on global warming or the human environment.

No-Action Alternative

Under the No Action Alternative, there would be no increase in operations from baseline activities. The emissions levels would remain constant for those emission sources that are not affected by other Federal, State, or local requirements to reduce air emissions. The proposed range extensions and associated operational scenarios would not occur and existing activities would continue to be conducted on all three range sites. Under the No-Action Alternative, existing conditions as described in Section 3.12.1.1 would remain unchanged. Therefore, implementation of the No-Action Alternative would have minimal impacts to air quality.

3.12.1.3 Mitigation Measures

Since there would be minimal impacts to air quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.12.2 DBRC Site

3.12.2.1 Existing Conditions

Conformity Status

The DBRC Site is located within the jurisdiction of both the PSCAA (Kitsap County) and the Olympic Region Clean Air Agency (ORCAA), which includes Jefferson, Clallam, Grays Harbor, Mason, Pacific, and Thurston counties. Kitsap and Jefferson counties are in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (PSCAA 2007; ORCAA 2007; USEPA 2007b). Since Kitsap and Jefferson Counties are in attainment of the NAAQS, the General Conformity Rule does not apply.

Climate

Due to the close proximity of the DBRC Site to the Keyport Range Site, climate summaries for the DBRC Site are the same as those described under the Keyport Range Site. The DBRC Site is situated in a maritime temperate subtropical climate regime. The average annual high temperature is approximately 60 °F (15.6 °C), ranging between an average summer maximum of 75°F (23.9°C) and an average winter maximum of 45°F (7.2°C) (WRCC 2006). The average annual low temperature is approximately 43°F (6.1°C), ranging between an average summer minimum of 53°F (11.7°C) and an average winter minimum of 34°F (1.1°C). Subfreezing temperatures and snow are rare. The area averages approximately 54 inches (137.1 cm) of rain a year, with the majority of precipitation in the late fall and winter months. Winds in the area are most frequent and strongest from the south-southwest, followed by winds from the south. Average wind speed is approximately 7 mph (11.2 kph); however, during intense storm events winds can gust in excess of 30 mph (48.3 kph) (WRCC 2006).

Emission Sources

There are no major air pollution sources in the immediate vicinity of the DBRC Site. Emission sources at the DBRC Site are concentrated around the Hood Canal area and include support boats, generators, and personal- and government-owned vehicles. Emissions sources associated with existing testing activities include support craft, special purpose barges, helicopters, and vehicles used to transport material and people.

3.12.2.2 Environmental Consequences

DBRC Alternative 1 (Southern Extension)

Implementation of Alternative 1 would result in small temporary emissions from fleet activities, launch systems (i.e., launch craft, barges, fleet vessels, and aircraft), and vehicles used to transport equipment and teams to the DBRC Site. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. Kitsap and Jefferson counties are in attainment of the NAAQS as well as state and regional air quality standards for all 7 criteria pollutants (PSCAA 2007; ORCAA 2007; USEPA 2007b). Implementation of Alternative 1 would have minimal impacts to air quality.

There would be no appreciable increase in greenhouse gas emissions with the implementation of Alternative 1; therefore, the Proposed Action would have no effect on global warming or the human environment.

DBRC Alternative 2 – Preferred Alternative (Southern and Northern Extensions)

Alternative 2 would result in small temporary emissions from fleet activities, launch systems (i.e., launch craft, barges, fleet vessels, and aircraft), and vehicles used to transport equipment and teams to the DBRC Site. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. Kitsap, Jefferson and Mason counties are in attainment of the NAAQS for all 7 criteria pollutants (PSCAA 2007; ORCAA 2007; USEPA 2007b). Alternative 2 would therefore have a negligible impact on air quality.

There would be no appreciable increase in greenhouse gas emissions with the implementation of Alternative 2; therefore, the Proposed Action would have no effect on global warming or the human environment.

No-Action Alternative

Under the No-Action Alternative, the proposed range extensions and associated operational scenarios would not occur and existing activities would continue to be conducted on all three range sites. There would be no increase in operations from baseline activities. The emissions levels would remain constant for those emission sources that are not affected by other Federal, State, or local requirements to reduce air emissions. Therefore, implementation of the No-Action Alternative would have minimal impacts to air quality.

3.12.2.3 Mitigation Measures

Since there would be minimal impacts to air quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

3.12.3 QUTR Site

3.12.3.1 Existing Conditions

Conformity Status

The QUTR Site is located within the jurisdiction of the ORCAA, which includes Jefferson, Clallam, Grays Harbor, Mason, Pacific, and Thurston Counties; the surf-zone alternative sites are found in Grays Harbor County. All counties are in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (ORCAA 2007, USEPA 2007b); therefore, the General Conformity Rule does not apply.

Climate

The QUTR Site is situated in a maritime temperate subtropical climate regime. The average annual high temperature is approximately 57°F (13.9°C), ranging between an average summer maximum of 64°F (17.8°C) and an average winter maximum of 48°F (8.9°C). The average annual low temperature is approximately 41°F (5.0°C), ranging between an average summer minimum of 48°F (8.9°C) and an average winter minimum of 34°F (1.1°C). Subfreezing temperatures and snow are rare. The area averages 88 inches (223.5 cm) of rain a year, with the majority falling in the late fall and winter months.

Emission Sources

There are no major air pollution sources in the immediate vicinity of QUTR Site. Emission sources associated with existing testing activities include support craft, helicopters, and vehicles used to transport material and people.

3.12.3.2 Environmental Consequences

QUTR Alternative 1 (Kalaloch Surf Zone Access Area)

Alternative 1 would result in minor temporary emissions from fleet activities, launch systems, and vehicles used to transport equipment to the QUTR Site. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. A limited number of vessels would be active at any given time during shore launch operations and the small increase in emissions would not adversely affect ambient air quality. The area is in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (ORCAA 2007; USEPA 2007b). Alternative 1 would have a negligible impact on air quality.

There would be no appreciable increase in greenhouse gas emissions with the implementation of Alternative 1; therefore, the Proposed Action would have no effect on global warming or the human environment.

QUTR Alternative 2 – Preferred Alternative (Pacific Beach Surf Zone Access Area)

Alternative 2 would result in minor temporary emissions from fleet activities, launch systems, and vehicles used to transport equipment to the QUTR Site. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. A limited number of vessels would be active at any given time during shore launch operations and the small increase in emissions would not adversely affect ambient air quality. The area is in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (ORCAA 2007; USEPA 2007b). Alternative 2 would have a negligible impact on air quality.

There would be no appreciable increase in greenhouse gas emissions with the implementation of Alternative 2; therefore, the Proposed Action would have no effect on global warming or the human environment.

QUTR Alternative 3 (Ocean City Surf Zone Access Area)

Alternative 3 would result in minor temporary emissions from fleet activities, launch systems, and vehicles used to transport equipment to the QUTR Site. As shown in Table 3.12-1 emissions associated with implementation of the combined alternatives would result in only very slight increases in air emissions above baseline (No Action Alternative) conditions and would not result in an adverse impact on the air quality. This increase in emissions of air pollutants would not result in exceedances of the air quality standards as discussed previously in this section. A limited number of vessels would be active at any given time during shore launch operations and the small increase in emissions would not adversely affect ambient air quality. The area is in attainment of the NAAQS as well as state and regional air quality standards for all seven criteria pollutants (ORCAA 2007; USEPA 2007b). Alternative 3 would have a negligible impact on air quality.

There would be no appreciable increase in greenhouse gas emissions with the implementation of Alternative 3; therefore, the Proposed Action would have no effect on global warming or the human environment.

No-Action Alternative

Under the No-Action Alternative, the proposed range extensions and associated operational scenarios would not occur and existing activities would continue to be conducted on all three range sites. There would be no increase in operations from baseline activities. The emissions levels would remain constant for those emission sources that are not affected by other Federal, State, or local requirements to reduce air emissions. Therefore, implementation of the No-Action Alternative would have minimal impacts on air quality.

3.12.3.3 Mitigation Measures

Since there would be minimal impacts to air quality with implementation of the Proposed Action or alternatives, no mitigation measures would be necessary.

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CHAPTER 4
CUMULATIVE IMPACTS AND IRREVERSIBLE / IRRETRIEVABLE COMMITMENT OF RESOURCES

4.1 CUMULATIVE IMPACTS

4.1.1 Analysis of Cumulative Impacts

The analysis of cumulative impacts (or cumulative effects)[1] follows the objectives of the National Environmental Policy Act (NEPA) of 1969 and Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] §§ 1500-1508) that provide the implementing procedures for NEPA. The CEQ regulations define "cumulative effects" as:

> ". . . the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7).

The CEQ also provides guidance on cumulative impacts analysis in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997). Noting that environmental impacts result from a diversity of sources and processes, this CEQ guidance observes that "no universally accepted framework for cumulative effects analysis exists," while noting that certain general principles have gained acceptance. One such principal provides that "cumulative effects analysis should be conducted within the context of resource, ecosystem, and community thresholds—levels of stress beyond which the desired condition degrades." Thus, "each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." Therefore, cumulative effects analysis normally will encompass geographic boundaries beyond the immediate area of the Proposed Action, and a time frame including past actions and foreseeable future actions, in order to capture these additional effects. Bounding the cumulative effects analysis is a complex undertaking, appropriately limited by practical considerations. Thus, CEQ guidelines observe, "[i]t is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful."

For the purposes of assessing cumulative impacts, the Navy reviewed all relevant and available environmental documentation pertaining to projects considered in the cumulative impacts analysis. The level of information available for the different cumulative projects is variable, and the best available data are used in the analysis. In addition, NMFS and USFWS reviewed the status of listed species and the environmental baseline of these species, as well as cumulative effects, in their respective Biological Opinions that resulted from the Navy's consultation under section 7 of the Endangered Species Act.

4.1.2 Geographic Boundaries for Cumulative Impacts Analysis

Geographic boundaries for analyses of cumulative impacts in this EIS/OEIS vary for different environmental resources. For example, for air quality, the potentially affected air basin is the appropriate

1 CEQ Regulations provide that the terms "cumulative impacts" and "cumulative effects" are synonymous (40 CFR § 1508.8(b)).

boundary for assessment of cumulative impacts from releases of pollutants into the atmosphere. For resources such as fish or marine mammals, impacts from the Proposed Action might combine with impacts from distant sources to affect the resource species, necessitating a wider geographic scope for the analysis. Table 4-1 identifies the geographic scope of this cumulative impacts analysis, by resource area.

The analysis of cumulative effects may go beyond the scope of project specific direct and indirect effects to include expanded geographic and temporal boundaries and a focus on broad resource sustainability. This "big picture" approach is becoming increasingly important as growing evidence suggests that the most siginificant effects result not from the direct impacts of a specific action, but from the combination of individual, often minor, effects of multiple actions over time. The underlying concern is whether or not a particular resource can recover from the effects of an action before the environment is exposed to a subsequent action or actions.

Table 4-1 Geographic Areas for Assessment of Cumulative Impacts

Resource	Area for Impacts Analysis
Terrestrial Wildlife	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Marine Flora and Invertebrates	Liberty Bay, Port Orchard Reach, Hood Canal, Dabob Bay, and Pacific Ocean off the coast of Jefferson County, including OCNMS and W-237 portion of offshore OPAREA
Sea Turtles	Liberty Bay, Port Orchard Reach, Hood Canal, Dabob Bay, and Pacific Ocean off the coast of Jefferson County, including OCNMS and W-237 portion of offshore OPAREA
Fish	Liberty Bay, Port Orchard Reach, Hood Canal, Dabob Bay, and Pacific Ocean off the coast of Jefferson County, including OCNMS and W-237 portion of offshore OPAREA
Marine Mammals	Liberty Bay, Port Orchard Reach, Hood Canal, Dabob Bay, and Pacific Ocean off the coast of Jefferson County, including OCNMS and W-237 portion of offshore OPAREA
Sediments and Water Quality	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Cultural Resources	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Recreation	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Land and Shoreline Use	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Public Health and Safety and Environmental Hazards to Children	Keyport Range, DBRC and QUTR Sites and Immediate Vicinity
Socioeconomics and Environmental Justice	Kitsap, Jefferson, Grays Harbor, and Mason Counties
Air Quality	PSCAA and ORCAA air basin jurisdictions

4.1.3 Past, Present, and Reasonably Foreseeable Future Actions

Identifiable effects of past actions are analyzed and evaluated to the extent they may be additive to impacts of the Proposed Action. In general, the Navy need not list or analyze the effects of individual past actions; cumulative impacts analysis appropriately focuses on aggregate effects of past actions. Reasonably foreseeable future actions that may have impacts additive to the effects of the Proposed Action are also analyzed. As part of the evaluation of cumulative impacts, a review of other projects in the vicinity of each of the three range sites was conducted. Table 4-2 provides a summary of the projects, indicating the approximate timeframe of each project. Other categories of ongoing (past, present, and reasonably foreseeable future) human activities that encompass multiple "actions" or "projects" by government or other entities (e.g., community development, commercial and other fishing or boating activities, scientific studies, port and commercial shipping operations, etc.), were also considered as potential contributors to cumulative effects on environmental resources.

Table 4-2 Cumulative Projects near the NAVSEA NUWC Keyport Range Complex

Cumulative Projects by Range Site	*Timeframe* Past	Present	Future
Keyport Range Site			
A – Undersea Weapons Systems Dependability Center	X		
B – Shoreline Construction	X	X	X
C – Keyport Lagoon Habitat Enhancement			X
DBRC Site			
A – Naval Surface Warfare Center Det Bremerton Command Consolidation		X	
B – Underwater Surveillance System	X		
C – Submarine Development Squadron Detachment FIVE Support Facilities	X		
D – Fred Hill Materials Gravel Project			X
E – Hood Canal Bridge Replacement and Retrofit		X	
F – Point Whitney Boat Ramp Upgrade			X
G – Hood Canal Dissolved Oxygen Program	X	X	X
H – Jefferson County Black Point Master Planned Resort Proposal			X
I – Swimmer Interdiction Security System, Naval Base Kitsap-Bangor		X	
J – Transit Protection System Facilities, Naval Base Kitsap-Bangor			X
K – Waterfront Restricted Area Land/Water Interface, Naval Base Kitsap-Bangor			X
L – Trident Support Facilities Explosives Handling Wharf			X
QUTR Site			
A – Deep Sea Corals Study	X	X	X
B – Washington Island NWR Comprehensive Conservation Plan	X		
C – NWTRC Activities	X	X	X
D – Other Categories of Activities (Research, Boating, Coastal Development)	X	X	X

4.1.3.1 Keyport Range Site

A – Undersea Weapons Systems Dependability Center

NUWC Keyport operates the Undersea Weapons Systems Dependability Center which provides the Fleet, system developers and acquisition managers with a Center for testing, validating, and assuring the dependability of next-generation undersea warfare vehicles, weapons, and systems. The 25,910 ft^2 (2,407.1 m^2) facility completed in 2006 is located in the industrial area of NUWC Keyport. The facility provides connectivity and real-time integration of in-situ range performance data with undersea battle space labs; multiple test and training ranges; Fleet submarine and air and surface units worldwide, and some engineering labs.

B – Shoreline Construction

The shoreline of Liberty Bay, Port Orchard Reach, and Hood Canal has been and continues to be subject to development by property owners. Over the past 5 years, an average of 15 shoreline development permits (Joint Aquatic Resource Permit Applications) per year have been applied for by property owners within the cumulative effects region. These actions (e.g., pier/dock construction, shoreline stabilization, stairways/beach access, shoreline construction, submarine cable installation, septic system failures) are likely to continue to occur within the cumulative effects region at the same pace (i.e., approximately 15 per year) over the next several years.

C – Keyport Lagoon Habitat Enhancement

As part of the WDOE water quality certification process for maintenance wharf replacement actions at Puget Sound Naval Shipyard, a mitigation opportunity was proposed by WDOE to restore a more natural flow of tidal influences between Puget Sound (Liberty Bay) and Keyport Lagoon. The mitigation opportunity at Keyport would return the 24-acre brackish lagoon to a saltwater marsh and intertidal mudflat by removing the concrete sill structure and 40-foot bridge on Bushnell Drive and installing two 42-foot span arch culverts. Implementing this mitigation would restore the habitat structure and function of Keyport Lagoon back to those of a Puget Sound tidal marsh habitat. The salinity of the lagoon would closely match that of Port Orchard Bay during high tide, with streams entering the lagoon supporting a lower salinity as the tide recedes.

4.1.3.2 DBRC Site

A – Naval Surface Warfare Center, Detachment Bremerton Command Consolidation

This action consolidates Naval Surface Warfare Center, Carderock Division Detachment Bremerton activities at Fox Island Laboratory and Detachment Bremerton to Naval Base Kitsap-Bangor in Silverdale, Washington. The project consists of constructing in-water facilities on Carlson Spit, including a new access pier and associated mooring components (e.g., dolphins, anchoring systems). The new pier supports a pontoon with two prefabricated buildings, the M241 barge, the Range Crane Barge, and several small motorized vessels and skiffs. The existing Carlson Spit Access Road is being improved and short-term parking and loading/unloading space is being provided at the base of the new access pier. In addition to the in-water facilities, a new structure, called the Office/Laboratory Building, is being constructed in an area just east of Sealion Road. Approximately 5 acres (2.0 ha) of mature forest are being removed to provide office and laboratory space for approximately 70 scientists and engineers and parking for approximately 100 vehicles. Construction of this project began in Spring 2007 with a project completion date scheduled for Fall 2008.

B – Underwater Surveillance System

The Navy installed an active-acoustic Underwater Surveillance System within the designated Restricted Area at Naval Base Kitsap-Bangor. The purpose of this project was to improve the underwater detection capabilities at Naval Base Kitsap-Bangor to comply with current Navy directives regarding base security. The system operates at the same frequency and range as a commercial “fish finder” and is in operation full time. The system was installed and operational as of April 2006.

C – Submarine Development Squadron FIVE Detachment Support Facilities

The Navy implemented upgrades to waterfront and shore-based support facilities for its Submarine Development Squadron FIVE Detachment at Submarine Base Bangor (now called Naval Base Kitsap-Bangor). These upgrades were completed in July 2005. Anticipated levels of mission support, and the operational tempo of assigned submarines, require additional shore-side buildings for administration, operations, industrial, and support functions. Security requirements and operational efficiency dictate consolidation of off-base contractor space onto a contiguous site adjacent to the Shore-based Support Facility.

D – Fred Hill Materials Gravel Project

Fred Hill Materials, a materials supply firm based in Poulsbo, is proposing construction of a 4-mi (~6-km) conveyor belt connecting a 781-acre (316-ha) inland gravel mine to a 1,100-ft (335-m) long, 80-ft (24-m) high pier and 900-ft (274-m) long moorage dock. The shipping facility would be on the west shore of Hood Canal, 5 mi (8 km) south of the Highway 104 Hood Canal Bridge. When fully operational, the "pit to pier" operation would mine, transport, and ship an estimated 60,000 tons (54,432 metric tons) of gravel 24 hours per day, loading into barges and ships bound for domestic and foreign ports. Each vessel would travel under or through the opening of the floating Hood Canal Bridge. The company (action proponent) has begun the process of applying for permits. Under the Washington State Environmental Policy Act, an EIS public scoping meeting was held on September 27, 2007 and an EIS is in progress.

E – SR-104 Hood Canal Bridge East-half Replacement and West-half Retrofit Project

The eastern half of the Hood Canal Bridge, located between Kitsap and Jefferson counties at the northern mouth of Hood Canal, is nearing the end of its structural service life. From the extent of cracking and damage caused by past major storms, the remaining service life of the bridge has been reduced. An EA and Supplemental EA were prepared for the project and a FONSI issued in May 2002; construction began in 2006. When completed, the Hood Canal Bridge will have a new, wider, floating section, new approach sections, and transition trusses on the east and west ends. In addition, the western half that was rebuilt after it sank during a 1980 storm will be widened to allow for continuous 8-ft (2.4-m) shoulders across the entire length of the bridge. The east-half of the replacement is scheduled to be completed in summer 2009, and west-half retrofitting is scheduled to be completed by December 2010.

F – Point Whitney Boat Ramp Upgrade

The Washington Department of Fish and Wildlife (WDFW) proposes to expand the existing public boat launch to better accommodate recreational boating access to Dabob Bay. The existing 10-ft (3-m) wide ramp would be widened to 12 ft (4 m) and extended 22 ft (7 m) beyond the end of the existing ramp to a total length of 132 ft (40 m). The existing ramp is 12 to 14 in (31-36 cm) thick. The replacement ramp would be 6 in (15 cm) thick. Potential impacts were identified for Pacific herring and epibenthic organisms and infauna that utilize eelgrass habitat in the boat ramp area. Mitigation measures were outlined in the Final State Environmental Policy Act (SEPA) documentation, dated November 3, 2004, and an addendum to Determination of Non-Significance was signed on September 15, 2005.

G – Hood Canal Dissolved Oxygen Program (HCDOP)

The Hood Canal Dissolved Oxygen Program was created to address the historically low DO situation and the effect on marine life. The Program is a partnership of 28 organizations that works with local, state, federal, and Tribal government policy makers to evaluate potential corrective actions that will restore and maintain DO to reduce stress to marine life. A three-year Integrated Assessment and Modeling Study was conducted from 2005-2007 to use marine, freshwater and biota monitoring data and a computer model to quantify the role the various natural processes and human actions are playing to control the concentrations of DO in Hood Canal and to test corrective action scenarios. Ongoing activities include education and outreach, working with policy makers, monitoring water quality, responding to fish kills and algal blooms, and using modeling to evaluate potential corrective actions.

H – Jefferson County Black Point Master Planned Resort

The Statesman Group of Companies, LTD, and Black Point Properties, LLC, have submitted an application for a Master Planned Resort in the Black Point area called the Pleasant Harbor Marina and

Golf Resort on the shore and uplands near Brinnon and the Navy Range at Dabob Bay. The project consists of 253 acres (102 ha), a marina with 290 slips, minor commercial facilities, an 18-hole golf course, and 1,090 residential units designed to serve the visiting public through a "condotel" program, with individual units privately owned but managed as a resort. Also at issue is the likelihood of the resort exchanging property with the Department of Fisheries to enable the construction of a new boat ramp, which would be open to the public. The document addressed potential impacts to shellfishing, water quality, transportation, public services, shorelines, fish and wildlife, rural character, archaeological and cultural resources, and critical areas. A FEIS was published in November 2007 and was included as part of the 2007 Comprehensive Plan Amendment Cycle. The Board of County Commissioners approved the proposal in January 2008.

I – Swimmer Interdiction Security System, Naval Base Kitsap-Bangor

The Navy has proposed to implement a Swimmer Interdiction Security System to meet special U.S. government security requirements for military installations in response to the terrorist attacks of September 11, 2001. The system would protect waterside Navy assets and sailors and would remain in operation as long as valuable naval assets are located at Naval Base Kitsap-Bangor. The Navy examined various alternatives for implementing the system: marine mammals (preferred alternative), combat swimmers, and remotely operated vehicles. Under the preferred alternative, specially trained marine mammals and their human teammates would respond rapidly to security alerts by detecting, classifying, and marking the location of underwater objects or interdicting intruders. Humans would work aboard small power boats and marine mammals would be in enclosures. A Draft EIS was made available to the public for comment in December 2008, with a Record of Decision anticipated for Winter 2009.

J – Transit Protection System Facilities, Naval Base Kitsap-Bangor

This project is being addressed in an EIS for Naval Base Kitsap-Bangor waterfront projects. This project is to provide berthing for three types of Transit Protection System vessels and various Port Operations tugs and small craft. In addition, the project will provide the necessary support facilities ashore for the command, administrative, operations, and support functions of the crews and command personnel of associated escort vessels and craft. The project involves the demolition of an existing pier and the installation of piles for the new pier, as well as construction of new facilities. The pier will be located at the site of the existing Magnetic Silencing Facility (MSF). The existing MSF and associated support facilities will be demolished. The proposed development involves several potentially significant issues, including endangered and threatened species, stormwater runoff, demolition material disposal, and the avoidance of impacts to valuable upland natural resources. This project is scheduled to occur in FY11.

K – Waterfront Restricted Area (WRA) Land/Water Interface (LWI), Naval Base Kitsap-Bangor

This project is being addressed in an EIS for Naval Base Kitsap-Bangor waterfront projects. This project is to provide security upgrades to the existing Naval Base Kitsap-Bangor WRA by constructing two WRA LWI Barriers, which connect both ends of the WRA enclave to the existing floating barriers. The LWIs will extend from the high water mark to the terminations of the Port Security Barriers (PSB) and will be capable of moving in the full tide range and providing an anchorage for the floating barriers. The project consists of two separate construction features. The first is the delay system, which connects the high tide termination with the existing PSB to prevent entry of the current postulated threat vehicle. The second is construction of the sensor equipment that will provide detection. This project is scheduled to occur in FY12.

L – Trident Support Facilities Explosive Handling Wharf

As part of its strategic deterrence mission, the Navy is proposing to build a second explosives handling wharf adjacent to, but separate from, the existing wharf at Naval Base Kitsap-Bangor. The preferred alternative, the Deep-Water Trestle Alternative, would comprise a covered operations area, warping wharf and access trestles built parallel to and approximately 600 feet (183 m) from shore, away from the intertidal zone to the extent possible. The construction of wharves and trestles for the preferred alternative could require up to 2,600 piles. Potential impacts of the Proposed Action and alternatives are being addressed in an EIS being prepared by the Navy.

4.1.3.3 QUTR Site

A – Deep Sea Corals Study

Scientists from the National Center for Coastal Ocean Science and the Olympic Coast National Marine Sanctuary (OCNMS) have initiated a study of deep sea coral/sponge assemblages at the OCNMS and their potential vulnerability to anthropogenic activities in the area. The project began in June 2004 with a pilot survey. A follow-up survey was conducted from May 22 to June 4, 2006 to explore other areas of the sanctuary looking for communities of deepwater corals and sponges. The Remotely Operated Platform for Ocean Science traveled over the seafloor 1 and 20 mi (1.6 to 32 km) from shore in the OCNMS at depths ranging from 300 to 2,000 ft (91.4 to 609.6 m) (Hyland et al. 2005; Brancato et al. 2007). Future efforts will seek to explore the remaining uncharacterized habitats.

B – Washington Islands NWR Comprehensive Conservation Plan

In 2007, the USFWS completed a Final Comprehensive Conservation Plan to guide its management and resources within the Flattery Rocks NWR, Quillayute Needles NWR, and Copalis NWR over the next 15 years (USFWS 2005b). Located along the Olympic Peninsula on the outer coast of Washington, these three NWRs are collectively called the Washington Islands NWR. A management plan for the Washington Islands NWR was prepared by the USFWS in 1986 and revised in 1989.

C – Northwest Training Range Complex Ongoing and Proposed Navy Training Activities

A wide variety of military training activities are conducted in the W-237 operating areas west of Washington, including training exercises in anti-air, anti-surface, and anti-submarine warfare; electronic combat exercises, mine countermeasures training; naval special warfare training; and various support operations. The Navy has developed policies and procedures to avoid harm and to minimize the effects of Navy training on terrestrial and marine species and habitats. The Navy is currently preparing an EIS/OEIS to assess effects of ongoing and potential future training activities in the Northwest Training Range Complex; the Draft EIS/OEIS was made available to the public in December 2008 and the ROD is anticipated in Fall 2009. Three alternatives (No-Action and two action alternatives) were assessed in the Draft EIS/OEIS. The marine mammal active sonar impact analysis presented in the Draft EIS/OEIS estimated more than 117,000 annual exposures potentially resulting in behavioral harassment of marine mammals and 480 annual exposures exceeding the TTS threshold.

D – Other Categories of Activities

In addition to the projects mentioned above, there are numerous ongoing activities that overlap the proposed QUTR site expansion and proposed activities therein. These include but are not limited to:

- Research studies and monitoring related to oceanographic conditions, fisheries, and cetaceans. This includes work conducted by government and academic scientists, Tribes and Nations, and the Navy. In general, these activities entail localized and minimal disturbance of natural resources but have long-term benefits.

- Fishing and boating throughout the OCNMS. Potential cumulative effects in the future have been diminished by the OCNMS' requiring that large vessel traffic be routed around the sanctuary, and by the regulation by NOAA Fisheries and the Pacific Marine Fisheries Council of destructive fishing activities, especially the designation of large areas as off-limits to bottom trawling. Derelict gear (lost or discarded nets, crab pots) is associated with other types of fishing and can impact benthic communities and pose entanglement hazards.
- Coastal community development along the Olympic coast. Development, e.g., in the Moclips area, results in a variety of incremental effects on coastal resources, especially recreational use of the immediate shoreline. Interaction and potential cumulative impacts with those of the Proposed Action, however, is unlikely because of the small and temporary effects of the proposed surf zone activities.

4.1.4 Impacts

This section summarizes the evaluation of cumulative effects associated with the Proposed Action in combination with the projects identified above in Table 4-2 and other ongoing activities in the marine environment in and around the Keyport Range, DBRC, and QUTR sites. Since environmental analyses for some of the projects listed are not complete or do not include quantitative data, cumulative impacts are addressed qualitatively.

4.1.4.1 Keyport Range Site

Terrestrial Wildlife

As described in Section 3.1, implementation of the Proposed Action at the Keyport Range Site would have minimal effects on terrestrial wildlife, including ESA-listed species. The Proposed Action does not involve any land or shoreline construction activities, and its effects on terrestrial species would be limited to localized, temporary disturbances to wildlife occurring during in-water RDT&E and other NUWC Keyport managed activities. In conjunction with non-military activities on the water, especially recreational boating and fishing, there is some potential for cumulative disturbance to wildlife. Continued adherence to the requirements of EO 13186 and the Bald and Golden Eagle Protection Act (16 USC 668a-d dated June 8 1940 as twice amended) by NUWC Keyport would limit disturbance to migratory birds and ensure that important habitats do not become degraded. Existing regulatory mechanisms would protect bald eagles and the ESA-listed marbled murrelet (Section 3.1) and potential cumulative impacts to these species would not be significant when added to other projects considered in the cumulative analysis.

Non-federal shoreline construction activities as listed in Table 4-2 that may occur in Liberty Bay and the Port Orchard Reach could cause temporary and potentially permanent shoreline impacts. The temporary impacts are directly and indirectly associated with shoreline construction activities while the more permanent impacts are associated with potential pier/dock and shoreline stabilization. These are state-approved projects that are consistent with the Washington SMA. The incremental impact of adding the effects of the Proposed Action to these projects would not result in significant cumulative impacts on terrestrial wildlife.

Marine Flora and Invertebrates

Implementation of the Proposed Action, when considered in combination with the projects listed in Section 4.1.3 and other anthropogenic activities, would have negligible cumulative effects on marine flora and invertebrates. Some of the projects (e.g., shoreline construction), as well as other anthropogenic activities such as commercial and recreational harvesting of bivalves, would have temporary direct and indirect impacts on marine flora and invertebrates due to the suspension of sediments and short-term increases in turbidity within the water column in the nearshore environments where the activities occur. Continuing management of populations of commercially and recreationally important invertebrates, such as the geoduck, by the WDFW would limit the potential for cumulative effects of harvesting. The Proposed Action would have a negligible contribution to benthic habitat disturbance (e.g., from expended materials) or water quality effects such as turbidity, such that no adverse long-term, permanent impacts to populations of marine flora and invertebrates are expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine flora and invertebrates would occur.

Sea Turtles

Sea turtles do not occur at the Keyport Range Site. Therefore, no cumulative impacts to sea turtles would occur.

Fish

As described in Section 3.4.2, implementation of the Proposed Action at the Keyport Range Site would have minimal effects on marine fish and their habitat, including EFH and ESA-listed species. When considered in conjunction with the cumulative projects listed in Section 4.1.3, the incremental effect of the Proposed Action remains inconsequential for the following reasons:

- Potential acoustic effects to fish would be negligible because of the lack of overlap between the acoustic sources that would be used and the hearing capabilities of fish (Appendix B).
- Other types of physical/mechanical disturbance to shoreline, benthic and water column habitats that are important to fish would also be negligible, being limited to extremely small areas for very brief periods, with no persistent effects on food, water quality, or other environmental features.

Some of the projects considered in the cumulative impacts analysis (e.g., shoreline construction) would likely have temporary direct and indirect impacts on marine fish primarily due to the temporary displacement of fish species and their prey (e.g., marine fish, invertebrates) from suitable habitat within the vicinity of the project areas. Due to the wide geographic separation of most of these projects, Navy activities would have small or negligible potential impact, and their potential impacts are not additive or synergistic. Long-term impacts to fish populations are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to fish would occur.

Marine Mammals

The Proposed Action at the Keyport Range Site would have limited effects on marine mammals. Acoustic exposures that would be considered harassment by NMFS are limited to a relatively small number of harbor seals (Section 3.5.6). Given the abundance of this species and its overlap with maritime-industrial activities in Puget Sound, individual harbor seals and local groups thereof probably experience disturbance from multiple anthropogenic sources, indicating the potential for cumulative effects. However, the abundance and coexistence of this species with anthropogenic activities suggests that cumulative effects have not been, and would not in the future be considerable. Continued regulation of marine mammal exposures to anthropogenic disturbance by NMFS under the MMPA, coupled with stock assessments, documentation of mortality causes, and research into acoustic effects, ensure that cumulative effects would be minimized. The regulatory process ensures that each project proposing take of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region. No other effects to marine mammals that might affect behavior, survival, distribution, or overall abundance are anticipated at the Keyport Range Site. This indicates that the overall potential for the Proposed Action to contribute incrementally to significant impacts is very low. No cumulative impacts are expected.

Risks to marine mammals emanate primarily from ship strikes, exposure to chemical toxins or biotoxins, exposure to fishing equipment that may result in entanglements, and disruption or depletion of food sources from fishing pressure and other environmental factors. Potential cumulative impacts of Navy activities on marine mammals would result primarily from possible ship strikes and sonar use. Stressors on marine mammals and marine mammal populations can include both natural stressors (i.e., disease, natural toxins, weather and climatic influence, navigation errors, social cohesion) and human-influenced stressors (i.e., fisheries interactions/bycatch, ship strikes, pollution and ingestion, noise, and whale watching). Implementing the Proposed Action at the Keyport Range Site would not, however, add to these risks and stressors. The activities that would be conducted would have minimal effects on marine mammals with respect to increased risk and stress. In addition, the projects considered for cumulative analysis described in Section 4.1.3 would not appreciably increase risks to and stresses upon marine mammals.

Implementation of the Proposed Action, including the ROP, would have minimal potential for cumulative effects on marine mammals, including ESA-listed species, when considered in conjunction with the cumulative projects listed in Section 4.1.3. Some of these projects (e.g., shoreline construction) would likely have temporary direct and indirect impacts on marine mammals primarily due to the temporary displacement of marine mammal species and their prey (e.g., marine fish, invertebrates) from suitable habitat within the vicinity of the project areas. However, the Proposed Action is not likely to affect the species through effects on annual rates of recruitment or survival. Long-term, permanent impacts to populations of marine mammals are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine mammals would occur.

Sediments and Water Quality

As described in Section 3.6.1, implementation of the Proposed Action would have only very minor, temporary and localized effects on sediments and water quality. The incremental effects of the Proposed Action would not add appreciably to any existing or future sediment or water quality impacts associated with other anthropogenic activities. Cumulatively, some of these activities would likely have direct and indirect but very minor effects on sediments associated with water quality. For example, although the projects considered for cumulative analysis near the Keyport Range Site are not expected to have any substantial sediment or water quality impacts, these projects may cause short-term temporary increases in turbidity in the nearshore environments. These disturbances, however, would not permanently nor adversely disrupt nearshore sediments because the sediments would quickly settle back down to the bottom. Cumulatively, sediment and water quality would not be adversely affected by these other projects. Therefore, no cumulative impacts to sediments and water quality would occur by adding the incremental impact of the Proposed Action to the effects of the other projects considered for cumulative analysis.

Cultural Resources

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on cultural resources. Though various shell midden sites lie on the beaches surrounding the proposed project locations, the projects are not expected to disturb identified cultural resource sites. Shipwrecks identified within the proposed project locations are also unlikely to be affected by the projects since the shipwrecks are not found in the areas where the projects would take place. Additionally, Government-to-Government communication with Native American Indian Tribes has been established as part of this EIS/OEIS for the Keyport Range Site. This communication process would continue during implementation of the Navy's Proposed Action and help minimize any potential cumulative cultural resources impacts.

Most other ongoing and anticipated ocean activities such as commercial ship traffic, fishing, oil and gas development, or scientific research, would not substantially affect underwater cultural resources. The projects listed in Section 4.1.3 would have little or no potential to impact underwater cultural resources, primarily because most activities would take place on or above the surface and cultural resources, if any, would be located on the ocean bottom. Project activities would not generally disturb areas where cultural resources are known or expected to be present.

Mitigation strategies developed under the Draft Programmatic Agreement with the State Historic Preservation Office, such as avoidance or data recovery, should reduce impacts to a level less than significant. Any activities with the potential for significant impacts on cultural resources will require Section 106 consultation, and would be mitigated as required.

Any projects that could disturb cultural resources in the area would be required to evaluate their potential effects and, if necessary, implement mitigation measures similar to those described for the Proposed Action. Where avoidance was practiced, no cumulative effect would result because no contact with the resource would occur. Where data recovery was practiced, the cumulative effect would be that more cultural sites underwent data recovery and removal than would occur under the Proposed Action alone. Therefore, no cumulative impacts to cultural resources would occur when the incremental effects of the Proposed Action are added to effects of the projects considered for cumulative analysis.

Recreation

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have no substantial effects on recreation. Some projects would be likely to have minor direct and indirect effects, both individually and collectively. The projects near the Keyport Range Site could have recreation impacts; there would be some minor, temporary impacts associated with construction-related activities and increased boat traffic, thus potentially conflicting with Navy sound measurements and testing requirements and the need for clear/safe access for torpedo testing and retrieval. While construction phase activities may temporarily disrupt roadway and marine vessel traffic, this would not substantially impact recreation use, cumulatively, in the area. Since minimal impacts would result, but no cumulative impacts to recreation are anticipated when adding the effects of the Proposed Action to impacts generated by the projects considered for cumulative analysis.

Land and Shoreline Use

Some of the projects listed in Section 4.1.3 could potentially have minor short term direct and indirect land and shoreline cumulative effects in the region. For example, shoreline construction activities occurring in Liberty Bay and the Port Orchard Reach could potentially cause temporary shoreline impacts. The temporary impacts are directly and indirectly associated with the proposed construction activities while the more permanent impacts are associated with proposed pier/dock and shoreline stabilization. However, these are state approved projects and are consistent with the Washington SMA. Erosion is a naturally recurring issue, but it is not heavily exacerbated by military activities. While construction type projects in the region may have localized erosion, overall cumulative effects would be negligible since Best Management Practices for soil-disturbing activities are typically implemented during any construction activity. Therefore, the cumulative impacts of the Proposed Action in association with the past, present, and future projects would be insignificant given that the Proposed Action requires no land and shoreline construction.

Public Health and Safety and Environmental Hazards to Children

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal cumulative effects on public health and safety and would not pose cumulative environmental hazards to children. Safety procedures would be implemented when conducting proposed activities and construction activities to ensure the safety of personnel and the general public. Public safety measures already in use within Keyport Range Site would continue. Implementation of other projects near the range sites would not adversely affect NUWC Keyport's abilities to conduct activities safely. Therefore, no cumulative impacts to public safety and children would occur when adding the incremental impact of the Proposed Action to effects generated by the projects considered for cumulative analysis.

Socioeconomics and Environmental Justice

Cumulatively, there would be minimal effects on socioeconomics or environmental justice. Although the projects near the Keyport Range Site are not expected to have any substantial socioeconomic or environmental impacts, there would be some minor, temporary economic benefits associated with construction-related activities.

Effects on commercial and recreational fishermen, divers, and boaters would be short-term in nature and produce some temporary access limitations. Some offshore range activities, especially if coincident with peak fishing locations and periods, could cause temporary displacement and potential economic loss to individual fishermen. However, most offshore RDT&E and other NUWC Keyport managed activities are of short duration and have a small operational footprint. Effects on fishermen are mitigated by a series of Navy initiatives, including public notification of scheduled activities, near-real time schedule updates, prompt notification of schedule changes, and adjustment of hazardous operations areas. In selected instances where safety requirements dictate exclusive use of a specific area, fishermen may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunities.

However, regardless of the projects' long-term impacts, any incremental contribution to such effects from implementation of the Proposed Action would be negligible or non-existent. Based on the analysis in Section 3.11, which concludes that the proposed range extensions would have no direct effect on population, employment, or income in the region, there would be negligible, if any, indirect effects on fishing or other industries. Accordingly, no cumulative impacts to socioeconomics would occur.

Air Quality

Cumulative activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industry, etc. Area emissions include emissions from aircrafts, ships, and commercial boats, which are included in the mobile source category. These emissions would account for a small percentage of the overall air emissions budgets for each the local air basins. They do not include marine vessel emissions for vessels operating outside of U.S. territorial waters. These emissions are generally not included in the SIP emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality. All areas are in attainment for criteria pollutants and projects (when considered cumulatively) would not emit pollutants to such an extent to change this attainment status. Therefore, implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on air quality and no cumulative impacts to air quality would occur.

4.1.4.2 DBRC Site

Terrestrial Wildlife

Implementation of the Proposed Action and associated mitigation measures (e.g., avoidance of nesting bald eagles) would have minimal cumulative effects on terrestrial wildlife, including ESA-listed species, when considered incrementally with the cumulative projects listed in Section 4.1.3. Some of the projects (e.g., Fred Hill Materials Gravel Project) would likely have temporary direct and indirect cumulative impacts on terrestrial wildlife primarily due to the temporary displacement of wildlife species and their prey from suitable habitat within the vicinity of the project areas. However, long-term, permanent impacts to populations of terrestrial wildlife are not expected, either as a result of each project or when combined with other past, present, and reasonably foreseeable actions. Continued adherence to the requirements of the MBTA, EO 13186, and the Bald and Golden Eagle Protection Act (16 USC 668a-d dated June 8 1940 as twice amended) by NUWC Keyport would limit disturbance to migratory birds and ensure that important habitats do not become degraded. Existing regulatory mechanisms would protect bald eagles and the ESA-listed marbled murrelet (Section 3.1) and potential cumulative impacts to these species would not be significant when added to other projects considered in the cumulative analysis.

Marine Flora and Invertebrates

Implementation of the Proposed Action, when considered in combination with the projects listed in Section 4.1.3 and other anthropogenic activities, would have negligible cumulative effects on marine flora and invertebrates. Some of the projects (e.g., Hood Canal Bridge Repairs, Trident Support Facilities Explosives Handling Wharf), as well as other anthropogenic activities such as commercial and recreational harvesting of bivalves, would have temporary direct and indirect cumulative impacts on marine flora and invertebrates due to the suspension of sediments and short-term increases in turbidity within the water column in the nearshore environments where the activities occur. Continuing management of populations of commercially and recreationally important invertebrates, such as the geoduck, by the WDFW would limit the potential for cumulative effects of harvesting. The Proposed Action would have a negligible contribution to benthic habitat disturbance (e.g., from expended materials) or water quality effects such as turbidity, such that no adverse long-term, permanent impacts to populations of marine flora and invertebrates are expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine flora and invertebrates would occur.

Sea Turtles

Sea turtles do not occur at the DBRC Site. Therefore, no cumulative impacts to sea turtles would occur.

Fish

Implementation of the Proposed Action at the DBRC Site would have minimal effects on marine fish and their habitat, including EFH and ESA-listed species. When considered in conjunction with the cumulative projects listed in Section 4.1.3, the incremental effect of the Proposed Action remains inconsequential for the following reasons:

- Potential acoustic effects to fish would be negligible because of the lack of overlap between the acoustic sources that would be used and the hearing capabilities of fish (Appendix B).
- Other types of physical/mechanical disturbance to shoreline, benthic and water column habitats that are important to fish would also be negligible, being limited to extremely small areas for very brief periods, with no persistent effects on food, water quality, or other environmental features.

Some of the projects considered for cumulative analysis (e.g., Fred Hill Materials Gravel Project, Hood Canal Bridge Repair, Trident Support Facilities Explosives Handling Wharf) would likely have temporary direct and indirect impacts on marine fish primarily due to the temporary displacement of fish species and their prey (e.g., marine fish, invertebrates) from suitable habitat within the vicinity of the project areas. Due to the wide geographic separation of most of the projects considered for cumulative analysis, Navy activities associated with the Proposed Action would have small or negligible potential impact, and their potential impacts are not additive or synergistic. Long-term impacts to fish populations are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to fish would occur.

Marine Mammals

The Proposed Action at the DBRC Site would have limited effects on marine mammals. Acoustic exposures that would be considered harassment by NMFS are limited to California sea lions and harbor seals (Section 3.5.7). Given the abundance of these species and their overlap with maritime-industrial activities in Puget Sound, individuals and local groups probably experience disturbance from multiple anthropogenic sources, indicating the potential for cumulative effects. However, the abundance and coexistence of these species with anthropogenic activities suggests that cumulative effects have not been, and would not in the future be considerable. Continued regulation of marine mammal exposures to anthropogenic disturbance by NMFS under the MMPA, coupled with stock assessments, documentation of mortality causes, and research into acoustic effects, ensure that cumulative effects would be minimized. The regulatory process ensures that each project proposing take of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region. No other effects to marine mammals that might affect behavior, survival, distribution, or overall abundance are anticipated at the DBRC Site. This indicates that the overall potential for the Proposed Action to contribute incrementally to significant impacts is very low. No cumulative impacts are expected.

Risks to marine mammals emanate primarily from ship strikes, exposure to chemical toxins or biotoxins, exposure to fishing equipment that may result in entanglements, and disruption or depletion of food sources from fishing pressure and other environmental factors. Potential cumulative impacts of Navy activities on marine mammals would result primarily from possible ship strikes and sonar use. Stressors on marine mammals and marine mammal populations can include both natural stressors (i.e., disease, natural toxins, weather and climatic influence, navigation errors, social cohesion) and human-influenced stressors (i.e., fisheries interactions/bycatch, ship strikes, pollution and ingestion, noise, and whale watching). Implementing the Proposed Action at the DBRC Site would not, however, add to these risks and stressors. The activities that would be conducted would have minimal effects on marine mammals with respect to increased risk and stress. In addition, the projects considered for cumulative analysis described in Section 4.1.3 would not appreciably increase risks to and stresses upon marine mammals.

Implementation of the Proposed Action, including the ROP, would have minimal potential for cumulative effects on marine mammals, including ESA-listed species, when considered in conjunction with the projects listed in Section 4.1.3. Some of the projects considered for cumulative analysis (e.g., Hood Canal Bridge repairs, pier pilings installation) would likely have temporary direct and indirect impacts on marine mammals primarily due to the temporary displacement of marine mammal species and their prey (e.g., marine fish, invertebrates) from suitable habitat within the vicinity of the project areas. However, the Proposed Action is not likely to affect the species through effects on annual rates of recruitment or survival. Long-term, permanent impacts to populations of marine mammals are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine mammals would occur.

Sediments and Water Quality

As described in Section 3.6.2, implementation of the Proposed Action would have only very minor, temporary and localized effects on sediments and water quality. The incremental effects of the Proposed Action would not add appreciably to any existing or future sediment or water quality impacts associated with other anthropogenic activities. Cumulatively, some of these activities would likely have direct and indirect but very minor effects on sediments associated with water quality. For example, although the projects near the DBRC Site are not expected to have any substantial sediment or water quality impacts, these projects (e.g., the proposed Trident Support Facilities Explosives Handling Wharf) may cause short-term temporary increases in turbidity in the nearshore environments. These disturbances, however, would not permanently nor adversely disrupt nearshore sediments because the sediments would quickly settle back down to the bottom. Cumulatively, sediment and water quality would not be adversely affected by these other projects. Therefore, no cumulative impacts to sediments and water quality would occur by adding the impact of the Proposed Action to effects generated by the projects considered for cumulative analysis.

Cultural Resources

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on cultural resources. Though various shell midden sites lie on the beaches surrounding the proposed project locations, the projects are not expected to disturb identified cultural resource sites. Shipwrecks identified within the proposed project locations are also unlikely to be affected by the projects since the shipwrecks are not found in the areas where the projects would take place. Additionally, the Government-to-Government communication process with Native American Indian Tribes is currently in place and ongoing for the DBRC Site. This communication process would continue during implementation of the Proposed Action and would help minimize any impacts that may occur when cumulatively considering the projects.

Most other ongoing and anticipated ocean activities such as commercial ship traffic, fishing, oil and gas development, or scientific research, would not substantially affect underwater cultural resources. The projects considered for cumulative analysis would have little or no potential to impact underwater cultural resources, primarily because most activities would take place on or above the surface and cultural resources, if any, would be located on the ocean bottom. Project activities would not generally disturb areas where cultural resources are known or expected to be present.

Mitigation strategies developed under any Programmatic Agreement with the State Historic Preservation Office, such as avoidance or data recovery, should reduce impacts to a level less than significant. Any activities with the potential for significant impacts on cultural resources will require Section 106 consultation, and would be mitigated as required.

Any projects considered for cumulative analysis with the potential to disturb cultural resources in the area would be required to evaluate potential effects and, if necessary, implement mitigation measures similar to those described for the Proposed Action. Where avoidance was practiced, no cumulative effect would result because no contact with the resource would occur. Where data recovery was practiced, the cumulative effect would be that more cultural sites underwent data recovery and removal than would occur under the Proposed Action alone. Therefore, no cumulative impacts to cultural resources would occur when the incremental impact of the Proposed Action is added to effects resulting from the projects considered for cumulative analysis.

Recreation

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal impacts on recreation. Some projects would be likely to have minor direct and indirect effects, both individually and collectively. For example, the Jefferson County Master Planned Resort project has the potential to generate substantial additional pleasure boat traffic in and around Dabob Bay. The projects near the DBRC Site could have recreation impacts; there would be some minor, temporary impacts associated with construction-related activities and increased boat traffic, thus potentially conflicting with Navy sound measurements and testing requirements and the need for clear/safe access for torpedo testing and retrieval. Other potential short-term impacts could occur during construction of the Fred Hill Materials Gravel project and Hood Canal Bridge widening and constrain Navy testing capabilities. While construction phase activities may temporarily disrupt roadway and marine vessel traffic, this would not substantially impact recreation use, cumulatively, in the area. No significant cumulative impacts to recreation are anticipated when the effects of the Proposed Action are added to impacts of other projects considered for the cumulative analysis.

Land and Shoreline Use

Some of the projects listed in Section 4.1.3 could potentially have minor, short-term direct and indirect land and shoreline cumulative effects in the region. For example, shoreline construction activities occurring in Hood Canal could cause temporary and potentially permanent shoreline impacts. The temporary impacts are directly and indirectly associated with the proposed construction activities while the more permanent impacts are associated with proposed pier construction and their associated support facilities. However, these construction activities are state approved projects and are consistent with the Washington SMA. The proposed Fred Hill Materials Gravel project, the Hood Canal Bridge proposed widening, and the Trident Support Facilities Explosives Handling Wharf project would have land and shoreline impacts associated with construction activities, including noise and traffic disruptions (sporadic closure of local roadways). Erosion is a naturally recurring issue, but it is not heavily exacerbated by military activities. While construction type projects in the region may have localized erosion, overall cumulative effects would be negligible since Best Management Practices for soil-disturbing activities are typically implemented during any construction activity. Therefore, the cumulative impacts of the Proposed Action in association with the past, present and future projects would be insignificant since the incremental impact is minimal.

Public Health and Safety and Environmental Hazards to Children

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal cumulative effects on public health and safety and would not pose cumulative environmental hazards to children. Safety procedures would be implemented when conducting proposed activities and construction activities to ensure the safety of personnel and the general public. Public safety measures already in use within DBRC Site would continue. Implementation of other projects near the range sites would not adversely affect NUWC Keyport's abilities to conduct activities safely. Therefore, no cumulative impacts to public safety and children would occur when adding the incremental impact of the Proposed Action to other projects considered for cumulative analysis.

Socioeconomics and Environmental Justice

Cumulatively, there would be minimal effects on socioeconomics or environmental justice. The Fred Hill Materials Gravel Project and Hood Canal Bridge widening project has the potential for substantial temporary benefits to the local economy associated with construction due to the magnitude of the projects but would not represent any major, long-term increase in employment. Although the construction phase of projects could involve some disruption of roadway and marine vessel traffic near the Hood Canal Bridge, this would not substantially disrupt economic activities in the area when considered cumulatively with the Proposed Action. Long-term socioeconomic and environmental justice impacts associated with post-construction operation of the gravel project activities are difficult to assess. However, regardless of the project's long-term impacts, any incremental contribution to such effects from implementation of the Proposed Action would be negligible or non-existent.

Effects on commercial and recreational fishermen, divers, and boaters would be short-term in nature and produce some temporary access limitations. Some offshore test and training activities, especially if coincident with peak fishing locations and periods, could cause temporary displacement and potential economic loss to individual fishermen. However, most offshore RDT&E and other NUWC Keyport managed activities are of short duration and have a small operational footprint. Effects on fishermen are mitigated by a series of Navy initiatives, including public notification of scheduled activities, near-real time schedule updates, prompt notification of schedule changes, and adjustment of hazardous operations areas. In selected instances where safety requirements dictate exclusive use of a specific area, fishermen may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunities.

Based on the analysis in Section 3.11, which concludes that the proposed range extensions would have no direct effect on population, employment, or income in the region, there would be negligible if any indirect effects on fishing or other industries. No cumulative impacts to socioeconomics would occur since the incremental impact of the Proposed Action is not significant when added to effects of the other projects considered for cumulative analysis.

Air Quality

Cumulative activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industry, etc. Area emissions include emissions from aircrafts, ships, and commercial boats, which are included in the mobile source category. These emissions would account for a small percentage of the overall air emissions budgets for each the local air basins. They do not include marine vessel emissions for vessels operating outside of U.S. territorial waters. These emissions are generally not included in the SIP emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality. All areas are in attainment for criteria pollutants and projects (when considered cumulatively) would not emit pollutants to such an extent to change this attainment status. Therefore, implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on air quality and no cumulative impacts to air quality would occur.

4.1.4.3 QUTR Site

Terrestrial Wildlife

Implementation of the Proposed Action and the associated ROP would have minimal cumulative effects on terrestrial wildlife, including ESA-listed species, when considered incrementally with the cumulative projects listed in Section 4.1.3. Long-term, permanent impacts to populations of terrestrial wildlife are not expected, either as a result of each project or when combined with other past, present, and reasonably foreseeable actions. Continued adherence to the requirements of the MBTA, EO 13186, and the Bald and Golden Eagle Protection Act (16 USC 668a-d dated June 8 1940 as twice amended) by NUWC Keyport would limit disturbance to migratory birds and ensure that important habitats do not become degraded. Existing regulatory mechanisms would protect bald eagles and the ESA-listed marbled murrelet (Section 3.1) and potential cumulative impacts to these species would not be significant when added to other projects considered in the cumulative analysis.

Marine Flora and Invertebrates

Implementation of the Proposed Action, when considered in combination with the projects listed in Section 4.1.3 and other anthropogenic activities, would have negligible cumulative effects on marine flora and invertebrates. The Proposed Action would have a negligible contribution to benthic habitat disturbance (e.g., from expended materials) or water quality effects such as turbidity, such that no adverse long-term, permanent impacts to populations of marine flora and invertebrates are expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine flora and invertebrates would occur.

Sea Turtles

Incidental take in fishing operations, or bycatch, is one of the most serious threats to sea turtle populations. Sea turtles commonly ingest or become entangled in marine debris (e.g., tar balls, plastic bags, plastic pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts, where debris and their natural food items converge. Marine pollution from coastal runoff, marina and dock construction, dredging, aquaculture, increased underwater noise, and boat traffic can degrade marine habitats used by sea turtles. Sea turtles swimming or feeding at or just beneath the surface of the water are vulnerable to boat and vessel strikes, which can result in serious propeller injuries and death.

Sea turtles potentially occur, but only rarely, within the proposed QUTR Site range extension area, and the implementation of protective avoidance measures for sea turtles minimizes the potential for any individual or cumulative effect associated with ship strikes of sea turtles. Proposed activities at the QUTR Site do not generate any other potential sources of cumulative impact to sea turtles such as entanglement or habitat degradation. None of the identified projects would singly or cumulatively impact sea turtle survival or reproduction within the proposed QUTR Site extension area. Therefore, no cumulative impacts to sea turtles would occur.

Marine Fish

Implementation of the Proposed Action at the QUTR Site would have minimal effects on marine fish and their habitat, including EFH and ESA-listed species. When considered in conjunction with the cumulative projects listed in Section 4.1.3, the incremental effect of the Proposed Action remains inconsequential for the following reasons:

- Potential acoustic effects to fish would be negligible because of the lack of overlap between the acoustic sources that would be used and the hearing capabilities of fish (Appendix B).
- Other types of physical/mechanical disturbance to shoreline, benthic and water column habitats that are important to fish would also be negligible, being limited to extremely small areas for very brief periods, with no persistent effects on food, water quality, or other environmental features.

Implementation of the Proposed Action would have minimal cumulative effects on marine fish and their habitat, including ESA-listed species, when considered in conjunction with the cumulative projects listed in Section 4.1.3. Some of these projects could have temporary direct and indirect impacts on marine fish primarily due to the temporary displacement of fish species and their prey (e.g., marine fish, invertebrates) from suitable habitat within the vicinity of the project areas. Navy activities would have small or negligible potential impact, and their potential impacts are not additive or synergistic. Long-term impacts to fish populations are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to fish would occur.

Marine Mammals

The Proposed Action at the QUTR Site would have limited effects on marine mammals. Acoustic exposures that would be considered harassment by NMFS are limited to four species of pinnipeds and the harbor porpoise, and consist almost exclusively of sub-TTS behavioral exposures (Section 3.5.8). Other anthropogenic sources, including Navy activities, are likely to generate additional exposures that would be considered harassment by NMFS, as well as contributing to increasing background noise in the ocean. Therefore, the potential for cumulative acoustic impacts would appear to exist, but the nature of any such cumulative effects is largely conjectural. Would animals avoid large areas where sub-TTS behavioral exposures and background noise increase? This is not clear, especially given the abundance and diversity of marine mammals in what would seem to be heavily impacted waters, such as off of southern California. Continued regulation of marine mammal exposures to anthropogenic disturbance by NMFS under the MMPA, coupled with stock assessments, documentation of mortality causes, and research into acoustic effects, assure that cumulative effects would be minimized. The regulatory process ensures that each project proposing take of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region. No other effects to marine mammals that might affect behavior, survival, distribution, or overall abundance are anticipated at the QUTR Site. This indicates that the overall potential for the Proposed Action to contribute incrementally to significant cumulative impacts is very low.

Risks to marine mammals emanate primarily from ship strikes, exposure to chemical toxins or biotoxins, exposure to fishing equipment that may result in entanglements, and disruption or depletion of food sources from fishing pressure and other environmental factors. Stressors on marine mammals and marine mammal populations can include both natural stressors (i.e., disease, natural toxins, weather and climatic influence, navigation errors, social cohesion) and human-influenced stressors (i.e., fisheries interactions/bycatch, ship strikes, pollution and ingestion, noise, and whale watching). The activities that would be conducted would have minimal effects on marine mammals with respect to increased risk and stress. In addition, the projects considered for cumulative analysis described in Section 4.1.3 would not appreciably increase risks to and stresses upon marine mammals.

Implementation of the Proposed Action, including the ROP, would have minimal cumulative effects on marine mammals, including ESA-listed species, when considered in conjunction with the cumulative projects listed in Section 4.1.3. Some of these projects, such as alternatives analyzed for the Northwest Training Range Complex EIS, would have temporary direct and indirect impacts on marine mammals. However, the Proposed Action is not likely to affect the species through effects on annual rates of recruitment or survival. Long-term, permanent impacts to populations of marine mammals are not expected, either as a result of each project or cumulatively when combined with other past, present, and reasonably foreseeable actions including the Proposed Action. Therefore, no cumulative impacts to marine mammals would occur.

Sediments and Water Quality

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on sediments and water quality.

Cumulative impacts on ocean water quality (i.e., pollutants and discharges) would consist of the effects of the Proposed Action in concert with other marine projects, actions, and processes that contributed to water pollutants. Such activities would include recreational and commercial fishing, offshore oil and gas development, and other ocean industries. The effects of these activities on the QUTR site are known only in a very general sense. Commercial ocean industries, such as fishing and ocean transport, are dispersed over broad areas of the ocean, while most of the Navy activities occur in remote areas of the open ocean. Therefore, cumulative effects on marine water quality in the QUTR site are expected to be less than significant when adding the incremental impact of the Proposed Action to other projects considered for cumulative analysis.

Cultural Resources

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on cultural resources. Though various shell midden sites lie on the beaches surrounding the proposed project locations, the projects are not expected to disturb identified cultural resource sites. Shipwrecks identified within the proposed project locations are also unlikely to be affected by the projects since the shipwrecks are not found in the areas where the projects would take place. Additionally, the Government-to-Government communication process with Native American Indian Tribes has been established as part of this EIS/OEIS for the QUTR Site. This communication process would continue during implementation of the Proposed Action and would help minimize any impacts that may occur when cumulatively considering the projects.

Most other ongoing and anticipated ocean activities such as commercial ship traffic, fishing, oil and gas development, or scientific research, would not substantially affect underwater cultural resources. The projects considered for cumulative analysis would have little or no potential to impact underwater cultural resources, primarily because most activities would take place on or above the surface and cultural resources, if any, would be located on the ocean bottom. Project activities would not generally disturb areas where cultural resources are known or expected to be present.

Mitigation strategies developed under the Draft Programmatic Agreement with the State Historic Preservation Office, such as avoidance or data recovery, should reduce impacts to a level less than significant. Any activities with the potential for significant impacts on cultural resources will require Section 106 consultation, and would be mitigated as required.

Any projects in the area with potential to disturb cultural resources would be required to evaluate potential effects and, if necessary, implement mitigation measures similar to those described for the Proposed Action. Where avoidance was practiced, no cumulative effect would result because no contact with the resource would occur. Where data recovery was practiced, the cumulative effect would be that more cultural sites underwent data recovery and removal than would occur under the Proposed Action alone. Therefore, no cumulative impacts to cultural resources would occur when the incremental impact of the Proposed Action is added to effects resulting from the projects considered for cumulative analysis.

Recreation

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have no substantial effects on recreation. Some projects would be likely to have minor direct and indirect effects, both individually and collectively. The projects near the QUTR Site are expected to have minimal recreation impacts. No significant cumulative impacts to recreation are anticipated when the effects of the Proposed Action are added to impacts of other projects considered for the cumulative analysis.

Land and Shoreline Use

The projects considered for cumulative analysis would not substantially disrupt land and shoreline use in the area; therefore, no cumulative impacts to land and shoreline use would occur when the impacts of the Proposed Action are added to the effects of these projects.

Public Health and Safety and Environmental Hazards to Children

Implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal cumulative effects on public health and safety and would not pose cumulative environmental hazards to children. Safety procedures would be implemented when conducting proposed activities and construction activities to ensure the safety of personnel and the general public. Public safety measures already in use within QUTR Site would continue. Implementation of other projects near the range sites would not adversely affect NUWC Keyport's abilities to conduct activities safely. Therefore, no cumulative impacts to public safety and children would occur when adding the incremental impact of the Proposed Action to other projects considered for cumulative analysis.

Socioeconomics and Environmental Justice

Cumulatively, there would be minimal effects on socioeconomics or environmental justice. Effects on commercial and recreational fishermen, divers, and boaters would be short-term in nature and produce some temporary access limitations. Some offshore Navy activities, especially if coincident with peak fishing locations and periods, could cause temporary displacement and potential economic loss to individual fishermen. However, most offshore RDT&E and other NUWC Keyport managed activities are of short duration and have a small operational footprint. Effects on fishermen are mitigated by a series of Navy initiatives, including public notification of scheduled activities, near-real time schedule updates, prompt notification of schedule changes, and adjustment of hazardous operations areas. In selected instances where safety requires exclusive use of a specific area, fishermen may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunities.

Based on the analysis in Section 3.11, which concludes that the proposed range extensions would have no direct effect on population, employment, or income in the region, there would be negligible if any indirect effects on fishing or other industries. No cumulative impacts to socioeconomics would occur since the incremental impact of the Proposed Action is not significant when added to effects of the other projects considered for cumulative analysis.

Air Quality

Cumulative activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industry, etc. Area emissions include emissions from aircrafts, ships, and commercial boats, which are included in the mobile source category. These emissions would account for a small percentage of the overall air emissions budgets for each the local air basins. They do not include marine vessel emissions for vessels operating outside of U.S. territorial waters. These emissions are generally not included in the SIP emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality. All areas are in attainment for criteria pollutants and projects (when considered cumulatively) would not emit pollutants to such an extent to change this attainment status. Therefore, implementation of the Proposed Action, when considered cumulatively with the projects listed in Section 4.1.3, would have minimal effects on air quality and no cumulative impacts to air quality would occur.

4.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action would constitute an irreversible or irretrievable commitment of nonrenewable or depletable resources (e.g., fuel, test material components), for the materials and energy expended during activities in the NAVSEA NUWC Keyport Range Complex. NUWC Keyport applies range sustainability concepts to all aspects of its activities. Such range sustainability practices are a comprehensive set of practices that result in a reduced volume of wastes to be dealt with or transferred to the environment.

The proposed activities could be accommodated largely by use of existing equipment and infrastructure at Keyport Range Site, DBRC Site, and QUTR Site. Additional equipment brought to the range sites to conduct certain types of activities would be used only for the duration of the activities they are supporting. The Proposed Action does not include construction or renovation projects that would require supplies of nonrenewable or depletable resources.

Implementation of the Proposed Action would not result in the destruction of environmental resources such that the range of potential uses of the environment would be limited. The Proposed Action would not adversely affect the biodiversity or cultural integrity of the marine, terrestrial, or human environment in the NAVSEA NUWC Keyport Range Complex. Therefore, although the Proposed Action would require the use of nonrenewable and depletable resources, NUWC Keyport would minimize the irreversible or irretrievable commitment of resources associated with the Proposed Action.

4.3 COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Based on evaluation of the Proposed Action with respect to consistency with land use guidelines for the project areas, the Proposed Action does not conflict with the objectives of federal, regional, state, and local land use plans, policies, and controls. Table 4-3 provides a summary of compliance of the Proposed Action with federal, state, and local plans, policies, and controls. Appendix H contains relevant communications associated with regulatory compliance.

Table 4-3 Status of Compliance with Relevant Plans, Policies, and Controls

Plans, Policies, and Controls	*Responsible Agency*	*Status of Compliance*
NEPA (42 USC §4321 *et seq*.) Department of the Navy Procedures for Implementing NEPA (32 CFR 775)	U.S. Navy	This EIS/OEIS has been prepared in accordance with CEQ Regulations implementing NEPA and Navy NEPA procedures. Preparation of this EIS/OEIS and provision for its public review are being conducted in compliance with NEPA.
EO 12114, *Environmental Effects Abroad of Major Federal Actions* (44 Federal Register 1957)	U.S. Navy	This EIS/OEIS has been prepared in accordance with Navy procedures implementing EO 12114 addressing components of the Proposed Action beyond 12 nm from shore.
CZMA (16 USC §1451 *et seq*.) Washington Shoreline Management Act (RCW 90.58; WAC 173-27-060)	U.S. Navy/ Washington Department of Ecology/ Local Counties	The Navy believes that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Washington Coastal Zone Management Program and will complete a Coastal Consistency Determination in accordance with the CZMA, after consideration of comments on the Draft EIS/OEIS. The Navy has submitted a description of the Preferred Alternative, along with a copy of the Coastal Consistency Determination, to the Washington Department of Ecology. The Washingto Department of Ecology has concurred with this determination (Appendix H).
Federal Water Pollution Control Act or CWA (Sections 401 and 404, 33 USC §1251 *et seq*.) and	USEPA/USACE	Section 401 and Section 404 permits would not be required for the Proposed Action.
Rivers and Harbors Act (Section 10, 33 USC 401 *et seq.)*	USEPA/USACE	A Section 10 Nationwide permit would not be required for the Proposed Action.
CAA (42 USC §7401 *et seq*.)	USEPA	All affected counties are in attainment. The Proposed Action would not compromise air quality attainment status in Washington or conflict with attainment and maintenance goals established in its SIP. Therefore, a CAA conformity determination is not required.
EO 11990, *Protection of Wetlands* (42 Federal Register 26961)	U.S. Navy	The Proposed Action does not occur in wetlands and would have no impact to wetlands.

Table 4-3 Status of Compliance with Relevant Plans, Policies, and Controls (Continued)

Plans, Policies, and Controls	*Responsible Agency*	*Status of Compliance*
ESA (16 USC §1531 *et seq.*)	USFWS, NMFS	The Navy consulted with the Services. Per section 7 requirements, a BE was prepared to address potential impacts to ESA-listed species. The Navy will comply with the reasonable and prudent measures and the required terms and conditions resulting from the consultations to the extent practicable.
Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§1801-1802)	NMFS	The Navy has determined that the Proposed Action would not have adverse affects on EFH and that consultation with NMFS is not required.
MMPA (16 USC §1431 *et seq.* and 50 CFR Part 216)	NMFS	As a result of acoustic effects associated with the use of underwater active acoustic sources, the Proposed Action may result in incidental harassment of marine mammals. No adverse effects on the annual rates of recruitment or survival of any of the species and stocks assessed in this document are expected. To support MMPA compliance and consultation regarding potential impacts to marine mammals, the Navy has applied to NMFS for an LOA for their proposed activities within the NAVSEA NUWC Keyport Range Complex analyzed under this EIS/OEIS.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 Federal Register 3853)	U.S. Navy	The Proposed Action is not likely to have a measurable negative effect on migratory bird populations and would be in compliance with EO 13186.
MBTA (16 USC §§703-712)	USFWS	The Proposed Action is not likely to have a measurable negative effect on migratory bird populations and would be in compliance with the MBTA.
Bald and Golden Eagle Protection Act (16 USC §668a) ("Eagle Act")	USFWS	The Proposed Action would not disturb, adversely affect, or result in any takes of bald eagles and would be in compliance with the Eagle Act.
EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 Federal Register 7629)	U.S. Navy	No disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EIS/OEIS.
EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 Federal Register 19885)	U.S. Navy	Children would not be disproportionately exposed to environmental health and safety risks by the Proposed Action.
National Historic Preservation Act (§ 106, 16 USC §470 *et seq.*)	Washington Department of Archaeology and Historic Preservation	The Proposed Action would have no effects on National Register or eligible properties (including shipwrecks) and would be in compliance with the Section 106 of the National Historic Preservation Act.

Table 4-3 Status of Compliance with Relevant Plans, Policies, and Controls (Continued)

Plans, Policies, and Controls	*Responsible Agency*	*Status of Compliance*
National Marine Sanctuaries Act (16 USC §1431 *et seq*.) and Olympic Coast National Marine Sanctuary Regulations (15 CFR §922.150 *et seq*.)	NOAA	NUWC Keyport has briefed OCNMS as a portion of the Proposed Action would take place within OCNMS Boundaries. Proposed Navy activities are consistent with continuing and historical use of the waters within and adjacent to the existing QUTR, and would not destroy, cause the loss of, or injure a Sanctuary resource. Therefore, consultation under § 304(d) of the NMSA is not required. The Proposed Action would be in compliance with the National Marine Sanctuaries Act, and no amendment to the OCNMS regulations would be required.
EO 13158, *Marine Protected Areas* (65 Federal Register 34909)	Department of Commerce: National Ocean Service and NMFS; Department of the Interior: NPS, USFWS, Minerals Management Service, and U.S. Geological Survey	Marine Protected Areas (MPAs) have not yet been officially designated under EO 13158.

4.4 Government-to-Government Consultation

Over the course of this EIS/OEIS, Navy representatives from NUWC Keyport have been in contact with Tribal representatives regarding the Proposed Action. See Section 1.4.3 for a discussion of Government-to-Government consultation conducted for this EIS/OEIS. As part of the environmental review process, this EIS/OEIS will be presented to Native American Indian Tribes and Nations to provide information, gather comments, and to continue the dialogue and ongoing communication regarding the Proposed Action.

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CHAPTER 5
STANDARD OPERATING PROCEDURES / PROTECTIVE MEASURES / MITIGATION MEASURES

This chapter presents NUWC Keyport's standard operating procedures, protective measures, and mitigation measures that would be in place to protect marine mammals and federally listed species during implementation of the Proposed Action. The protective measures presented have been standard operating procedures for all NUWC Keyport range activities since 2004.

5.1 STANDARD OPERATING PROCEDURES AND PROTECTIVE MEASURES

Operating policies and procedures, as described in NUWC Keyport Report 1509, *Range Operating Policies and Procedures Manual (ROP)*, are followed for all NUWC Keyport range activities. NUWC Keyport would continue to implement the ROP policies and procedures within the NAVSEA NUWC Keyport Range Complex with implementation of any of the proposed range-site alternatives, including the No-Action Alternative.

NUWC Keyport's mission is unique both in the nature of its RDT&E activities and geographic locations in which the activities occur. The activities have relatively small footprints and include range craft support. Keyport range personnel are composed of a small number of career civil servants who reside in the area and monitor the same small geographic area frequently as part of their normal duties. Keyport personnel acquire local knowledge about the habits and behaviors of indigenous marine species. Accordingly, it is more manageable for Keyport range personnel to focus on marine mammal identification. Such training is inconsistent for the large numbers of military personnel throughout the entire Navy associated with large scale fleet training over large areas. Fleet personnel are responsible with responding to a multitude of operational tasking and requirements and for whom responses relative to cetaceans must remain constant. NUWC Keyport career civil servants have the same job in the same locations from the same craft over many years and can therefore build upon the standard Navy MSAT training to further their knowledge of marine mammals for species identification. The Keyport employees can also enjoy a long term relationship with National Marine Fisheries Service Region Northwest office personnel to continually confirm sightings and become more educated in marine mammals that habituate or migrate through the same area on an annual basis.

Because of its RDT&E mission, NUWC Keyport conducts its activities under relatively controlled conditions which allow it to suspend an event when the requisite conditions are not met. One of these conditions includes the requirements that it conduct an event using the proposed systems at their operating limits. Another factor is that many events involve systems with sound propagation capabilities that cannot be reduced as is the case with some Fleet active sonar systems. Therefore, if the event will not meet its objectives unless operating at its limits, NUWC Keyport activities may suspend or delay the activity. Unlike fleet training activities which are interdependent on one another as part of the training event or within the unit's schedule, RDT&E scenarios are usually focused on a single unit or system under a controlled environment at NUWC Keyport taking advantage of the environmental conditions that NUWC Keyport provides. Accordingly, the range operating procedures identified as part of the alternatives were developed in a way that they did not impact the practicality of implementation, safety of personnel and negatively impact the military readiness activity.

The ROP is followed to protect the health and safety of the public and Navy personnel and equipment as well as to protect the marine environment. The policies and procedures address issues such as safety, development of approved run plans, range operation personnel responsibility, deficiency reporting, all facets of range activities, and the establishment of 'exclusion zones' to ensure that there are no marine mammals within a prescribed area prior to the commencement of each in-water exercise within the NAVSEA NUWC Keyport Range Complex. All range operators are trained by NOAA in marine mammal identification, and active acoustic activities are suspended or delayed if whales, dolphins, or porpoises (cetaceans) are observed within 1,000 yards, or pinnipeds are observed within 100 yards, from the intended track of the test unit. Table 5-1 provides a summary of selected ROP sections and other range procedures. The ROP contains additional sections; only the sections that specifically apply to this analysis are covered here.

NUWC Keyport's geographic conditions involving surrounding land mass and sea state provide a very narrow ability to adopt mitigation measures that do not impact the military readiness activity. Two of the three range sites occur in inland waters, (Keyport range Site and DBRC site) where the RDT&E location provides for shore to shore surveillance. Land masses of the unique Northwest region limit underwater sound from propagating over large areas as it would during open ocean events. At the QUTR site, the relatively limited small area needed for RDT&E events allows for more focused visual observations over a smaller planned area. This in part provides NUWC Keyport the ability to provide more observers. In the inland waters, the sea states are reduced as major weather conditions do not develop because of the relatively sheltered areas presented by DBRC site and the Keyport range site.

The ROP sections shown in Table 5-1 apply to current NUWC Keyport activities at the Keyport Range Site, DBRC Site, and QUTR Site, and they would also apply to proposed activities within the current and proposed range site boundaries. The policies and procedures outlined in the ROP are continually being updated as new environmental and health and safety information becomes available. In addition, the ROP will be revised in the future to reflect any conservation or mitigation measures that arise from ongoing agency consultations (e.g., NMFS) and permitting process regarding this EIS/OEIS.

Table 5-1 NAVSEA NUWC Keyport Range Complex ROP Sections and General Flight Rules

ROP	*ROP Implementation*
ROP 10-1 (Revision E, June 2004)	Establishes policies and procedures to be followed in the event of an OTTO Fuel II spill within the NAVSEA NUWC Keyport Range Complex or aboard a NUWC Keyport craft during the loading/off-loading, retrieval/recovery, or stowage of test units containing OTTO Fuel II; and the handling of OTTO Fuel II waste material or reclaimable liquids by range or craft personnel.
ROP 10-4 *Safety/Environmental Requirements and Operational Restrictions for Test Units* (Revision E, June 2004)	Establishes safety/environmental requirements and operational restrictions for all test units (this includes but is not limited to, torpedoes, mobile ASW targets, inert mines, UUVs, and research and developmental vehicles) to be tested within the NAVSEA NUWC Keyport Range Complex or used in support of range activities.

Table 5-1 NAVSEA NUWC Keyport Range Complex ROP Sections and General Flight Rules (Continued)

ROP	*ROP Implementation*
ROP 6-4 *Range Operations and Marine Mammals* (Revision E, June 2004)	Ensures that NAVSEA NUWC Keyport Range Complex personnel from NUWC Keyport are in compliance with OPNAVINST 5090.1C, *Navy Environmental and Natural Resources Program Manual*; MMPA; and Endangered Species Act (ESA). In particular, the following marine mammal protection measures are implemented per ROP 6-4: 1. Range activities shall be conducted in such a way as to ensure marine mammals are not harassed or harmed by human-caused events. 2. Marine mammal observers are on board ship during range activities. All range personnel shall be trained in marine mammal recognition. Marine mammal observer training is normally conducted by qualified organizations such as NOAA/National Marine Mammal Lab (NMML) on an as needed basis. 3. Vessels on a range use safety lookouts during all hours of range activities. Lookout duties include looking for any and all objects in the water, including marine mammals. These lookouts are not necessarily looking only for marine mammals. They have other duties while aboard. All sightings are reported to the Range Officer in charge of overseeing the activity. 4. Visual surveillance shall be accomplished just prior to all in-water exercises. This surveillance shall ensure that no marine mammals are visible within the boundaries of the area within which the test unit is expected to be operating. Surveillance shall include, as a minimum, monitoring from all participating surface craft and, where available, adjacent shore sites. 5. The Navy shall postpone activities until cetaceans (whales, dolphins, and porpoises) leave the project area. When cetaceans have been sighted in an area, all range participants increase vigilance and take reasonable and practicable actions to avoid collisions and activities that may result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (e.g., safety, weather). 6. In accordance with the MMPA and ESA, which address marine mammal protection, an "exclusion zone" shall be established and surveillance will be conducted to ensure that there are no marine mammals within this exclusion zone prior to the commencement of each in-water exercise. For cetaceans (whales, dolphins, and porpoises), the exclusion zone must be at least as large as the entire area within which the test unit may operate, and must extend at least 1,000 yards (914.4 m) from the intended track of the test unit. For pinnipeds, the exclusion zone extends out 100 yards (91 m) from the intended track of the test unit. 7. The minimum marine mammal exclusion zones defined above are sufficient to mitigate the effects of the acoustic energy transmitted by the test units, range tracking equipment, and the range target simulators currently in operation on U.S. ranges as of this writing. The exclusion zones specified in ROP 6-4 meet the requirements of Navy (2002a, 2003b) and NOAA (1993) and thereby ensure that active acoustic emissions from the acoustic sources currently in use do not constitute marine mammal harassment. 8. The NMFS recommendation that vessels not approach within 100 yards (91 m) of marine mammals shall be followed to the extent practicable considering human and vessel safety priorities. All Navy vessels and aircraft, including helicopters, are expected to comply with this directive. This includes marine mammals "hauled-out" on islands, rocks, and other areas such as buoys. 9. In the event of a collision between a Navy vessel and a marine mammal, NUWC Keyport activities will notify the Navy chain of Command, which would result in notification to NMFS. 10. Procedures for reporting marine mammal sightings on the NAVSEA NUWC Keyport Range Complex shall be promulgated, and sightings shall be entered into the Range Operating System and forwarded to NOAA/NMML Platforms of Opportunity Program.
Aircraft Flight Rules (per Navy 2001a, 2002a)	General flight rules for terrestrial and marine wildlife include: • Flights over land must be at least 1,000 ft (305 m) above the level of the land; • Flights over water must be at least 500 ft (152 m) above the level of the sea; and • Flights within 500 yards (457 m) of the shore (beach) must be at least 1,000 ft (305 m) above sea level. • A 656-ft (200-m) lateral no-fly area around bald eagle nests for all aircraft (Navy 2001a, 2002a).

5.2 NAVY PROPOSED MITIGATION MEASURES

To maximize the ability of Navy personnel to recognize instances when marine mammals are in the vicinity the following procedures will be implemented:

1. General Maritime Protective Measures: Personnel Training
    a. All lookouts onboard platforms involved in range events will have reviewed NMFS approved MSAT material prior to use of MFA/HFA sonar.
    b. Navy lookouts will undertake extensive training in order to qualify as a lookout.
    c. Lookouts will be trained in the most effective means to ensure quick and effective communication with the command structure in order to facilitate implementation of protective measures if marine species are spotted.
2. General Maritime Protective Measures: Lookout Responsibilities
    a. There will always be at least one person on watch whose duties include observing the water surface around the vessel or platform.
    b. Personnel on lookout will have at least one set of binoculars available to aid in the detection of marine mammals.
    c. After sunset and prior to sunrise, lookouts will employ night lookout techniques.
3. Operating Procedures
    a. Craft personnel will make use of marine species detection information to limit interaction with marine species to the maximum extent possible consistent with safety of the craft.
    b. All personnel engaged in passive acoustic sonar operation will monitor for marine mammal vocalizations and report the detection of any marine mammal to the Range Officer for dissemination and appropriate action.
    c. During MFA/HFA operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.
    d. Safety Zones – When cetaceans are detected by any means within 1,000 yards of the intended track of the test vehicle, the transmissions will be terminated. For all range sites the sources are either on or off; there is no capability to reduce source levels.
    e. Prior to start-up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.
4. Coordination and Reporting
    a. Navy will coordinate with the local NMFS Stranding Coordinator regarding any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with a test event.

5.3 MMPA-REQUIRED MITIGATION, MONITORING AND REPORTING

5.3.1 Requirements for Mitigation (50 CFR §218.173) Monitoring and Reporting (50 CFR §218.174)

Mitigation measures and monitoring and reporting were specified in NMFS Proposed Rule (2009a) to issue the LOA for the proposed activities on the Keyport Range Complex. Following Navy and public review of the Proposed Rule, NMFS is preparing a Final Rule which will contain the mitigation measures and monitoring and reporting as required by the MMPA. Keyport will comply with these requirements to the extent practicable.

5.4 ESA PROTECTIVE MEASURES

In its Letter of Concurrence and Biological Opinion, the USFWS (2010) concluded that the Proposed Action may affect but is not likely to adversely affect bull trout, is not likely to destroy or adversely modify bull trout critical habitat, and is not likely to jeopardize the continued existence of the marbled murrelet. Protective measures applicable to the marbled murrelet from the BO are provided below.

5.4.1 Measures from USFWS BO

5.4.1.1 Conservation Measures

Through the consultation, the Navy agreed to implement the following "performance measures" to reduce the potential exposure of marbled murrelets to underwater sound.

PERFORMANCE MEASURE 1: During the period of 1 April through 15 September, the Navy, to the extent practicable, will not commence countermeasure RDT&E activities earlier than two hours after sunrise for RDT&E events conducted at the Keyport and DBRC sites.

PERFORMANCE MEASURE 2: The Navy will meet the following thresholds for sound sources at the distances described for RDT&E events conducted at the Keyport and DBRC sites.

Table 5-2 Maximum Distances to Sound Exposure Levels

Source	Frequency (kHz)	Radius (m) to			
		206 dB $_{SPL}$ re 1 μPa	187 dB $_{SEL}$ re 1 μPa^{2}s	183 dB $_{SEL}$ re 1 μPa^{2}s	150 dB $_{RMS}$ re 1 μPa
S1*	4.5	1	4	6	253
S2	15	< 1	< 1	< 2	46
S3*	10	< 1	2	< 3	24
S4	150	5	5	7	133
S5*	5	23	78	123	691
S6	20	23	76	119	2060
S7	25	16	54	84	571
S8	30	22	75	115	684

* S1, S3, and S5 are the only sources within the hearing range of marbled murrelets (<12.5 kHz as provided by USFWS).

PERFORMANCE MEASURE 3: Ninety-five percent of the countermeasures tested will have a duration less than 30 minutes for RDT&E events conducted at the Keyport and DBRC sites.

PERFORMANCE MEASURE 4: For 97 percent of the countermeasures tested, the distance to the 183 dB SEL threshold is less than 221 m. All countermeasures tested (100 percent) will attenuate to 183 dB SEL (or less) at a distance less than 345 m. Moreover, for 90 percent of the countermeasures tested, the distance is significantly less than 221 m for RDT&E events conducted at the Keyport and DBRC sites.

5.4.1.2 Reasonable and Prudent Measures

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of marbled murrelets:

- Reasonable and Prudent Measure 1: Conduct testing activities at locations and times to minimize exposure of marbled murrelets to sound from countermeasures.
- Reasonable and Prudent Measure 2: Assure that performance measures described above are met to assure that incidental take is not exceeded.

5.4.1.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Navy must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

(1) Where practicable (as determined by the Navy) during the summer, conduct long duration (exceeding 30 minutes) countermeasures tests in the Keyport Range instead of DBRC.

(2) Where practicable (as determined by the Navy), conduct countermeasure testing activities during the summer rather than the winter.

(3) The Navy shall submit an Annual Report for the Keyport Range and DBRC on April 1 of every year (covering data gathered through December 31 of the prior year). These data can be characterized broadly describing frequency level and duration with regard to location and date. These data shall be summarized at the end of the 5-year period in a report as well. These reports shall contain the exercise information for each countermeasure event: a) Date and times that event began and ended b) Location c) Total hours that sound was generated d) Frequency/ies and maximum source levels generated during event.

(4) To the extent practicable, the Navy, in coordination with USFWS, shall develop and implement a method of summarizing countermeasure activities geographically and seasonally across the Keyport Range and DBRC sites. The Navy shall develop this method, in a coordinated Navy-USFWS joint report format, 6 months from the date of the issuance of the Record of Decision for this action.

(5) The Navy, in coordination with the USFWS, shall develop and implement a plan to monitor compliance with the performance measures for countermeasure sound sources described as part of the action. This monitoring plan will be completed within 6 months from date of the Record of Decision for this action and subject to approval by Navy and USFWS. The plan and reporting will be in a coordinated Navy-USFWS joint report format, ensuring classification requirements are met.

(6) The USFWS believes that no more than 30 murrelets will be incidentally taken as a result of the Proposed Action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the Proposed Action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. Exceedance of the incidental take level could occur should the performance measures described not be met or the numbers or duration of activities be exceeded. The Federal agency must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

(7) The USFWS is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest USFWS Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the USFWS Law Enforcement Office at (425) 883-8122, or the USFWS's Washington Fish and Wildlife Office at (360) 753-9440.

5.4.2 Measures from NMFS Draft BO

NUWC Keyport will comply with the reasonable and prudent measures and the required terms and conditions issued by NMFS in their BO to the extent practicable.

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CHAPTER 6
LIST OF PREPARERS AND DISTRIBUTION LIST

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6.2.1 Parties Receiving EIS/OEIS

Federal Elected Officials

U.S. Senator Maria Cantwell
U.S. Senator Patty Murray
U.S. Representative Norm Dicks
U.S. Representative Jay Inslee

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19th Legislative District, Representative Dean Takko
23rd Legislative District, State Senator Phil Rockefeller
23rd Legislative District, Representative Sherry Appleton
24th Legislative District, State Senator Jim Hargrove
24th Legislative District, Representative Kevin Van De Wege
26th Legislative District, State Senator Derek Kilmer
26th Legislative District, Representative Patricia Lantz
35th Legislative District, State Senator Tim Sheldon
35th Legislative District, Representative Kathy Haigh

Local Elected Officials

Grays Harbor Council of Governments
Jefferson County Superior Court
Kitsap County Superior Court
Mason County Superior Court

Federal Agencies

Department of Interior Office of Environmental Policy and Compliance
NOAA Fisheries, Northwest Regional Office
NOAA Fisheries, Northwest Fisheries Science Center
Olympic Coast National Marine Sanctuary
U.S. Army Corps of Engineers, Seattle District, CENWS-OD-RG
U.S. Coast Guard - 13th District

USEPA Region 10 Office
U.S. Fish and Wildlife Service Pacific Region

Washington State Agencies

Office of Archaeology and Historic Preservation
Department of Community, Trade, and Economic Development
Department of Ecology
Department of Fish and Wildlife
Department of Natural Resources

Local Agencies and Organizations

North Mason Chamber of Commerce
Port of Grays Harbor
Port Orchard - South Kitsap Chamber of Commerce
Quilcene/Brinnon Chamber of Commerce
Shelton Mason County Chamber of Commerce

Native American Indian Tribes, Nations, Commissions and Councils

Hoh Tribe
Jamestown S'Klallam Tribe
Lower Elwha Klallam Tribe
Makah Tribe
Northwest Indian Fisheries Commission
Point No Point Treaty Council
Port Gamble S'Klallam Tribe
Quileute Tribe
Quinault Nation
Skokomish Tribe
Suquamish Tribe

Libraries

Aberdeen Timberland Library
Hoodsport Timberland Library
Jefferson County Rural Library District
Kitsap Regional Library
North Mason Timberland Library
Ocean Shores Public Library
Port Orchard Library
Port Townsend Public Library
Poulsbo Branch Library
Quinault Indian Nation Tribal Library
Skokomish Tribal Center

Interest Groups

Acoustic Ecology Institute

All My Relations

Center for Whale Research

Natural Resource Defense Council

Ocean's Advocates

Oregon Fishermen's Cable Committee

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See Appendix A.

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CHAPTER 7
REFERENCES AND PERSONAL COMMUNICATIONS

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APPENDIX A:
PUBLIC INVOLVEMENT

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Notice of Intent

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another agency to address the problems and needs of the study area. While final alternatives have not been determined at this study initiation phase, the earlier Reconnaissance phase of the study and Section 905B Report identified several preliminary measures that could address the problems and needs within the study area. The 905B report concluded that there is the potential for significant storm damages from wave impacts to existing development and facilities along the 1,500 feet reach stretching from Ash Avenue up to Linden Avenue in the City of Carpinteria. A range of conceptual alternatives were identified as having potential for having a Federal interest to address the problems and needs of the study area: (1) Beach Nourishment with periodic renourishment; (2) Artificial Reef Submerged Breakwater; and (3) Seawall. The feasibility study will investigate measures to address the problems and needs and an array of alternatives will be developed and be analyzed for inclusion in the Feasibility Report and EIS.

DATES: A public meeting will be held on 23 September 2003 at 6:30 p.m., at the City Council Chamber, 5775 Carpinteria Avenue, Carpinteria, CA 93013, to discuss the feasibility Study and to obtain input to the scoping of the EIS. Comments concerning the Feasibility Study and Scoping for the EIS may be made at the public meeting or be mailed to the following address by October 27, 2003.

ADDRESSES: District Engineer, U.S. Army Corps of Engineers, Los Angeles District, ATTN: CESPL–PD–RP, P.O. Box 532711, Los Angeles, CA 90052–2325.

FOR FURTHER INFORMATION CONTACT: Mr. Kirk C. Brus, Environmental Coordinator, telephone (213) 452–3876, or Mr. Alex Bantique, Study Manager, telephone (213)–452–3837. The cooperating entity, City of Carpinteria, requests inquiries to Mr. Matthew Roberts, telephone (805) 684–5405, ext. 449 for any additional information.

SUPPLEMENTARY INFORMATION:

1. Authorization

Section 208 of the Flood Control Act of 1965 (Pub. L. 89–298) authorized feasibility studies for Carpinteria Shoreline. The 89th Congress of the United States passed what became Public Law 298. Congressional Energy and Water Development Appropriations Bill H.R. 21–22 (1995) provided funds to initiate the reconnaissance study for Carpinteria Shoreline.

2. Background

The Carpinteria Shoreline is part of the Carpinteria City Beach, bound by the Pacific Ocean to the west, lies within the City of Carpinteria, and is an integral part of the southern coastal area of California in Santa Barbara County. The sandy beach is typically narrow, and backed by public and private developments. The Carpinteria Salt Marsh is located north of the Carpinteria Shoreline on the ocean side of the Pacific Coast Highway (PCH) 1, and is fed by the Franklin and Santa Monica Creeks. The coastal plain in the study area continues has limited groundwater resources, partly due to saltwater intrusion coming from the Pacific Ocean.

The Feasibility Studies to be evaluated by this Draft EIS will analyze: (1) Beach Nourishment concepts for the Carpinteria Shoreline using sand including vegetated sand dunes, and periodic beach nourishment operation and maintenance (O&M) operations to prevent erosion and reduce coastal storm damages to the shoreline; (2) Artificial Reef Submerged Breakwater (ARSB) opportunities located in the ocean parallel to the Carpinteria Shoreline to avoid erosion, and decrease wave and coastal storm flooding damages to public and private properties; and (3) Reinforced Concrete Seawall designs as part of the Carpinteria Shoreline to lessen off shore wave impact and storm damages to public facilities and private residences; (4) Plans for maintaining and enhancing existing recreational facilities for the Carpinteria Shoreline to maintain public access and advert a decline in its recreational value. Prehistoric and historic cultural resources are not known to exist along this stretch of the Carpinteria Shoreline.

3. Proposed Action

No plan of action has yet been identified.

4. Alternatives

Alternatives will be developed as part of the planning process. These would likely include:

a—No Action: No nourishment, improvement or reinforcement of shoreline.

b—Proposed Alternative Plans: Conceptual feasible alternatives to prevent erosion and coastal storm damage within the Carpinteria Shoreline are the following: (1a) Beach Nourishment with two year renourishment period; (1b) Beach Nourishment with five year renourishment; (2a) Artificial Reef Submerged Breakwater (ARSB) with one segment; (2b) ARSB with three segments; and (3) Seawalls.

5. Scoping Process

Participation of all interested Federal, State, and County resource agencies, as well as Native American peoples, groups with environmental interests, and all interested individuals is encouraged. Public involvement will be most beneficial and worthwhile in identifying pertinent environmental issues, offering useful information such as published or unpublished data, direct personal experience or knowledge which inform decision making, assistance in defining the scope of plans which ought to be considered, and recommending suitable mitigation measures warranted by such plans. Those wishing to contribute information, ideas, alternatives for actions, and so forth can furnish these contributions in writing to the points of contacts indicated above, or by attending public scoping opportunities. The scoping period will conclude 45 days after publication of this NOI.

When plans have been devised and alternatives formulated to embody those plans, potential impacts will be evaluated in the DEIS. These assessments will emphasize at least thirteen categories of resources: land use, physical environment, hydrology, biological, esthetics, air quality, noise, transportation, socioeconomic, safety recreation, cultural resources, and hazardous material.

Dated: September 4, 2003.

Richard G. Thompson,

Colonel, U.S. Army, District Engineer.

[FR Doc. 03–23173 Filed 9–10–03; 8:45 am]

BILLING CODE 3710–KF–M

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement for Northwest Range Complex Extension, Naval Undersea Warfare Center, Division Keyport, Keyport, WA

AGENCY: Department of the Navy, DOD.

ACTION: Notice.

SUMMARY: Pursuant to Section 102 (2) (c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500–1508), the Department of the Navy (Navy) announces its intent to prepare an Environmental Impact Statement/ Overseas Environmental Impact

Statement (EIS/OEIS) to evaluate the potential environmental impacts associated with the extension of the Northwest Range Complex, in Washington state, to provide additional space and volume outside the existing operational areas, to support the existing and evolving range operations of Naval Undersea Warfare Center, Division Keyport, Keyport, WA (NUWCDIVKPT). Existing and evolving range operations include requirements for testing, training, and evaluation of manned and unmanned vehicles in multiple marine environments to evaluate system capabilities such as guidance, control, and sensor accuracy.

DATES: Public scoping meetings will be held in Kitsap County, WA, Mason County, WA, Jefferson County, WA, and Grays Harbor County, WA, to receive oral and/or written comments on environmental concerns that should be addressed in the EIS/OEIS. The public meeting dates are:

1. November 17, 2003, 6 p.m. to 9 p.m., Kitsap County, WA.
2. November 18, 2003, 6 p.m. to 9 p.m., Mason County, WA.
3. November 19, 2003, 6 p.m. to 9 p.m., Jefferson County, WA.
4. November 20, 2003, 6 p.m. to 9 p.m., Grays Harbor County, WA.

ADDRESSES: The public meeting locations are:

1. Kitsap County—Naval Undersea Museum, 610 Dowell Street, Keyport, WA.
2. Mason County—Belfair Elementary School, Gymnasium, 22900 NE Highway 3, Belfair, WA.
3. Jefferson County—Quilcene Public Schools, Multi-Purpose Room, 294715 Highway 101, Quilcene, WA.
4. Grays Harbor County—Hoquiam High School, Cafeteria, 501 West Emerson, Hoquiam, WA.

FOR FURTHER INFORMATION CONTACT: Mrs. Shaari Unger (Code 521), Naval Undersea Warfare Center Div, Keyport, 610 Dowell St, Keyport, WA 98345; (360) 315–7730, fax (360) 396–2259, E-Mail: *RangeExtensionE @efanw.navfac.navy.mil*.

SUPPLEMENTARY INFORMATION: The Navy needs to extend the Northwest Range Complex operating area to provide multiple in-water environments that meet the evolving operational requirements for manned and unmanned vehicle testing in Washington State. The Northwest Range Complex is comprised of three marine ranging areas in the Pacific Northwest (Washington state): (1) The Dabob Bay Military Operating Area (MOA), two Hood Canal MOAs and the connecting waters known as the Dabob Bay Range Complex (DBRC); (2) the Keyport MOA; and (3) the Quinault Underwater Tracking Range (QUTR) MOA which is located within the Navy MOA W237A. The range extension is required in order to provide adequate testing area and volume in multiple marine environments to fulfill the NUWCDIVKPT mission of providing test and evaluation services in both surrogate and simulated war-fighting environments for emergent manned and unmanned vehicle program operations.

Alternatives to be considered in the EIS/OEIS address the need to provide adequate testing area and volume as well as the type, tempo, and location of the testing and training to be conducted on the range. The alternatives proposed will meet the requirements for evolving range operations including manned and unmanned vehicle program needs. Additionally the alternatives will provide multiple marine environments including varied salinity types, variable depths, and surf zone access.

The Navy has developed three action alternatives that meet evolving range operations including manned and unmanned vehicle requirements. These alternatives meet operational criteria to provide adequate test and training area and volume in multiple marine environments in varying proximity to existing NUWCDIVKPT facilities. Alternative (1) is to conduct existing and new activities within the DBRC with extensions in Hood Canal north and south; including shallow water activity, extension of the Keyport Range operating area, and extension of QUTR operating area to W–237A. Alternative (2) is to conducting existing and new activities within the DBRC without extension, extension of the Keyport Range operating area, and extension of QUTR operating area to W–237A or (3) conducting existing and new activities within the DBRC with additional shallow water activity, extension of the Keyport Range operating area, and extension of QUTR operating area to W–237A. The No Action alternative is to continue activities carried out at existing operating areas for the DBRC, Keyport range, and QUTR.

The EIS/OEIS will evaluate the potential environmental impacts associated with identified alternatives. Issues to be addressed will include, but not be limited to, the following resource areas: marine/benthic communities, fisheries including an analysis of essential fish habitat, water quality, wildlife including threatened and endangered species and marine mammals, vegetation/plants, soils, land/shoreline use, recreation, socioeconomics, transportation, public utilities, cultural resources, usual and accustomed fishing, air quality, and noise. The analysis will include an evaluation of the direct, indirect, short-term, and cumulative impacts. No decision will be made to implement any alternative until the NEPA process is completed.

The Navy is initiating the scoping process to identify community concerns and local issues that will be addressed in the EIS/OEIS. Federal, state, local agencies, and interested persons are encouraged to provide oral and/or written comments to the Navy to identify specific issues or topics of environmental concern that should be addressed in the EIS/OEIS. The Navy will consider these comments in determining the scope of the EIS/OEIS.

Written comments on the scope of the EIS/OEIS should be submitted in accordance with future Federal Register notices for public scoping meetings and should be mailed to: Commander, Engineering Field Activity, Northwest, Naval Facilities Engineering Command, 19917 7th Ave NE., Poulsbo, WA 98370, Attn: Code 05EC3.KK (Mrs. Kimberly Kler) E-Mail: *RangeExtensionE @efanw.navfac. navy.mil*.

Dated: September 8, 2003.

E.F. McDonnel,

Major, U.S. Marine Corps, Federal Register Liaison Officer.

[FR Doc. 03–23181 Filed 9–10–03; 8:45 am]

BILLING CODE 3810–FF–U

DEPARTMENT OF DEFENSE

Department of the Navy

Meeting of the Chief of Naval Operations (CNO) Executive Panel

AGENCY: Department of the Navy, DOD.

ACTION: Notice of closed meeting.

SUMMARY: The CNO Executive Panel is to report the findings and recommendations of the FORCEnet Working Group to the Chief of Naval Operations. This meeting will consist of discussions relating to development of FORCEnet, the Navy's transformational architecture for force integration and application. This meeting will be closed to the public.

DATE: The meeting will be held on Friday, September 12, 2003, from 11:30 a.m. to 12 p.m.

ADDRESS: The meeting will be held at the Office of the Chief of Naval Operations, Room 4E660, 2000 Navy Pentagon, Washington, DC 20350–2000.

FOR FURTHER INFORMATION CONTACT: Commander David Hughes, CNO Executive Panel, 4825 Mark Center

Newspaper Advertisement

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RANGE EXTENSION EIS/OEIS PUBLIC NOTICE LIST
3 COL x 5 IN

PAPER	DATE PUBLISHED, 2003
Central Kitsap Reporter	Wednesday, 12 November
North Kitsap Herald	Wednesday, 12 November
Bremerton Sun	Thursday, 13 November
Bremerton Sun Neighbors (increased circulation)	Tuesday, 11 November
Port Townsend Leader	Wednesday, 12 November
Montesano Vidette (Hoquiam)	Thursday, 13 November
Shelton-Mason County Journal/Belfair Herald	Thursday, 13 November
Peninsula Daily News (Port Townsend)	Tuesday, 18 November
Aberdeen Daily World	Monday, 17 November

The ***U.S. Navy***, Naval Undersea Warfare Center would like to ***invite you*** to scoping meetings for the proposed extension of the Northwest Range Complex Operating area that includes the Keyport Range, Dabob Bay Range Complex, and Quinault Underwater Tracking Range. We encourage your attendance at our open house meetings. Navy representatives will be available to provide descriptions of the proposed action and alternatives, answer questions on the proposal and the National Environmental Policy Act process, and receive any comments you might have on the proposal. Meetings will be held in the following locations:

City/Town	***Date***	***Time***	***Location***
Keyport	Monday, November 17	6:00 p.m. – 9:00 p.m.	Naval Undersea Museum 610 Dowell Street
Belfair	Tuesday, November 18	6:00 p.m. – 9:00 p.m.	Belfair Elementary School Gymnasium, 22900 NE Highway 3
Quilcene	Wednesday, November 19	6:00 p.m. – 9:00 p.m.	Quilcene Public Schools, Multi-Purpose Room 294715 Highway 101
Hoquiam	Thursday, November 20	6:00 p.m. – 9:00 p.m.	Hoquiam High School Cafeteria 501 West Emerson

Please send any written comments by December 31, 2003 in care of:

Commander
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 7th Avenue NE
Poulsbo, Washington 98370
Attn: Code 05EC3.KK (Mrs. Kimberly Kler)

You may email your comments to RangeExtensionE@efanw.navfac.navy.mil

For more information, please visit the project website at
http://www-keyport.kpt.nuwc.navy.mil

Summary of Scoping Comments

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RANGE EXTENSION EIS/OEIS SCOPING COMMENTS TALLY SHEET

AS OF 1/29/04

ISSUES	Total
PROCESS	
Provide public involvement requirements	1
Inadequate notification of public meetings**	15
Extend comment period**	16
Who is decisionmaker	1
Hold meeting in Port Townsend	19
Notify public better when testing	7
Will an EIS/EA be prepared prior to each test	3
Describe NEPA process	1
SUBTOTAL	*63*
PROPOSED ACTION/ALTERNATIVES	
Better describe NUWC present and proposed activities	18
Evaluate an alternative not in sanctuary waters/shore	7
Limit NUWC activities to 5 days/week, 8 to 5	11
Describe materials used in testing and evaluation	4
Describe sonar used in testing and evaluation	1
Explain fake mines and handling of such	1
Explain surf zone testing	2
Describe shallow water testing	2
Describe all (NUWC and Navy) activities at Quinault Underwater Training Range (undersea, surface & air)	2
Baseline at QUTR should be zero	1
Deficient alternatives	2
SUBTOTAL	*51*
Operations	
Radio frequency conflicts	1
Describe UUV operations and materials used in vehicles	1
SUBTOTAL	*2*
ENVIRONMENTAL RESOURCE AREAS	
Cultural Resources (Native American Indian Tribes and Nations Concerns)	
Concern disrupt fish harvest, navigation, access	5
Concern restrict access to Quinault Indian Nation	3
Concern affect historic, traditional, and cultural resources	10
Concern tribal economy affected by operations	2
Quinault Indian Nation unhappy that marine sanctuary briefed first	1
Concern conflicts with tribal fishing rights	2
SUBTOTAL	*23*
Noise and Acoustics	
Concern effects to marine mammals and fish	32
Concern noise disturbance to neighboring homes, marinas, and boaters	3
Portray the undersea noise contour levels for Dabob Bay Range, Liberty Bay, and QUTR	1
Re-evaluate the 180-dB standard and added sound exposure	1
Evaluate cumulative noise effects on behavior	1
SUBTOTAL	*38*
Marine Flora and Fauna	
Concern effects to marine fauna from cables and equipment disturbance	11

RANGE EXTENSION EIS/OEIS SCOPING COMMENTS TALLY SHEET

ISSUES	Total
Evaluate seafloor disturbance from cables, listening devices, targets, UUVs, submarines, torpedos, etc.)	7
Concern effects of aircraft and surface vessels on sea and shoreline birds (e.g., nesting	5
Concern overall operational effects on marine flora and fauna	11
Concern effects on T&E marine species	7
Concern effects on surf zone, shallow water, and intertidal habitat	12
Concern effects to kelp and eelgrass beds	4
Concern effects of ingesting debris on marine life	6
Concern about affecting the Hamma Hamma, Duckabush, and Dosewallips river estuaries	2
Employ a monitoring program to assess impacts to marine life and disclose in EIS	2
Concern impacts to marine flora and fauna from lights, sound, electronic and sonar emissions	1
SUBTOTAL	*68*
Socioeconomics	
Concern impacts to regional economy (fisheries, recreation, tourism)	24
Concern real estate value will decline with implementation of expansion	7
Concern cause increased ship traffic and conflicts	3
Concern access will be limited around all three ranges	16
Concern expansion will discourage tourism with recreational boaters, whale watchers, etc.	10
Fisheries include: crabs (dungenous), clams (razor), oysters, geoduck, shrimp, halibut, salmon, blackcod, mussels	*summary*
SUBTOTAL	*60*
Hazardous Materials/Solid Waste	
Evaluate pollution discharge from fuel, batteries, UUVs	3
Evaluation overall pollution due to testing and evaluation activities	9
Describe the toxins emitted and used during testing and evaluation	11
Describe the effect of leaving equipment on seabottom	4
Describe waste/debris removal activiites	2
What types of waste will be generated	4
Concern effects on fish and humans from ingesting toxins and hazardous materials	1
SUBTOTAL	*34*
Land and Shoreline Use	
Describe affects to the National Marine Sanctuary	7
Concern conflicts with beach use and recreationalists	8
Concern affects to the Olympic National Park	1
SUBTOTAL	*16*
Recreation	
Concern effects to kayakers, canoers, pleasure boaters/fishing, whale watchers	10
Concern effects of lights on recreationalists	2
SUBTOTAL	*12*
Water Resources	
Describe contribution to oxygen problem in Hood Canal	2
Describe water quality effects from operations	3

RANGE EXTENSION EIS/OEIS SCOPING COMMENTS TALLY SHEET

ISSUES	Total
SUBTOTAL	*5*
Air Quality	
Concern how will air quality be affected by operations	2
SUBTOTAL	*2*
CUMULATIVE IMPACTS	
How will NUWC activities affect ongoing scientific research in the region	1
Conflict with Fred Hill project	2
SUBTOTAL	*3*
COMMENTS BEYOND SCOPE	
Oppose any NUWC activity	20
Mile 5 marker	1
Light coloring system	1
Depleted uranium use	4
SUBTOTAL	*26*

*Letters: 23 letters, 44 emails (of which 14 were form letters)
**Form letters generated out of Port Townsend
Note: More than 19 people requested the meeting be held in Port Townsend. Each form letter signed by multiple people was counted as one letter.

Scoping meeting comments	
Belfair (2); Hoqiam (0); Keyport (13); Quilcene (25); Quileute (0)	40

Comment Type	**Letters**
County Commissioners	1
Non-Governmental Organization (NGO) For example NRDC	3
Gov't to Gov't: Quinalt, Suquamish, Point No Point Treaty Council	4
Chamber of Commerce	1
Interested Citizens	67
23 letters, 44 emails (of which 14 were form letters)	
Native American Indians	

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Address List

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NAVSEA NUWC Keyport Range Extension EIS/OEIS

Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
Lead Agency						
				Commander, Engineering Field Activity Northwest	Silverdale	WA
Military						
Ms.	Sandra	Gagnon		Marine Environmental Support Office	San Diego	CA
Ms.	Karen	Foskey	Office of the Chief of Naval Operations	Operational Environmental Readiness and Planning	Washington	DC
Ms.	Deborah	Verderame		Naval Sea Systems Command	Washington Naval Yard	DC
Ms.	Elaine	Burress	Commander	Naval Undersea Warfare Center	Newport	RI
Dr.	Paul D.	LeFabvre	Commander	Naval Undersea Warfare Center	Newport	RI
Libraries (Repositories)						
				Aberdeen Timberland Library	Aberdeen	WA
				Hoodsport Timberland Library	Hoodsport	WA
				Jefferson County Rural Library District	Port Hadlock	WA
				Kitsap Regional Library	Bremerton	WA
				NAVSEA 04R		
				North Mason Timberland Library	Belfair	WA
				Ocean Shores Public Library	Ocean Shores	WA
				OPNAV N45		
				Port Townsend Public Library	Port Townsend	WA
				Poulsbo Branch Library	Poulsbo	WA
				Quinault Indian Nation Tribal Library	Taholah	WA
				Skokomish Tribal Center	Shelton	WA
				Squaxin Island Cultural Center	Shelton	WA
Native American Tribes						
Mr.	Rodney	Thysell	Fisheries	Hoh Indian Nation	Forks	WA
Ms.	Mary	Leitka	Chairperson	Hoh Indian Nation - Trabal Business Committee	Forks	WA
Mr.	W. Ron	Allen	Chaiperson	Jamestown S'Kallam Indian Tribe	Sequim	WA
Ms.	Ann	Seiter	Natural Resources Director	Jamestown S'Klallam Tribe	Sequim	WA
Mr.	Scott	Shitwood		Jamestown S'Klallam Tribe	Sequim	WA
Ms.	Kelly	Toy		Jamestown S'Klallam Tribe	Sequim	WA
Ms.	Lisa	Hillyer		Lower Elwha Klallam Tribe	Port Angeles	WA
Mr.	Doug	Morell		Lower Elwha Klallam Tribe	Port Angeles	WA
Mr.	Dennis	Sullivan	Chairperson	Lower Elwha Klallam Tribe	Port Angeles	WA
Mr.	Russ	Svec	Fisheries	Makah Tribe	Neah Bay	WA
Mr.	Nate	Taylor	Chairman	Makah Tribe	Neah Bay	WA
Mr.	Randy	Harder	Executive Director	Point No Point Treaty Council	Kingston	WA
Mr.	Randy	Hatch	Shellfish	Point No Point Treaty Council	Kingston	WA
Mr.	Nick	Lampsakis	Finfish	Point No Point Treaty Council	Kingston	WA
Mr.	Ronald G.	Charles	Chairman	Port Gamble S'Klallam Tribe	Kingston	WA
Ms.	Sharon	Purser	Natural Resources Director	Port Gamble S'Klallam Tribe	Kingston	WA
Ms.	Katherine	Krueger	Environmental Attorney	Quileute Natural Resources	LaPush	WA
Mr.	Mel	Moon	Natural Resources Director	Quileute Tribe	LaPush	WA
Ms.	Pearl	Capoeman-Baller	Chairman	Quinault Indian Nation	Taholah	WA
Mr.	Mark	Mobbs	Environmental Programs	Quinault Indian Nation	Taholah	WA
Ms.	Fawn	Sharp		Quinault Indian Nation	Taholah	WA
Mr.	John	Simms	Environmental Programs	Quinault Indian Nation	Taholah	WA
Mr.	James	Gordon	Chairman	Skokomish Tribal Nation	Skokomish	WA
Mr.	David	Herrera	Fisheries	Skokomish Tribal Nation	Skokomish	WA
Mr.	David	Lopeman	Chairman	Squaxin Indian Tribe	Shelton	WA
Mr.	Wayne	George	Executive Director	Suquamish Tribal Center	Suquamish	WA
Mr.	Rich	Brooks	Fisheries	Suquamish Tribe	Suquamish	WA
Mr.	Charlie	Sigo	Cultural Resources	Suquamish Tribe	Suquamish	WA
Mr.	Bernie	Armstrong	Chairman	Suquamish Tribe	Suquamish	WA
Ms.	Alison	O'Sullivan	Biologist	The Suquamish Tribe	Suquamish	WA
Federal Agencies						
Mr.	Preston	Sleeger	Pacific N.W. DOI Environmental Compliance Contact	DOI Office of Environmental Policy and Compliance	Portland	OR
Ms.	Cat	Hoffman-Hawkins	Natural Resource Division Chief	National Park Service, Olympic National Park	Port Angeles	WA
Mr.	Jonathan B.	Jarvis	Chief Ranger	National Park Service, Pacific West Region	Oakland	CA
Mr.	Brent	Norberg	(Marine Mammals)	NOAA Fisheries	Seattle	WA
Mr.	Bob	Lohn	Regional Administrator	NOAA Fisheries Northwest Regional Office	Seattle	WA
				NOAA Fisheries Service, Northwest Fisheries Science Center	Seattle	WA
Mr.	Matt	Longenbaugh	Team Leader, OPSPS	NOAA Fisheries, Washington Habitat Branch	Lacey	WA
Ms.	Carol	Bernthal	Superintendent	Olympic Coast National Marine Sanctuary, NOAA Marine Sanctuaries Division	Port Angeles	WA
Mr.	Alan B.	Brooks	Chair	Olympic Coast National Marine Sanctuary	Port Angeles	WA
Mr.	Bill	Laitner	Superintendent	Olympic National Park	Port Angeles	WA
				U.S. Army Corps of Engineers, Seattle District, CENWS-OD-RG	Seattle	WA
Admiral	Jeffery	Garrett	District Commander	U.S. Coast Guard - 13th District	Seattle	WA
Mr.	William	Reilly		U.S. EPA Region 10 Office	Seattle	WA
Mr.	John	Grettenberger		U.S. Fish and Wildlife Service	Lacey	WA
Ms.	Martha	Jensen		U.S. Fish and Wildlife Service	Lacey	WA
Mr.	Kevin	Ryan	Project Leader for WA Maritime Wildlife Refuge Complex	U.S. Fish and Wildlife Service	Port Angeles	WA
Mr.	Dave	Allen	Regional Director	U.S. Fish and Wildlife Service Pacific Region	Portland	OR
Ms.	Linda	Goodman	Regional Forrester	USDA Forest Service, Pacific Northwest Region	Portland	OR
Mr.	Ward	Hoffman		USDA Forest Service, Pacific Northwest Region	Olympia	WA
Mr.	Robert	Hansen		NOAA		
Ms.	Kathy	O'Hallaran		USDA Forest Service, Pacific Northwest Region	Olympia	WA

NAVSEA NUWC Keyport Range Extension EIS/OEIS

Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
			State Agencies			
Mr.	Rob	Woodland	Acting State Historic Preservation Officer	Office of Archaeology and Historic Preservation. Washington State Department of Community, Trade, and Economic Development	Olympia	WA
Mr.	Tom	Fitzsimmons	Director	Washington State Department of Ecology	Olympia	WA
Ms.	Barbara	Ritchie	Environmental Review Section	Washington State Department of Ecology	Olympia	WA
Mr.	Tim	Schlender	Shorelands and Environmental Assistance	Washington State Department of Ecology	Olympia	WA
Dr.	Jeff	Koenings	Diector	Washington State Department of Fish and Wildlife	Olympia	WA
Ms.	Sue	Patenude	Regional Director	Washington State Department of Fish and Wildlife, Region 5	Montesano	WA
Mr.	Steve	Jennison		Washington State Department of Natural Resources	Sedro-Woolley	WA
Mr.	David	Roberts		Washington State Department of Natural Resources	Sedro-Woolley	WA
Mr.	Douglas	Sutherland	Commissioner of Public Lands	Washington State Department of Natural Resources	Olympia	WA
Mr.	Ray	Hellwig		Washington State Dept. of Ecology-Bellue Regional Office	Bellvue	WA
Mr.	Jeff	Shreck		Washington State Dept. of Natural Resources Chimacum Regional Office	Chimacum	WA
				Washington State Parks and Recreation Commission	Olympia	WA
			Local Agencies			
Mr.	David	Goldsmith	County Administrator	Board of County Commissioners	Port Townsend	WA
				Bainbridge Island Chamber of Commerce	Bainbridge Island	WA
				Bremerton Area Chamber of Commerce	Bremerton	WA
				Grays Harbor Chamber of Commerce	Aberdeen	WA
Ms.	Vicki	Cummings	Executive Director	Grays Harbor Council of Governments	Aberdeen	WA
Ms.	Chreyl	Brown	County Clerk	Grays Harbor Superior Court	Montesano	WA
Mr.	Robert	Fort	Executive Director	Greater Poulsbo Chamber of Commerce	Poulsbo	WA
Mr.	Pat	Pearson		Jefferson County Marine Resources Committee		
Ms	Marianne	Walters	County Clerk	Jefferson County Superior Court	Port Townsend	WA
Mr.	David	Petersen	County Clerk	Kitsap County Superior Court	Port Orchard	WA
	Pat	Swartos	County Clerk	Mason County Superior Court	Shelton	WA
				North Mason Chamber of Commerce	Belfair	WA
				Ocean Shores Chamber of Commerce	Ocean Shores	WA
				Port Ludlow Chamber of Commerce	Port Ludlow	WA
Mr.	Jack	Thompson	Commissioner	Port of Grays Harbor	Aberdeen	WA
Mr.	Herbert F.	Beck	Port of Port Townsend Commissioners	Port of Port Townsend	Port Townsend	WA
Mr.	Larry	Crockett	Executive Director	Port of Port Townsend		
Mr.	Conrad W.	Pirner	Port of Port Townsend Commissioners	Port of Port Townsend	Port Townsend	WA
Mr.	Robert H.	Sokol	Port of Port Townsend Commissioners	Port of Port Townsend	Port Townsend	WA
				Port Orchard - South Kitsap Chamber of Commerce	Port Orchard	WA
				Port Townsend Chamber of Commerce	Port Townsend	WA
Ms.	Kathleen	Emmerson	President	Quilcene/Brinnon Chamber of Commerce	Quilcene	WA
				Shelton Mason County Chamber of Commerce	Shelton	WA
				Silverdale Chamber of Commerce	Silverdale	WA
			Elected Officials - Federal			
Hon.	Jay	Inslee	Congressman	Keyport (WA-1)	Poulsbou	WA
Hon.	Norm	Dicks	U.S. Representative	Sixth District	Washington	DC
Hon.	Maria	Cantwell	U.S. Senator	U.S. Senate	Washington	DC
Hon.	Patty	Murray	U.S. Senator	U.S. Senate	Washington	DC
			Elected Officials - Local (Grays Harbor County)			
			Mayor of Aberdeen		Aberdeen	WA
			Mayor of Hoquiam		Hoquiam	WA
			Mayor of Montesano		Montesano	WA
			Mayor of Ocean Shores		Ocean Shores	WA
			Mayor of Westport	West Port City Hall	Westport	WA
Mr.	Dennis	Hunter	City Manager	City of Ocean Shores (Grays Harbor County)	Ocean Shores	WA
Mr.	Bob	Beerbower	Commissioner District No. 1	Grays Harbor County Board of Commissioners	Montesano	WA
Mr.	Al	Carter	Commissioner District No. 3	Grays Harbor County Board of Commissioners	Montesano	WA
Mr.	Dennis	Morrisette	Commissioner District No. 2	Grays Harbor County Board of Commissioners	Montesano	WA
			Elected Officials - Local (Jefferson County)			
Mr.	Mark	Welch	Mayor of Port Townsend		Port Townsend	WA
Mr.	Glen	Huntingford	Commissioner District No. 2	Jefferson County Board of Commissioners	Port Townsend	WA
Ms.	Judi	Mackey	Commissioner District No.3	Jefferson County Board of Commissioners	Port Townsend	WA
Mr.	Dan	Titterness	Commissioner District No. 1	Jefferson County Board of Commissioners	Port Townsend	WA
Ms.	Frieda	Fenn	Port Townsend City Counselor	Port Townsend City Council	Port Townsend	WA
	Pat	Rodgers	Brinnon Commissioner		Brinnon	WA
			Elected Officials - Local (Kitsap County)			
Ms.	Darlene	Kordonowy	Mayor of Bainbridge Island		Bainbridge Island	WA
			Mayor of Port Orchard		Port Orchard	WA
			Mayor of Poulsbo		Poulsbo	WA
Ms.	Jan	Angel	Commissioner District No. 2	Kitsap County Board of Commissioners	Port Orchard	WA
Ms.	Christine	Endresen	Commissioner District No. 1	Kitsap County Board of Commissioners	Port Orchard	WA
Ms.	Patty	Lent	Commissioner District No.3	Kitsap County Board of Commissioners	Port Orchard	WA
Ms.	Carol	Arends	Councilmember	Puget Sound Regional Council - Kitsap County Cities/Towns	Seattle	WA
			Elected Officials - Local (Mason County)			
			Mayor of Shelton		Shelton	WA
Ms.	Mary	Faughender	Commissioner District No. 2	Port of Shelton Board of Commissioners	Shelton	WA
Ms.	Marlene	Taylor	Commissioner District No.3	Port of Shelton Board of Commissioners	Shelton	WA
Ms.	Lynda	Ring- Erickson	Commissioner District No. 1	Port of Shelton Board of Commissioners	Shelton	WA

NAVSEA NUWC Keyport Range Extension EIS/OEIS

Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
				Elected Officials - State		
Hon.	Mark	Doumit	Senator	19th Legislative District	Olympia	WA
Hon.	Kevin	Van De Wege	Representative	24th Legislative District	Hoquiam	WA
Hon.	Jim	Hargrove	Senator	24th Legislative District	Olympia	WA
Hon.	William	Eickmeyer	Representative	35th Legislative District	Olympia	WA
Hon.	Tim	Sheldon	Senator	35th Legislatvie District	Olympia	WA
Mr.	Chris	Rose	Executive Policy Advisor to the Governor	Governor's Executive Policy Office	Olympia	WA
				Interest Groups		
Mr.	Jim	Cummings		Acoustic Ecology Institute	Santa Fe	NM
				ACS/Puget Sound Chapter	Seattle	WA
Mr.		Raven		All My Relations	Port Townsend	WA
				American Cetacean Society (HQ)	San Pedro	CA
Mr.	Benjamin L.	White, Jr.	Special Projects Consultant	Animal Welfare Institute		
				B.C. Endangered Species Coalition	Smithers B.C.	Canada
				Battelle Marine Sciences Laboratory	Sequim	WA
				Canadian Wildlife Service & Species at Risk	Hull, Quebec	Canada
Mr.	Ken	Balcom	President	Center for Whale Research	Friday Harbor	WA
				Center for Whale Research	Friday Harbor	WA
				Coalition for Salmon and Steelhead Habitat	Portland	OR
				Earth Share of Washington	Seattle	WA
				Fisheries and Oceans Canada	Ottawa, Ontario	Canada
				Friends of the San Juans	Friday Harbor	WA
				Georgia Strait Alliance	Vancouver B.C.	Canada
Mr.	Dean	Schwickerath	Conservation Chair	Grays Harbor Audubon Society	Montesano	WA
				Hood Canal Coordinating Council	Poulsbo	WA
				Hood Canal Salmon Enhancement Group	Belfair	WA
				Hood Canal Watershed Project Center	Belfair	WA
				Institute for Fisheries Resources	San Francisco	CA
				Johnstone Strait Killer Whale Interpretive Centre Society	Telegraph Cove B.C.	Canada
				Kitsap Conservation District	Port Orchard	WA
				Kitsap Diving Association	Bremerton	WA
				Liberty Bay Foundation	Poulsbo	WA
				Long Live the Kings	Seattle	WA
				Marine Conservation Biology Institute	Bellevue	WA
				Mason County Conservation District	Shelton	WA
Mr.	Michael	Jasny	Principal, Cetus Consulting	Natural Resource Defense Council	Santa Monica	CA
Mr.	Joel	Reynolds	Senior Attorney	Natural Resource Defense Council	Santa Monica	CA
				Natural Resources Defense Council	New York	NY
				Northwest Environmental Defense Center	Portland	OR
				Northwest Resource Information Center	Eagle	ID
				Northwest Sportfishing Industry Association	Oregon City	OR
				Ocean Futures Society	Santa Barbara	CA
Mr.	Fred	Felleman		Ocean's Advocates	Seattle	WA
Mr.	Brent	Plater		Center for Biological Diversity	San Francisco	CA
				Orca Conservancy	Seattle	WA
				Orca Network	Greenbank	WA
Mr.	Scott	McMullen	Chairman	Oregon Fishermen's Cable Committee	Astoria	OR
				Pacific Coast Federation of Fishermen's Associations	San Francisco	CA
				Pacific Environmental Advocacy Center	Portland	OR
				Pacific Marine Conservation Council	Astoria	OR
				Parks Canada	Gatineau, Quebec	Canada
				People for Puget Sound	Seattle	WA
				Puget Sound Action Team	Olympia	WA
				Raverocks.com	Victoria B.C.	Canada
				Save Our Wild Salmon	Seattle	WA
				Shipwrite Productions	Sidney B.C.	Canada
				Surfrider Foundation	B'ham	WA
				The Committee to Save the Kings River	Fresno	CA
				The Whale Musuem	Friday Harbor	WA
				University of Washington School of Oceanography	Seattle	WA
				Veins of Life Watershed Society	Victoria B.C.	Canada
				Washington Foundation for the Environment	Seattle	WA
				Washington Kayak Club	Seattle	WA
				Washington Scuba Alliance	Snoqualmie	WA
				Whale Watch Operators Association Northwest	Friday Harbor	WA
				Wild Whales, Vancouver Aquarium, B.C. Cetacean Sighting Network	Vancouver B.C.	Canada
	Bob	Bohlman	Executive Director	Marine Exchange of Puget Sound	Seattle	WA
Ms.	Peggy	Willis		Olympic Coast Alliance (OCA)	Seattle	WA
				Community/Business Group		
			Chamber Director	Ocean Shores Chamber of Commerce	Ocean Shore	WA
			Chamber Director	Port Townsend Chamber of Commerce	Port Townsend	WA
Mr.	Rick	Emmerson		Quilcene Hotel	Quilcene	WA
Ms.	Kathleen	Emmerson	President	Quilcene/Brinnon Chamber of Commerce	Quilcene	WA

NAVSEA NUWC Keyport Range Extension EIS/OEIS
Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
			Media - Newspaper			
			Environmental Reporter	Associated Press Seattle	Seattle	WA
Mr.	Douglas	Crist	Editor	Bainbridge Island Review	Bainbridge Island	WA
Mr.	Earl and Linda	Olsen	Editor	Central Kitsap Reporter	Silverdale	WA
Mr.	Scott	Warren	Editor	Daily World	Aberdeen	WA
			Environmental Reporter	Islands' Sounder	Eastsound	WA
Mr.	Chris	Dunagan	Environmental Reporter	Kitsap Sun	Bremerton	WA
Mr.	Ed	Friedrich	Military Reporter	Kitsap Sun	Bremerton	WA
Mr.	Jeff	Chew	Editor	Peninsula Daily News	Port Townsend	WA
			Editor	Peninsula Daily News	Port Angeles	WA
Mr.	Patrick J.	Sullivan	Managing Editor	Port Townsend/Jefferson County Leader	Port Townsend	WA
Mr.	Eric	Engleman	Staff Reporter	Puget Sound Business Journal	Seattle	WA
			Environmental Reporter	San Juan Islander	Friday Harbor	WA
			Environmental Reporter	San Juan Islands Journal	Friday Harbor	WA
Mr.	Mike	Barber	Military Reporter	Seattle Post-Intelligencer	Seattle	WA
Mr.	Robert	McClure	Military Reporter	Seattle Post-Intelligencer	Seattle	WA
Ms.	Lisa	Stiffler	Environmental Reporter	Seattle Post-Intelligencer	Seattle	WA
			Environmental Reporter	Seattle Press On Line	Mill Creek	WA
Mr.	Ian	Ith	Environmental Reporter	Seattle Times	Seattle	WA
Mr.	Robert	Wagner	Military Reporter	Seattle Times	Seattle	WA
			Environmental Reporter	Sequim Gazette	Sequim	WA
			Environmental Reporter	Snohomish County Business Journal	Everett	WA
Mr.	Larry	Thomas	Editor	South Beach Bulletin	South Beach	WA
			Environmental Reporter	South Whidbey Record	Langley	WA
			Environmental Reporter	Whidbey News-Times	Oak Harbor	WA
Ms.	Dee Ann	Shaw	Editor	Montesano Vidette	Montesano	WA
Mr.	Joe	Irwin	Editor	North Kitsap Herald	Poulsbo	WA
Mr.	Luke	Bogues	Reporter	Peninsula Daily News	Port Townsend	WA
Mr.	John	Brewer	Editor	Peninsula Daily News	Port Angeles	WA
Mr.	Jeff	Rhodes	Editor	Port Orchard Independent	Port Orchard	WA
Mr.	Fred	Obee	Editor	Port Townsend/Jefferson County Leader	Port Townsend	WA
Mr.	Charles	Gay	Editor	Shelton-Mason County Journal	Shelton	WA
Ms.	Barbara	Aue	Editor	South Beach Bulletin	South Beach	WA
Mr.	Larry	Thomas	Editor	The Bremerton Patriot	Silverdale	WA
Mr.	John C.	Hughes	Editor	The Daily World	Aberdeen	WA
			Environmental Reporter	KPTK AM	Seattle	WA
			Environmental Reporter	KUOW 94.9 National Public Radio	Seattle	WA
			Environmental Reporter	KWDB AM	Oak Harbor	WA
			Producer	KCPQ 13 TV, FOX	Seattle	WA
			Producer	KCTS TV, PBS	Seattle	WA
Mr.	Gary	Chittim	Environmental Reporter	KING 5 TV, NBC	Seattle	WA
Ms.	Ruth	Pumphrey	Weekend Producer	KING 5 TV, NBC	Seattle	WA
Mr.	Ed	White	Producer	KING 5 TV, NBC	Seattle	WA
Mr.	Graham	Johnson		KIRO 7 TV, CBS	Seattle	WA
Mr.	Brian	Thielke		KIRO 7 TV, CBS	Seattle	WA
Mr.	John	White		KIRO 7 TV, CBS	Seattle	WA
	D	Reynolds		KOMO 4 TV, ABC	Seattle	WA
			Producer	Northwest Cable News	Seattle	WA
			Individuals			
Mr.	Larry	Lewis			Quilcene	WA
	David R.	Farford			Aberdeen	WA
	Doug	Fricke			Hoquiam	WA
Mr.	Arthur	Grunbaum			Aberdeen	WA
Ms.	Linda	Orgel			Aberdeen	WA
Mr.	Michael	Ewing			Quilcene	WA
	Penney	Hubbard			Quilcene	WA
Ms.	Deborah	Weishaar			Silverdale	WA
Ms.	Penelope Leila	Grace			Port Townsend	WA
	Brooks and Barbara	Hanford			Brinnon	WA
Mr. and Mrs.	Paul D.	Coover			Poulsbo	WA
Ms.	Mira	Lutz	Marine Science Educator	AHEP	Anacortes	WA
	Rudy	Kler			Silverdale	WA
	Mark	Pouliot			Hoquiam	WA
Mr.	Chuck	Helmer			Seabeck	WA
	Craig	Zora			Aberdeen	WA
	Steven	Kristrom			Hoquiam	WA
Mr.	Richard A.	Nelson			Silverdale	WA
Mr.	Jim	Stark			Grapeview	WA
Ms.	Sally	Holm			Port Townsend	WA
Mr.	Leland P.	Miller			Port Townsend	WA
	Earl and Linda	Gruer			Shelton	WA
Mr.	John W.	McDuff			Quilcene	WA
Mr.	Brian E.	Watson			Bremerton	WA
	Bob	Martin			Hoquiam	WA
Mr.	David	Jenkins			Port Townsend	WA
Mr.	Allen	Vau			Poulsbo	WA
Mr.	Art	Schick			Poulsbo	WA
Ms.	Mary	Gleysteen			Kingston	WA
Mr.	R.A. (Bud)	Schindler			Brinnon	WA
Mr.	Dick	Keithahn			Port Ludlow	WA
Ms.	Brenda	McMillan			Port Townsend	WA

NAVSEA NUWC Keyport Range Extension EIS/OEIS

Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
Mr.	William	Lynn			Tacoma	WA
Mr.	Glen	Milner			Seattle	WA
Mr.	Douglas	Milholland			Port Townsend	WA
Ms.	Nancy	Milholland			Port Townsend	WA
Mr. and Ms.	Neal & Barbara	Liden			Port Townsend	WA
Mr. and Ms.	James R. and Zoe	Stehn and Washburn			Forks	WA
Ms.	Linda	Morris			Langley	WA
Mr.	Bob	Johnston			Bremerton	WA
Mr. and Ms.	Jim and Judy	Tough			Port Townsend	WA
Mr.	Gil	Whately			Port Townsend	WA
Mr. and Ms.	Helmut and Marcy J.	Golde			Seattle	WA
Drs.	Thomas and Margo	Wyckoff			Seattle	WA
Mr.	Ken	Turner			Quilcene	WA
Ms.	Margaret	Moore			Clinton	WA
Mr.	Joe	Spencer			Seabeck	WA
Mr.	K.	Pederson			Brinnon	WA
Mr.	Frank	Kelly			Port Ludlow	WA
Ms.	Marsha	McMullen			Astoria	OR
Mr.	Peter	Grahn			Bremerton	WA
Mr.	Robert H.	Swarts			Brinnon	WA
Mr.	Randy	Welle			Port Townsend	WA
Mr.	Wally	Lake			Bremerton	WA
Ms.	Larissa	Forseth			Silverdale	WA
	Carey	Wallace			Port Hadlock	WA
Mr.	Adam	James			Lilliwaup	WA
Ms.	Kelly	Smith			Brinnon	WA
Ms.	Nancy	Woodman			Keyport	WA
	D.	Gates			Poulsbo	WA
Mr.	David	Ward			Quilcene	WA
	Bill	Walsh			Westport	WA
Ms.	Mary	Tax			Kingston	WA
Mr.	Mike	O Hare			Keyport	WA
Ms.	Anita	Latch			Belfair	WA
Mr.	Don	Reum			Silverdale	WA
Ms.	Connie	Lovelace			Belfair	WA
Mr. and Mrs.	Charles and Teri	Ward			Quilcene	WA
	George and Reta	Miller			Quilcene	WA
Ms.	Kate	Marsh			Brinnon	WA
Mr.	Bob	Kuehn			Clinton	WA
	W.D.	Jones			Quilcene	WA
Ms.	Kristin	Kennell			Quilcene	WA
	R.S.	Rakhra			Quilcene	WA
Mr.	Larry	Schinke			Quilcene	WA
Mr.	Jack	Fletcher			Quilcene	WA
Mr. and Ms.	Don & lorna	Ward			Quilcene	WA
Ms.	Connie	Ward			Quilcene	WA
Mr.	Tom	Williams			Quilcene	WA
Ms.	Lisa	Pedersen			Seabeck	WA
Mr.	Adam	James			Lilliwamp	WA
Mr.	Mark	Case				
Ms.	Candice	Cosler				
Ms.	Patti	Courtright			Moclips	WA
Mr.	Brooks	Hanford				
Mr. and Ms.	Scott and Kathy	Kaseburg				
Mr.	John	Kennell				
Ms.	Susan	Macfarlane			Port Townsend	WA
Mr.	Barry	McKenna				
Mr.	Greg	Rae				
		Raven				
Ms.	Judith	Rothstein				
Ms.	Johanna	Santer				
Ms.	Carol	Sword				
Ms.	Polly	Thurston			Port Townsend	WA
Ms.	Heather	Verhey			Lilliwaup	WA
Ms.	SC	Walker				
Mr.	Robert	Jackson		Quinault Indian Nation	Seattle	WA
Mr.	Martin	Prehm			Bremerton	WA
Ms.	Mattie	Robbins			Lilliwaup	WA
Mr. and Ms.	Alan and Lee Ann	Hightower		F/V Sea Otter - 560484 Neah Bay, WA	Port Townsend	WA
Ms.	Lynne	Sterling		F/V Sea Otter - 560484 Neah Bay, WA	Port Townsend	WA
Mr.	Dan	Baskins		FHM	Poulsbo	WA
Mr. and Ms.	Glenn and Beverly	Gustavson		FHM	Quilcene	WA
Mr.	John	Adams			Langley	WA

NAVSEA NUWC Keyport Range Extension EIS/OEIS

Master Address List as of April 2008

Salut.	First & Mi.	Last	Title	Organization	City	State
Ms.	Hisei	Akamine			Bremerton	WA
Mr.	Mattie	Ryan			Bremerton	WA
Mr.	Everett E.	Baldwin			Aberdeen	WA
Mr. and Ms.	Rodney and Patty	Barrow			Quilcene	WA
Mr.	Eric	Cederwall			Bainbridge Island	WA
	D.	Chance			Seabeck	WA
Mr.	Ron	Copeland			Brinnon	WA
Mr.	Don	Cramsey			Keyport	WA
Ms.	Trudy	Davis			Port Townsend	WA
Mr.	Jonathan P.	Davis, Ph.D.			Bainbridge Island	WA
Mr.	Noah	Dentzel			Port Townsend	WA
Mr.	Bill	Dentzel			Port Townsend	WA
Mr.	Clyde	Dietz			Ocean Shores	WA
Mr.	Lou D.	Domenico			Brinnon	WA
Mr. and Ms.	Nelson and Danise	Downs			Quilcene	WA
Mr.	Ken	Ward			Quilcene	WA
Ms.	Cheryl	Schroeder	Senior Scientist	Marine Acoustics, Inc.	Arlington	VA
Mr.	Len	Unger			Poulsbo	WA
Ms.	L. Katherine	Baril	Director	SWU - Jefferson County Extension	Port Hadlock	WA
Mr.	R. Sebastian	Eggert			Port Townsend	WA
				Marinas		
				Port of Hoodsport Ingvold Gronvold Park	Hoodsport	WA
				Port of Poulsbo Marina	Poulsbo	WA
Mr.	Ken	Harrington	Commodore	Poulsbo Yacht Club	Poulsbo	WA
Mr.	Jim	Spears		Quilcene Boat Haven	Quilcene	WA
Mr.	Ken	Dressler	Harbormaster	Quilcene Marina	Quilcene	WA
				Rest-A-While Marina	Hoodsport	WA
	Robin	Leraas	Interim Marina Manager	Westport Marina	Westport	WA
Mr.	Donald L.	Larson		Kitsap Diving Association	Bremerton	WA
Mr.	Gary	Nelson	Executive Director	Port of Grays Harbor	Aberdeen	WA
			Port Commissioners	Port of Keyport	Keyport	WA
Mr.	Herb	Beck	Commissioner	Port of Port Townsend	Port Townsend	WA
Mr.	Larry	Crockett	Executive Director	Port of Port Townsend	Port Townsend	WA
Mr.	Bob	Sokol	Commissioner	Port of Port Townsend	Port Townsend	WA
Mr.	Dave	Thompson	Commissioner	Port of Port Townsend	Port Townsend	WA
				Washington Kayak Club	Seattle	WA
				Washington Scuba Alliance	Snoqualmie	WA
Mr.	Reed	Waite	Executive Director	Washington Trollers Association	Westport	WA
Mr.	Reed	Waite	Executive Director	Washington Water Trails Association	Seattle	WA
Mr.	Dan	Kukat	President	Whale Watch Operators Association Northwest	Friday Harbor	WA
				Companies		
Mr.	Anthony J.	Gaspich		Fred Hill Materials, Inc.	Poulsbo	WA
				Gaspich & Williams PLLC	Seattle	WA
Ms.	Deborah S.	Corliss	Outdoor Education and Camp Properties Director	Girl Scouts Totem Council	Seattle	WA
Mr.	Jay	Brevik	Owner	Peninsula Coastal Expeditions	Port Townsend	WA
Mr. and Ms.	Rick and Kathleen	Emmerson		Quilcene Hotel	Quilcene	WA
Ms.	Allison	Turner	Public Involvement Project Manager	Kalz & Associates	Kingston	WA
Mr. and Ms.	Don and Diane	Coleman		Pacific Adventure Charters on Hood Canal	Brinnon	WA

Public Hearing Summary Report

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1.0 INTRODUCTION

Public hearings are an important aspect of the environmental impact analysis process. This document presents a summary of the public hearing meetings for the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS) for the proposed Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension. All comments (written and oral) received during the official comment period (September 12, 2008 through October 27, 2008) were considered and are included in this Final EIS/OEIS (see Appendix G).

2.0 PUBLIC COMMENT PERIOD

The public comment period provided opportunities for government agencies, interest groups, and the general public to express their concerns regarding the analyses conducted in support of the draft EIS/OEIS. A Public Hearing Plan defined how the public hearings would be performed, described the purpose and objective of public hearings, and provided the organization of (meeting format and activities), as well as assigned roles and responsibilities for the hearings. In addition, the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS public hearing support material (draft hearing script, mailing list, fact sheets, comment and registration forms, and newspaper advertisements), meeting dates, and locations were included within the Plan.

Official notification of the NAVSEA NUWC Keyport Range Complex Extension DEIS/OEIS public comment period began with publication of the Notice of Availability (NOA) on September 12, 2008 in the Federal Register. Once this period commenced, the Navy:

- Overnight expressed hard copies and CDs of the draft EIS/OEIS to 11 tribes;
- Mailed hard copies and CDs of the EIS/OEIS to 10 federal agency offices and 11 local repositories (i.e., libraries);
- Mailed CDs to 18 federal, state and local elected officials, 5 Washington state agencies, 5 local agencies and organizations, and 6 interest groups;
- Mailed a CD to 56 individuals who had requested a copy of the draft EIS/OEIS through the scoping process;
- Mailed "Notice of Availability" postcards to all other entities (77 total) indicating when the draft EIS/OEIS was issued, where copies may be obtained and reviewed, the duration of the comment period, where comments may be sent, and the location, date and time of the draft EIS/OEIS public hearings;
- Published Notice of Availability/Notice of Public Hearings in local newspapers;
- Placed the DEIS/OEIS on the project website;
- Conducted 4 public hearings each with an "open house" poster session staffed by Navy subject matter experts, a formal briefing by the Navy, and the opportunity to provide oral and/or written comments (see Sections 3.0 and 4.0 of this Summary);
- Distributed a "fact sheet" brochure at the public hearings that included information on providing comments and a comment sheet to help facilitate public input and feedback;
- Provided a CD to any individual requesting a copy of the DEIS/OEIS at the public hearings; and
- Conducted briefings to support Government-to-Government consultation process and legislative coordination efforts.

3.0 PUBLIC HEARING FORMAT

The public hearing meetings were divided into three sessions. The first session was designed in an "open house" format to create a comfortable atmosphere for attendees—one in which they could dialogue individually with Navy personnel. The second session comprised a formal presentation of the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS analyses. The third session was presided by a hearing officer. In this part of the hearing meeting, the public was invited to provide verbal comments on the Draft EIS/OEIS; everyone was given at least one opportunity to speak and, given enough time, was allowed further opportunities to present their concerns.

Navy representatives welcomed the public at the entrance. The greeters asked attendees to sign-in and indicate on the registration card whether they would like to speak. Handout materials consisting of fact sheet packets were distributed. The public was either escorted or directed to the open-house display area.

Seven displays were presented to inform the public about the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. These were designed to: 1) enhance public understanding of the NEPA process, 2) present the purpose and need and proposed action and alternatives, and 3) illustrate acoustic and non-acoustic effects on marine life and the environment. Following the open-house forum, the Navy's formal presentation began.

After the formal presentation session, the facilitator reviewed the public hearing guidelines and called on individuals who indicated their desire to speak on the registration cards. Public officials were provided the first opportunity to speak. The general public was then called upon in the order in which they submitted their cards. A court reporter recorded the formal presentation and verbal testimony verbatim. All hearings provided ample time for everyone who had registered to speak, as well as the opportunity to speak more than once.

In addition to seeking verbal comments, the Navy provided several other venues for the public to express their concerns. Public hearing attendees could submit written comments they brought with them, complete a comment sheet provided by the Navy, send a letter at their convenience, or comment on the website provided in the fact sheet packet. Attendees chose to submit letters at their convenience; four (4) written comments were received at the hearing meetings.

4.0 PUBLIC HEARING SCHEDULE

The Navy planned public hearing meetings at 4 locations in the state of Washington. The schedule, location, and attendance level for the public hearing meetings are provided in Table 1.

Table 1. Schedule of Meetings and Attendance

Date	*Location*	*Number of Attendees*
October 1, 2008	Keyport, WA Naval Undersea Museum	33
October 2, 2008	Belfair, WA North mason Senior High School	2
October 6, 2008	Pacific Beach, WA Gray’s Harbor Fire District #8	6
October 7, 2008	Quilcene, WA Quilcene Public Schools, Multi-Purpose Room	17

5.0 COMMENT SUMMARY

Table 2 provides the number of attendees and comments received at the public hearing meetings. During the meetings, a total of 58 attended, 7 attendees provided verbal comments, and 4 comment sheets were filled out.

Table 2. Public Hearing Meeting Comment Summary

Meeting Location	*Attended*	*Verbal Comments*	*Written*
Keyport	33	3	4
Belfair	2	0	0
Pacific Beach	6	0	0
Quilcene	17	4	0
TOTAL	**58**	**7**	**4**

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Notice of Public Hearings

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City is the local agency responsible for preparing an Environmental Impact Report in compliance with the California Environmental Quality Act (CEQA).

DATES: The Corps and the City of Folsom will jointly conduct a public scoping meeting that will be held on Thursday, September 25, 2008 from 5 p.m. to 7 p.m.

ADDRESSES: The scoping meeting will be held at the Folsom Public Library located at 411 Stafford Street, Folsom, CA.

FOR FURTHER INFORMATION CONTACT: Ms. Lisa Gibson, (916) 557–5288, e-mail: *lisa.m.gibson2@usace.army.mil.*

SUPPLEMENTARY INFORMATION: Interested parties are invited to submit written comments on the permit application on or before October 1, 2008. Scoping comments should be submitted within the next 60 days, but may be submitted at any time prior to publication of the Draft EIS. To submit comments on this notice or for questions about the proposed action and the Draft EIS, please contact Lisa Gibson, 1325 J Street (Room 1480), Sacramento, CA 95814–2922. Parties interested in being added to the Corps' electronic mail notification list for the proposed project can register at: *http://www.spl.usace.army.mil/regulatory/register.html.* Please refer to Identification Number SPK–2007–02159 in any correspondence.

The South Folsom Property Owners Group consists of seven property owners. Each property owner would file an application for Department of the Army authorization under Section 404 of the Clean Water Act. The City of Folsom has filed a permit application for the proposed project. Because these applications are interrelated, USACE is considering them in a comprehensive and combined manner. The joint purpose of these applications is to construct a large-scale, mixed-use, mixed-density master planned community and associated supporting infrastructure. To comply with the National Environmental Policy Act (NEPA), USACE has decided to prepare an EIS to assess the potential impacts to waters of the United States from these combined applications.

The proposed Folsom South of 50 Specific Plan project site lies within unincorporated Sacramento County, CA, immediately south of the City of Folsom's existing city limits. The site is within the City of Folsom's Sphere of Influence (SOI). It is located south of U.S. Highway 50, north of White Rock Road, east of Prairie City Road, and west of the El Dorado County line.

Preliminary wetland delineations of the project site show that a total of 82.89 acres of waters of the United States are present within the proposed project area, including 4.11 acres of vernal pools, 24.43 acres of seasonal wetland swales, 4.75 acres of seasonal wetlands, 1.25 acre of freshwater marsh, 10.46 acres of freshwater seeps, 7.72 acres of ponds, 17.80 acres of stream channels (relatively permanent waters), 10.43 acres of ephemeral drainage channels (non relatively permanent waters), and 1.93 acres of ditches. The City of Folsom has applied to fill approximately 21.28 acres of these waters to construct the proposed project. These acreages do not include indirect impacts from the proposed action or impacts anticipated to result from off-site infrastructure that may be determined to be required to support the proposed project as part of the EIS process.

The EIS/EIR will include alternatives to the Proposed Action that will meet both NEPA and CEQA requirements. The alternatives will also meet the requirements of CWA Section 404(b)(1) Guidelines. At this time it is expected that the joint EIS/EIR will evaluate the following on-site alternatives: (1) No Action Alternative; (2) Proposed Action; (3) Resource Impact Minimization Alternative; (4) Centralized Development Alternative; (5) Reduced Hillside Development Alternative; (6) No Build Alternative; and at least one off-site alternative.

The Corps' public involvement program includes several opportunities to provide verbal and written comments on the proposed Folsom South of 50 Specific Plan project through the EIS process. Affected federal, state, and local agencies, Native American tribes, and other interested private organizations and parties are invited to participate. Potentially significant issues to be analyzed in depth in the EIS include loss of waters of the United States (including wetlands), and impacts related to cultural resources, biological resources, air quality, hydrology and water quality, noise, traffic, aesthetics, utilities and service systems, and socioeconomic effects.

USACE would initiate formal consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act for the proposed impacts to listed species. USACE would also consult with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act for properties listed or potentially eligible for listing on the National Register of Historic Places, as appropriate.

The joint lead agencies expect the Draft EIS/EIR to be made available to the public in the summer 2009.

Dated: August 22, 2008.

Thomas C. Chapman,

Colonel, U.S. Army, District Engineer.

[FR Doc. E8–21289 Filed 9–11–08; 8:45 am]

BILLING CODE 3710–EH–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Hearings for the Naval Sea Systems Command Naval Undersea Warfare Center, Keyport Range Complex Extension Draft Environmental Impact Statement/Overseas Environmental Impact Statement

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] 4321); the Council on Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508); Department of the Navy Procedures for Implementing NEPA (32 CFR 775); Executive Order (EO)12114, Environmental Effects Abroad of Major Federal Actions; and Department of Defense (DoD) regulations implementing EO 12114 (32 CFR Part 187), the Department of the Navy (Navy) has prepared and filed with the U.S. Environmental Protection Agency a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) on September 3, 2008. The National Marine Fisheries Service (NMFS) is a Cooperating Agency for the EIS/OEIS.

The EIS/OEIS evaluates the potential environmental impacts associated with current and proposed research, development, testing, and evaluation (RDT&E) and related activities scheduled and coordinated by Naval Undersea Warfare Center (NUWC) Keyport at the Naval Sea Systems Command (NAVSEA) NUWC Keyport Range Complex in Washington State. The proposed action includes an extension of the operational areas of the NAVSEA NUWC Keyport Range Complex and small increases in the average annual number of tests and days of testing at two of the three range sites that comprise the Range Complex. A Notice of Intent for this Draft EIS/OEIS was published in the **Federal Register** on September 11, 2003 (68 FR 176).

The Navy will conduct four public hearings to receive oral and written comments on the Draft EIS/OEIS. Federal agencies, state agencies, and local agencies and interested individuals are invited to be present or represented at the public hearings. This notice announces the dates and locations of the public hearings for this Draft EIS/OEIS.

An open house session will precede the scheduled public hearing at each of the locations listed below and will allow individuals to review the information presented in the Draft EIS/OEIS. Navy representatives will be available during the open house sessions to clarify information related to the Draft EIS/OEIS.

DATES AND ADDRESSES: All meetings will start with an open house session from 5 p.m. to 6:30 p.m. A presentation and formal public comment period will be held from 7 p.m. to 9 p.m. Public hearings will be held on the following dates and at the following locations: Wednesday, October 1, 2008, at the Naval Undersea Museum, 610 Dowell Street, Keyport; Thursday, October 2, 2008, at North Mason Senior High School, 200 E. Campus Drive, Belfair; Monday, October 6, 2008, at Gray's Harbor Fire District #8, 4 First Street N., Pacific Beach; and Tuesday, October 7, Quilcene Public Schools, Multi-Purpose Room, 294715 Hwy 101, Quilcene.

FOR FURTHER INFORMATION CONTACT: Naval Facilities Engineering Command, Northwest, *Attention:* Ms. Kimberly Kler (EIS/OEIS PM), 1101 Tautog Circle, Suite 203, Silverdale, WA 98315–1101; *facsimile:* 360–396–0857; or *http://www-keyport.kpt.nuwc.navy.mil.*

SUPPLEMENTARY INFORMATION: The Department of the Navy (Navy) proposes to extend the operational areas associated with the NAVSEA NUWC Keyport Range Complex in Washington State. The Keyport Range Complex is composed of three geographically distinct range sites: The Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and the Quinault Underwater Tracking Range (QUTR) Site. The proposed action would provide additional operating space at each of the three range sites and would also include small increases in the average annual number of tests and days of testing at the Keyport Range Site and the QUTR Site. Portions of the proposed extension associated with the QUTR Site fall outside the 12-nautical mile (nm) (22-kilometer [km]) Territorial Waters established by Presidential Proclamation 5928. Therefore, this Draft EIS/OEIS has also been prepared in accordance with Navy procedures implementing Executive Order 12114 addressing components of the proposed action beyond U.S. Territorial Waters.

The purpose of the proposed action is to enable NUWC Keyport to continue fulfilling its mission of providing test and evaluation services and expertise to support the Navy's evolving manned and unmanned undersea vehicle program. NUWC Keyport has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare. Technological advancements in the materials, instrumentation, guidance systems, and tactical capabilities of manned and unmanned vehicles continue to evolve in parallel with emerging national security priorities and threat assessments. In response, range capabilities and vehicle test protocols must also evolve in order to provide effective program support for such advancements.

The proposed action to extend range operational areas is needed because the existing Range Complex is becoming increasingly incapable of satisfying the existing and evolving operational capabilities and test requirements of next-generation manned and unmanned vehicles. The Navy requires a range complex with assets that provide a broader diversity of sea state conditions, bottom type, deeper water, and increased room to maneuver and combine activities. Extending the Range Complex operating areas as proposed would enable the Navy to better support current and future vehicle test requirements in multiple marine environments.

The proposed action would support current and evolving test requirements and range activities conducted at the NAVSEA NUWC Keyport Range Complex. The action also proposes increases in the average annual number of tests and days of testing at Keyport Range and QUTR Sites. As the three range sites within the NAVSEA NUWC Keyport Range Complex are geographically distinct, the set of alternatives for one range site is independent of the set of alternatives for another range site. One or more action alternatives have been identified for each range site (in addition to the No-Action Alternative):

- *Keyport Range Site:* Keyport Range Alternative 1 (Preferred Alternative)—extend range boundaries to the north, east, and south, increasing the size of the range from 1.5 square nautical miles (nm^2) to 3.2 nm^2 (5.2 square kilometers [km^2] to 11.0 km^2). The average annual days of use would increase from 55 to 60 days.
- *DBRC Site:* DBRC Alternative 1—extend the southern boundary of this range approximately 10 nm (19 km). DBRC Alternative 2 (Preferred Alternative)—extend the southern boundary approximately 10 nm (19 km), and the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge, increasing the size of the range from 32.7 nm^2 to 45.7 nm^2 (112.1 km^2 to 156.7 km^2). There would be no increase in average annual days of use under either DBRC alternative.
- *QUTR Site:* QUTR Alternative 1—extend the range boundaries to coincide with the overlying special use airspace of W–237A plus locate an 8.4 nm^2 (28.8 km^2) surf zone at Kalaloch. The total range area under QUTR Alternative 1 would increase from approximately 48.3 nm^2 (165.5 km^2) to approximately 1,840.4 nm^2 (6,312.4 km^2). QUTR Alternative 2 (Preferred Alternative)—extend the range boundaries the same as Alternative 1 but locate a 7.8 nm^2 (26.6 km^2) surf zone at Pacific Beach instead of at Kalaloch. The total range area under QUTR Alternative 2 would be 1,839.8 nm^2 (6,310.2 km^2). QUTR Alternative 3—extend the range boundaries the same as Alternative 1 but locate a 22.6 nm^2 (77.6 km^2) surf zone at Ocean City instead of at Kalaloch. The total range area under QUTR Alternative 3 would be 1,854.6 nm^2 (6,361.2 km^2). For all three QUTR alternatives, the average annual use for offshore activities would increase from 14 days to 16 days and activities in the selected surf zone would occur an average of 30 days per year.

The Navy considered a number of other alternatives that were potentially able to support the NUWC Keyport mission. These testing alternatives were initially screened and evaluated to determine their ability to meet the minimum operational selection criteria but were eliminated from consideration due to their inconsistency with the mission and strategic vision for NUWC Keyport and with the purpose and need for the Proposed Action. Three additional surf zone alternatives were initially considered but eliminated from consideration because they did not meet the screening criteria for the Proposed Action. Therefore, these alternatives were not carried forward for analysis in the EIS/OEIS.

Section 1502.14(d) of the CEQ guidelines requires that the alternatives analysis in the EIS "include the alternative of no action." In its NEPA's Forty Most Asked Questions, CEQ identifies two distinct interpretations of "no action." The interpretation selected by the action proponent depends on the nature of the proposal being evaluated. One interpretation of the No-Action alternative is that the proposed activity would not take place. This would mean that Navy would not conduct test or training activities in the Range Complex. This interpretation does not meet the purpose and need of the proposed action and would neither be reasonable nor practical. The other interpretation of the No-Action alternative is "no change from current management direction or level of management intensity." This interpretation would meet the purpose and need of the proposed action and would allow the Navy to compare the potential impacts of the proposed action to the impacts of maintaining the status quo. With regard to this EIS/OEIS, the No-Action Alternative represents the regular and historic level of activity on the Range Complex. Thus, the No-Action Alternative serves as a baseline "status quo" when studying levels of range use and activity. In the Draft EIS/OEIS, the potential impacts of the current level of RDT&E and fleet activity on the NAVSEA NUWC Keyport Range Complex (defined by the No-Action Alternative) are compared to the potential impacts of activities proposed under the action alternatives.

The Navy analyzed potential effects of its current and proposed activities on marine mammals, fish, sea turtles, marine flora and invertebrates, terrestrial wildlife, sediments and water quality, cultural resources, recreation, land and shoreline use, public health and safety, socioeconomics and environmental justice, and air quality.

No significant adverse impacts are identified for any resource area in any geographic location within the NAVSEA NUWC Keyport Range Complex Study Area that cannot be mitigated, with the exception of exposure of marine mammals to underwater sound. The Navy has requested from NMFS a Letter of Authorization (LOA) in accordance with the Marine Mammal Protection Act to authorize the incidental take of marine mammals that may result from the implementation of the activities analyzed in the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. In compliance with the Magnuson-Stevens Fisheries Conservation Management Act, the Navy is in consultation with NMFS regarding potential impacts to Essential Fish Habitat. In accordance with section 7 of the Endangered Species Act, the Navy is consulting with NMFS and U.S. Fish and Wildlife Service (USFWS) for potential impacts to federally listed species. The Navy is coordinating with the Washington Department of Ecology for a Coastal Consistency Determination under the Coastal Zone Management Act. Navy analysis has indicated that under the Clean Air Act requirements, no significant impacts would occur to the regional air quality and under the Clean Water Act there would be no significant impacts to water quality. National Historic Preservation Act analysis indicated that no significant impacts to cultural resources would occur if the proposed action or alternatives were implemented. Implementation of the No Action Alternative or any of the proposed action alternatives would not disturb, adversely affect, or result in any takes of bald eagles. None of the alternatives would result in a significant adverse effect on the population of a migratory bird species.

The decision to be made by the Assistant Secretary of the Navy (Installations & Environment) is to determine which alternatives analyzed in the EIS/OEIS best meet the needs of the Navy given that all reasonably foreseeable environmental impacts have been considered.

The Draft EIS/OEIS was distributed to Federal, State, and local agencies, elected officials, and other interested individuals and organizations on September 12, 2008. The public comment period will end on October 27, 2008. Copies of the Draft EIS/OEIS are available for public review at the following libraries:

- Aberdeen Timberland Library, 121 E. Market St., Aberdeen, WA
- Hoodsport Timberland Library, N. 40 Schoolhouse Hill Road, Hoodsport, WA
- Jefferson County Rural Library District, 620 Cedar Avenue, Port Hadlock, WA
- Kitsap Regional Library, 1301 Sylvan Way, Bremerton, WA
- North Mason Timberland Library, 23801 NE State Rt. 3, Belfair, WA
- Ocean Shores Public Library, 573 Pt. Brown Ave., NW., Ocean Shores, WA
- Port Orchard Library, 87 Sidney St., Port Orchard, WA
- Port Townsend Public Library, 1220 Lawrence St., Port Townsend, WA
- Poulsbo Branch Library, 700 NE Lincoln St., Poulsbo, WA
- Quinault Indian Nation Tribal Library, P.O. Box 189, Taholah, WA
- Skokomish Tribal Center, N 80 Tribal Center Road, Shelton, WA

The NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS is also available for electronic public viewing at: *http://www-keyport.kpt.nuwc.navy.mil.* A paper copy of the Executive Summary or a single CD with the Draft EIS/OEIS will be made available upon written request by contacting Naval Facilities Engineering Command, Northwest, Attention: Mrs. Kimberly Kler (EIS/OEIS PM), 1101 Tautog Circle, Suite 203, Silverdale, WA 98315–1101; facsimile: 360–396–0857.

Federal, State, and local agencies and interested parties are invited to be present or represented at the public hearing. Written comments can also be submitted during the open house sessions preceding the public hearings.

Oral statements will be heard and transcribed by a stenographer; however, to ensure the accuracy of the record, all statements should be submitted in writing. All statements, both oral and written, will become part of the public record on the Draft EIS/OEIS and will be responded to in the Final EIS/OEIS. Equal weight will be given to both oral and written statements. In the interest of available time, and to ensure all who wish to give an oral statement have the opportunity to do so, each speaker's comments will be limited to three (3) minutes. If a long statement is to be presented, it should be summarized at the public hearing with the full text submitted either in writing at the hearing, or mailed or faxed to Naval Facilities Engineering Command, Northwest, *Attention:* Mrs. Kimberly Kler (EIS/OEIS PM), 1101 Tautog Circle, Suite 203, Silverdale, WA 98315–1101; *facsimile:* 360–396–0857. In addition, comments may be submitted on-line at *http://www-keyport.kpt.nuwc.navy.mil* during the comment period. All written comments must be postmarked by October 27, 2008 to ensure they become part of the official record. All comments will be addressed in the Final EIS/OEIS.

Dated: September 3, 2008.

T.M. Cruz,

Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–21343 Filed 9–11–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Hearings for the Navy Cherry Point Range Complex Draft Environmental Impact Statement/ Overseas Environmental Impact Statement

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

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Public Hearing Informational Materials

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NAVSEA KEYPORT
Undersea Warfare Center Division

NAVSEA NUWC Keyport Range Extension EIS/OEIS

Public Hearing Informational Materials
October 2008

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NAVSEA NUWC Keyport Range Complex Extension

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

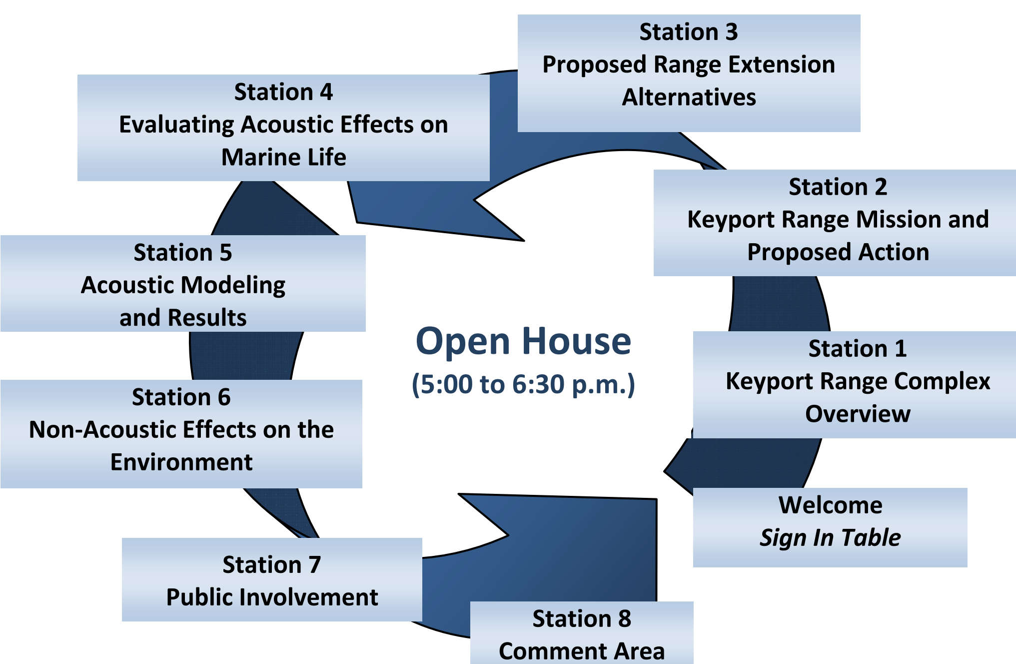
Welcome to the Navy's Public Hearing

The Navy proposes to extend the operational areas associated with the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex in Washington State. The Navy has completed a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate potential impacts of extending three existing range sites to support current and future activities for both manned and unmanned vehicle programs in multiple marine environments.

The Range Complex is composed of: 1) Keyport Range Site in Kitsap County, 2) Dabob Bay Range Complex (DBRC) Site in Kitsap and Jefferson Counties, and 3) Quinault Underwater Tracking Range (QUTR) Site located in the Pacific Ocean off the coast of Jefferson County. Alternatives have been identified for each range site: Keyport Alternative 1; DBRC Alternatives 1 and 2; and QUTR Alternatives 1, 2, and 3. The proposed alternatives extend to Mason and Grays Harbor counties.

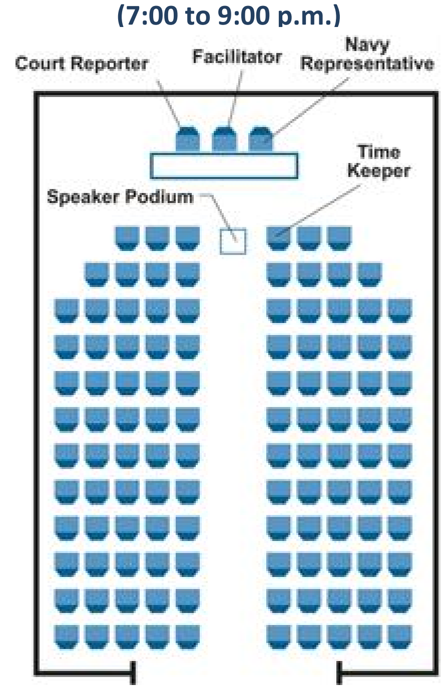
We are here tonight because your community lies within a county that is adjacent to one of the three NAVSEA NUWC Keyport Range Complex sites. The purpose of the hearings is two-fold: first, to provide you with an opportunity to visit the open house stations and review handout materials and posters, informally speak with Navy representatives and subject matter experts about the Draft EIS/OEIS, and submit written comments; and second, following a Navy presentation at 7:00 p.m., to provide an opportunity to have your oral comments on the Draft EIS/OEIS recorded by a court reporter.

Please visit the open house stations and then either place your written comments in the drop box or visit the hearing and publicly present your comments (or both).



Public Hearing

(7:00 to 9:00 p.m.)



Visit our website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

Public Meeting Agenda

Open House—5:00 p.m. to 6:30 p.m.
Break—6:30 p.m. to 7:00 p.m.
Navy Presentation—7:00 p.m. to 7:20 p.m.
Oral Comments—7:20 p.m. to 9:00 p.m.

Commenting Guidelines

- If you wish to provide oral comments, please indicate so on the registration card given to you at the welcome desk.
- Speakers are organized in the following priority:
  - Public/Elected Officials
  - Individuals officially representing state/local government agencies and Tribal organizations
  - Individuals
- Please address your oral comments to the hearing facilitator. This will help ensure your comments are recorded accurately.
- Please limit your comments to the analyses presented within the Draft EIS/OEIS.
- To assist the court reporter, please speak clearly and start your comments with your name and, if applicable, the organization that you represent. Please spell your last name out for the court reporter.
- Comments will be limited to 3 minutes:
  - The 3 minutes will begin after you state your name for the record.
  - After 2 minutes have elapsed, a yellow card will be shown by the timekeeper to indicate you have 1 minute to finish your comment.
  - At the end of 3 minutes, a red card will be shown and you will need to finish your comments.
  - Depending on the number of speakers and the duration of the public hearing, the public hearing facilitator may offer individuals additional time to speak; however, written comments are encouraged to ensure your input is completely received.
- The audience is requested to minimize movement while others are making comments. If you need to leave the room, do so between speakers.
- Depending on the number of commenters, you may be asked to move to a reserved seating area to minimize time between speakers. This ensures that everyone has an opportunity to provide comments.
- The audience is requested to refrain from applause or open remarks during comments, which makes it difficult for the court reporter to hear the speaker and takes time away from that person and subsequent speakers.

Thank you.

The Navy Wants Your Input!

Public involvement is a fundamental part of the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS development and the Navy wants and appreciates your comments.

Comments on the Draft EIS/OEIS will be accepted via mail or the project web site. All comments should be submitted no later than October 27, 2008 to ensure consideration in the Final NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS.

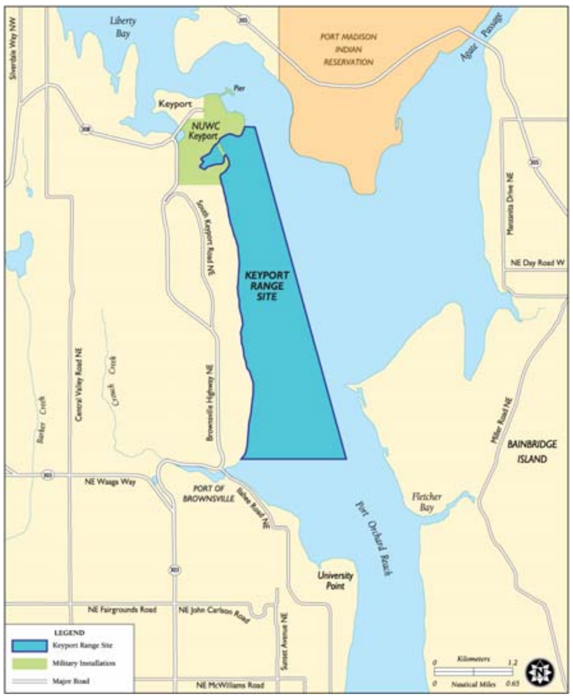
For more information or to submit comments, please contact:

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

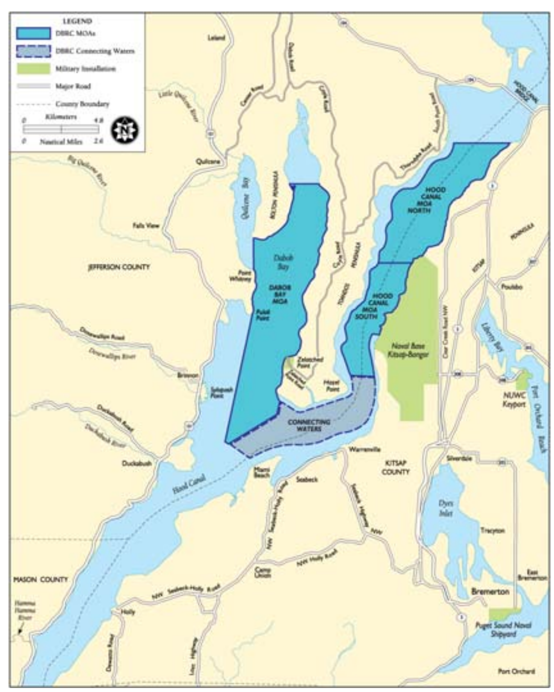
NAVSEA NUWC KEYPORT RANGE COMPLEX

The geographic scope of the Draft EIS/OEIS involves three distinct range sites comprising the NAVSEA NUWC Keyport Range Complex: the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located in Kitsap County and includes portions of Liberty Bay and Port Orchard Reach. The DBRC Site is located in Hood Canal and Dabob Bay, in Jefferson and Kitsap counties. The QUTR Site is located in the Pacific Ocean off the coast of Jefferson County, Washington. Explosive warheads are not placed on test units or tested as part of Keyport activities.



Keyport Range Site

The Navy has conducted underwater testing at the Keyport Range Site since 1914. Located adjacent to NUWC Keyport, this range provides approximately 1.5 square nautical miles (nm^2) (5.1 square kilometers [km^2]) of shallow underwater testing area, including in-shore shallow water sites and a shallow lagoon to support integrated undersea warfare systems and vehicle maintenance, and engineering activities. Water depth at the Keyport Range Site is less than 100 ft (30.5 m). Underwater tracking of test activities is accomplished by using temporary or portable range equipment. The range site also supports: 1) detection, classification, and localization test objectives; and 2) magnetics measurement programs.



DBRC Site

The Navy has conducted underwater testing at the DBRC Site since 1956, beginning with a control center at Whitney Point. The control center was subsequently moved to Zelatched Point. Currently, DBRC Site assets include the Dabob Bay Military Operating Area (MOA), the Hood Canal North and South MOAs adjacent to Naval Base Kitsap-Bangor, and the connecting waters. The total DBRC Site encompasses 32.7 nm^2 (112.1 km^2). The DBRC Site is the Navy's premier location within the U.S. for research, development, test and evaluation (RDT&E) of underwater systems such as Unmanned Undersea Vehicles (UUVs), torpedoes, countermeasures, targets, and ship systems; and is a component of the Department of Defense Major Range Test Facility Base (MRTFB). MRTFB ranges are recognized as critical assets to national defense.

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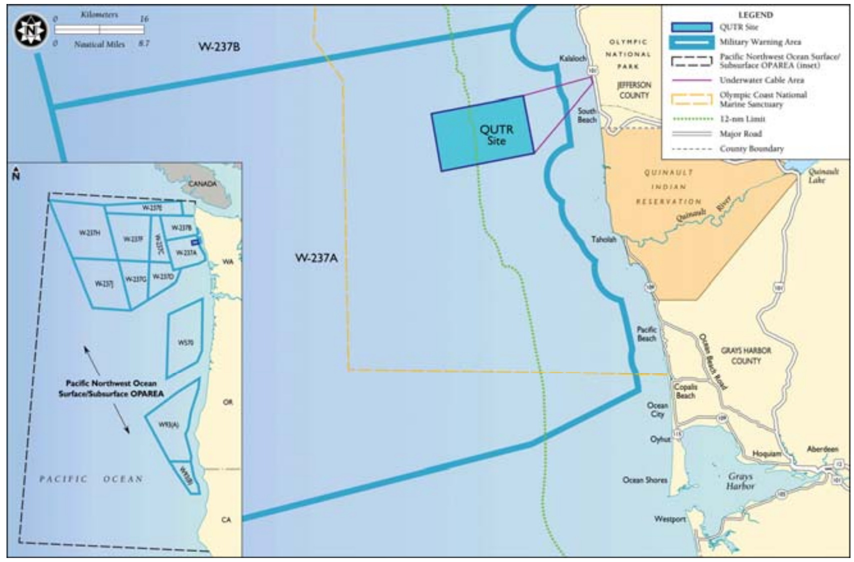
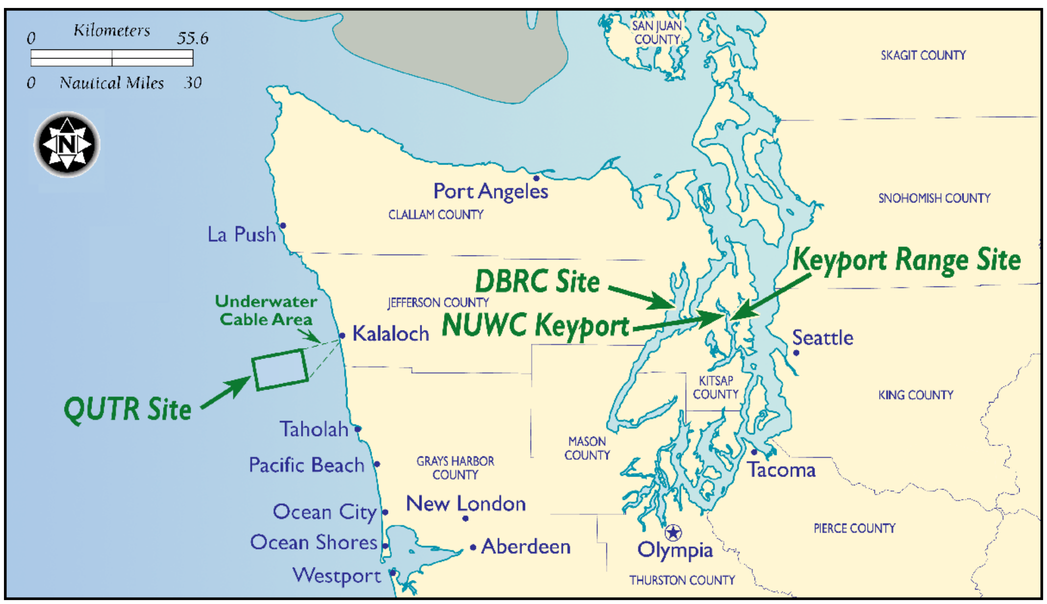
Primary activities at the DBRC Site support proofing of underwater systems, research and development test support, and Fleet training and tactical evaluations involving aircraft, submarines, and surface ships. Test and evaluation of underwater systems, from the first prototype and pre-production stages up through Fleet readiness activities (inception to deployment) ensures reliability and availability. The DBRC Site also supports acoustic/magnetic measurement programs. These programs include underwater vehicle/ship noise/magnetic signature recording, radiated sound investigations, and sonar evaluations. In the course of these activities, various combinations of aircraft, submarines, and surface ships are used as launch platforms. Test equipment may also be launched or deployed from shore off a pier or placed in the water by hand.

QUTR Site

The Navy has conducted underwater testing at the QUTR Site since 1981. The instrumented QUTR Site is a rectangular-shaped test area of about 48.3 nm^2 (165.5 km^2), located approximately 6.5 nm (12 km) off the Pacific Coast at Kalaloch, Washington. Water depth at the QUTR Site is less than 400 ft (122 m). It lies within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS).



NUWC Keyport personnel regularly apply their expertise in vehicle retrieval and recovery as they collect all major test equipment used anywhere within the NAVSEA NUWC Keyport Range Complex. This includes systems under test for post analysis and test equipment requiring maintenance or upgrade. This capability allows unique systems in early development to be tested and expensive equipment to be reused.



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BACKGROUND

The Navy proposes to extend the operational areas associated with the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex in Washington State. The Draft EIS/OEIS addresses potential effects associated with this Proposed Action and alternatives. Portions of the QUTR Site and proposed extension associated with the Range Complex fall outside the 12-nautical mile (nm) (22-kilometer [km]) Territorial Waters established by Presidential Proclamation 5928. Therefore, this Draft document has also been prepared in accordance with Navy procedures implementing Executive Order 12114 to address components of the Proposed Action beyond U.S. Territorial Waters. The Navy is the lead agency for the Draft EIS/OEIS, and the National Marine Fisheries Service (NMFS) is a cooperating agency.

WHY IS THIS NEEDED NOW?

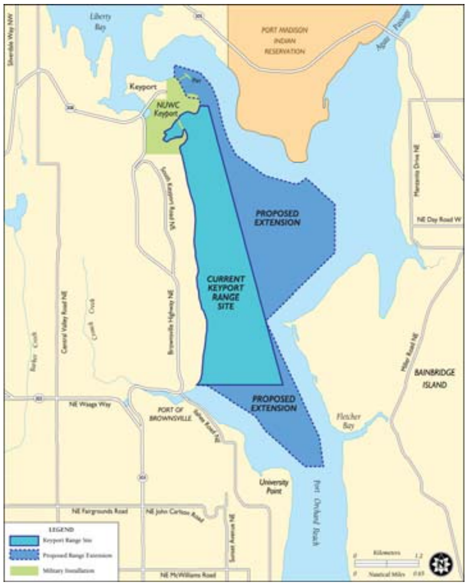
The Proposed Action to extend range operational areas is needed to satisfy evolving technologies and test requirements of next-generation manned and unmanned vehicles. The Navy requires a range complex with assets that provide a broader diversity of sea state conditions, bottom type, water depth, and increased room to maneuver and combine activities. Extending the Range Complex operating areas as proposed would enable the Navy to better support current and future vehicle test requirements in multiple marine environments.

The purpose of the Proposed Action is to enable NUWC Keyport to continue fulfilling its mission of providing evaluation services and expertise to support the Navy's evolving manned and unmanned undersea vehicle program. NUWC Keyport has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare. Technological advancements in the materials, instrumentation, guidance systems, and tactical capabilities of manned and unmanned vehicles continue to evolve in parallel with emerging national security priorities and threat assessments. In response, range capabilities and vehicle test protocols must also evolve in order to provide effective program support for such advancements.

WHAT IS PROPOSED?

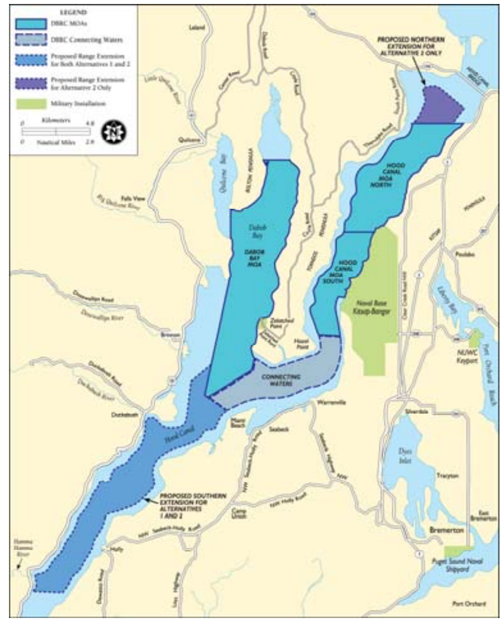
The Proposed Action would provide additional operating space at each of the three range sites in the NAVSEA NUWC Keyport Range Complex to better support current and evolving test requirements and range activities conducted by NUWC Keyport. Extending the operating areas would not increase the size of any permanent instrumented site, and there would be no additional permanent bottom-deployed instrumentation. All bottom-deployed equipment associated with the Proposed Action would be temporary and would be recovered.

The action would also include small increases in the average annual number of days of testing at the Keyport Range Site and the QUTR Site. The Proposed Action and alternatives for each range site analyzed in the Draft EIS/OEIS include:

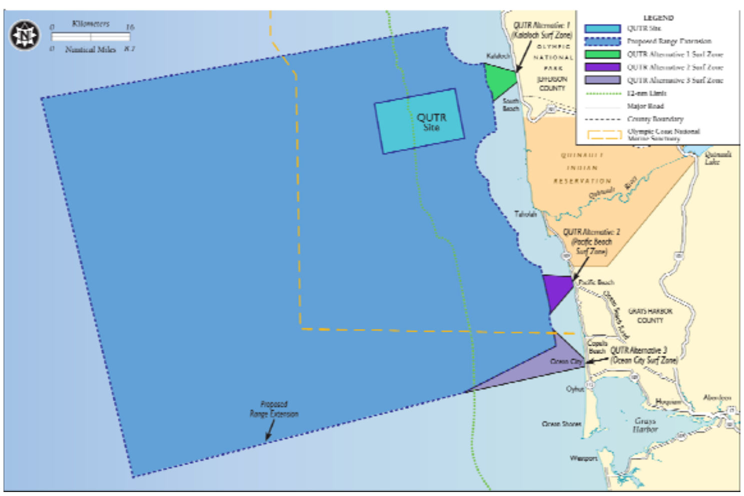


Keyport Range Site: *Keyport Range Alternative 1* (Preferred Alternative) – extend range boundaries to the north, east, and south, increasing the size of the range from 1.5 nm^2 to 3.2 nm^2 (5.2 km^2 to 11.0 km^2). The average annual days of use would increase from 55 to 60 days.

DBRC Site: *DBRC Alternative 1* – extend the southern boundary of this range approximately 10 nm (19 km). *DBRC Alternative 2* (Preferred Alternative) – extend the southern boundary approximately 10 nm (19 km), and the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge, increasing the size of the range from 32.7 nm^2 to 45.7 nm^2 (112.1 km^2 to 156.7 km^2). There would be no increase in average annual days of use under either DBRC alternative.



QUTR Site: *QUTR Alternative 1* – extend the range boundaries to coincide with the overlying special use airspace of W-237A, plus locate an 8.4 nm^2 (28.8 km^2) surf zone at Kalaloch. The total range area under QUTR Alternative 1 would increase from approximately 48.3 nm^2 (165.5 km^2) to approximately 1,840.4 nm^2 (6,312.4 km^2). *QUTR Alternative 2* (Preferred Alternative) – extend the range boundaries the same as Alternative 1 but locate a 7.8 nm^2 (26.6 km^2) surf zone at Pacific Beach instead of at Kalaloch. The total range area under QUTR Alternative 2 would be 1,839.8 nm^2 (6,310.2 km^2). *QUTR Alternative 3* – extend the range boundaries the same as Alternative 1 but locate a 22.6 nm^2 (77.6 km^2) surf zone at Ocean City instead of at Kalaloch. The total range area under QUTR Alternative 3 would be 1,854.6 nm^2 (6,361.2 km^2). For all three alternatives, the average annual use for offshore activities would increase from 14 days to 16 days and activities in the selected surf zone would occur an average of 30 days per year.



The Draft EIS/OEIS also evaluates a No-Action alternative in which Range Complex sites would not be extended and testing activities would remain at their current levels. Implementing the No-Action Alternative for all three range sites would not allow NUWC Keyport to fulfill evolving mission requirements.

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Sound in the Water

The NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS modeled effects of mid- and high-frequency active acoustic sources. In this EIS, low frequency is defined as below 1 kHz, mid frequency is defined as between 1 kHz and 10 kHz, and high frequency is defined as above 10 kHz.

Acoustic sources put sound in the water that could lead to potential physiological effects or behavioral responses in marine animals. As shown on Figure 1, sound radiates outward from the source. In general, the closer an animal is to the source, the louder the sound and greater the potential effect. Sound in the water associated with active acoustic sources disperses or weakens as it moves away from the source, as does the potential for a physiological effect or behavioral response in a marine animal.

The Navy is Committed to Minimizing Potential Effects of Sound in the Water

The Navy takes its environmental stewardship commitment seriously as it assists our nation in defending the U.S. and Allied Forces. The Navy has prepared this Draft EIS/OEIS to assess active acoustic sources used for NAVSEA NUWC Keyport Range Complex activities in Washington State. Navy Fleet activities in the Range Complex assessed in this Draft EIS/OEIS do not include the tactical use of surface ship and submarine hull-mounted sonars. The EIS/OEIS process provides the Navy an opportunity to review and assess its activities, ensuring that the benefits of recent scientific and technological advances are applied toward minimizing environmental effects.

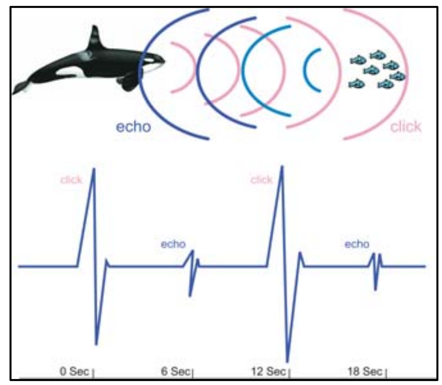

Figure 1

Evaluating the Effects of Sound in the Water

The Navy evaluated potential effects of active acoustic sources on biological resources occurring within the three range sites proposed for extension. Biological resources evaluated include:

- Marine mammals including cetaceans (e.g. orcas and gray whales) and pinnipeds (e.g. harbor seals and California sea lions)
- Fish
- Diving Birds
- Marine invertebrates (e.g. clams, crabs, geoducks)

NUWC Keyport has a long standing history of conducting ranging activities at the sites.

Modeling Potential Exposures to Marine Mammals

The Navy's use of active acoustic sources puts sound into the marine environment. The acoustic model and criteria presented in the Draft EIS/OEIS were developed by the Navy in cooperation with the National Marine Fisheries Service, and represent the best science currently available. Acoustic sources are used by NUWC Keyport for many purposes including underwater communications, underwater detection and tracking, mapping the seabed, torpedo testing and detecting inert mines and obstacles. The tactical use of surface ship and submarine hull-mounted sonars are not part of NUWC Keyport's test activities.

Potential acoustic sources used during test and evaluation activities within the NAVSEA NUWC Keyport Range Complex were examined. The Navy was able to characterize and predict the number of potential marine animal exposures to sound using the general steps summarized below.

- Identify acoustic source parameters
- Determine sound propagation loss
- Calculate the zone of influence
- Determine marine mammal densities
- Predict potential exposures

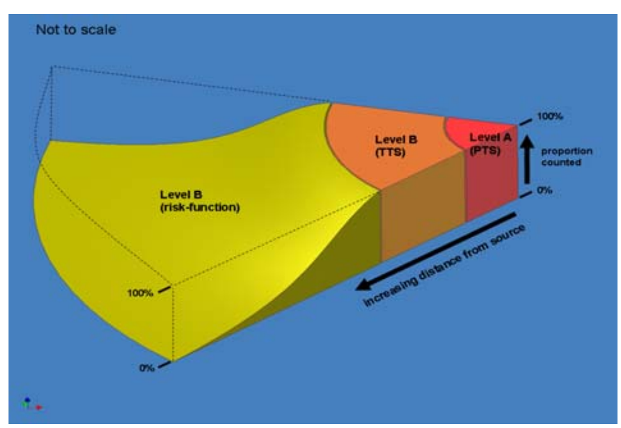

Figure 2

The quietest sound a marine animal can hear at a specific frequency is called the hearing threshold. Sounds above their hearing threshold are accommodated until a certain level of sound intensity or duration is reached. Too much sound exposure might cause a temporary shift in the animal's hearing ability (similar to a rock concert effect on humans). This is referred to as a temporary threshold shift (TTS). When exposure to sound ends, hearing is recovered over time. If the sound exposure further increases, a level can be reached at which the threshold shift will be permanent, called a permanent threshold shift (PTS). Besides a physiological effect, an animal may also react to a sound by changing its behavior. Behavioral reactions may include disruption of social activity, disruption of feeding, moving away from the sound, or stress. Biologically important sounds, such as calls from mates, predators, or prey can also be masked by human-made sounds. How an animal reacts to a sound and the degree of the reaction can vary widely. It depends on the level of sound received and the sensitivity of an individual animal or a particular species. It is shown in Figure 2 that the PTS exposure zone extends from the source out to where the slightest amount of injury is predicted to occur. TTS exposure begins just beyond the point of slightest injury and extends outward from that point to include all animals that may possibly experience TTS. Behavioral responses to sound begin just beyond the point of TTS exposures with decreasing effects on the animal population as distance from the acoustic source increases.

EFFECTS

On all range sites, the model shows no predicted permanent threshold shift for any species.

While the possibility for TTS and some altered behavior is likely from sound in the water, no mortalities to marine mammals from NAVSEA NUWC Keyport Range Complex activities are anticipated. In addition, NUWC Keyport implements range operating procedures to protect and ensure minimal impacts to marine mammals during testing activities at all range sites. In accordance with the Marine Mammal Protection Act (MMPA), the Navy has requested a Letter of Authorization (LOA) regarding Level B exposures. The following tables provide the predicted number of marine mammal acoustic exposures for each range site alternative.

Annual MMPA Exposures for Keyport Range Alternative 1

Species	Level B *Risk Function (Sub TTS Behavioral)*	Level B *TTS*
Cetaceans		
All species	0	0
Pinnipeds		
Harbor seal	109	41

Keyport Range Site. Based on the analysis of potential impacts, there would be no adverse effects to marine mammals listed under the Endangered Species Act (ESA-listed) from active acoustic sources under the Keyport No Action or Alternative 1.

DBRC Site. Based on the analysis of potential impacts, there are over a thousand predicted harassments of harbor seals because they are very common animals. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected.

There would be no adverse effects to marine mammals listed under the Endangered Species Act (ESA-listed) from active acoustic sources under the DBRC No Action, Alternatives 1 or 2.

Annual MMPA Exposures for DBRC Alternative 2

Species	Level B *Risk Function (Sub TTS Behavioral)*	Level B *TTS*
Cetaceans		
All species	0	0
Pinnipeds		
Harbor seal	3320	1998
California Sea lion	109	0

QUTR Site. Based on the analysis of potential impacts, there are over a thousand predicted harassments to harbor porpoises. Although individuals may be temporarily affected, long-term harm or any effects on numbers or distribution of the population are not expected.

There would be no adverse effects to marine mammals listed under the Endangered Species Act (ESA-listed) from active acoustic sources under the QUTR No Action, Alternatives 1, 2, or 3.

Annual MMPA Exposures for all QUTR Alternatives

Species	Level B *Risk Function (Sub TTS Behavioral)*	Level B *TTS*
Cetaceans		
Harbor porpoise	11,282	1
Pinnipeds		
Harbor seal	78	23
Northern elephant seal	14	0
California sea lion	5	0
Northern fur seal	44	0

Fish. Based on previous studies, most fish normally experience only minor or no hearing loss when exposed to continuous sound. While there is a possibility for behavioral effects to occur, the results of the analysis indicate that there would be no significant, adverse impacts to fish populations as a result of NUWC Keyport activities. Furthermore, there would be no adverse effects to fish listed under the Endangered Species Act (including salmon) from active acoustic sources for NAVSEA NUWC Keyport Range Complex activities.

Diving Seabirds and Marine Invertebrates. Effects to seabirds from sound in the water are unlikely. Birds spend a small fraction of time underwater, and there are no data to indicate that seabirds use underwater sound. Although there are only minimal data regarding the hearing capability of marine invertebrates (e.g. clams), most are thought to lack the physical characteristics to be affected by sound.

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EFFECTS FROM EXPENDED MATERIALS

Types of Materials Released during NUWC Keyport Range Complex Extension Activities.

Few expendable materials would be introduced as part of the Proposed Action; however, those that are expended pose a potential hazard to marine mammals from ingestion and entanglement. There are some torpedo launching accessories, sonobuoys, markers, as well as target parts and components that are not recovered and may be encountered by marine mammals. In addition, test activities may use equipment employing guidance wires or fiber-optic cables that introduce the potential for entanglement. These wires are negatively buoyant and sink to the sea floor as they pay out behind the equipment; they sink rapidly and settle.

About 95 percent of the underwater vehicles tested in the Range Complex contain buoyancy systems that allow the vehicles to float to the surface for retrieval upon test completion, and the other 5 percent sink to the bottom and are typically recovered by a Remotely Operated Vehicle (ROV) or a Submerged Object Recovery Device. The ability to recover assets from the sea floor is unique to the NAVSEA NUWC Keyport Range Complex given the specialized retrieval and recovery expertise that has been developed by Keyport range personnel.

NUWC Keyport has procedures in place to ensure we operate safely.

Potential Resource Impacts.

Ingestion. Most marine mammal species feed at the surface, in the water column, or in shallow areas. Consequently, it is unlikely that marine mammals would ingest these materials because large objects are recovered and others would sink to the bottom in deep areas. Species that feed on or near the bottom may encounter expended materials; however, it is unlikely they would ingest the materials as they are dissimilar from natural prey items. Activities within the range site areas would produce few expendable materials, and the likelihood of a marine mammal encountering and ingesting expended material is minimal.

Entanglement. The Navy has analyzed the potential for equipment guide wire entanglement with marine mammals in previous studies and concluded that it would not be significant. In addition, because range activities do not occur when whales are on range, it is unlikely a whale would encounter, or be entangled in, the wire or fiber-optic cable while it is being payed out. Any wire that is recovered in the process of retrieving any range asset such as a tracking array is disposed of on land in accordance with applicable federal and state regulations.

Hydrocarbon-based Materials. During testing activities, a variety of hydrocarbon or other chemical liquids could be accidentally spilled. In the event of an accidental release of fuel oil or other hazardous substance during range activities, contingency plans developed by the Navy are followed that provide instructions on proper spill response action and notification requirements. Therefore, impacts to marine mammals from hazardous materials would be minimal and there would be no effect to ESA-listed species or their critical habitat.

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Other Potentially Toxic Materials. Various markers, sensors, and other materials are expended during test activities with the potential for water and sediment quality degradation from material contaminants as these materials erode. These potential contaminants include lead, copper, aluminum, steel, nylon, various plastics, lithium, zinc, fiberglass, tungsten, and iron. Lead, copper, and other metals are relatively inert, are slowly released into water, or are rapidly diluted.

- Lead corrodes and dissolves slowly in seawater; under oxygenated conditions the rate of dissolution is 8 to 30 microns per year. Under conditions where there is no or minimal oxygen, a layer forms around the lead keeping it from further corrosion.
- Most copper associated with expendable materials is coated copper wire and coated electrical circuitry. The plastic coatings are long-lived in the ocean because of the relatively low temperatures and absence of ultra-violet light. Once the copper is exposed, the corrosion rate is about 50 microns per year. Under conditions where there is no or minimal oxygen, or if the copper is buried in the sediments, it will not be available for ingestion by organisms.
- Zinc corrodes rapidly in seawater and is frequently used in sacrificial anodes and coatings for corrosion protection. Average concentrations of zinc in seawater are less than 10 parts per billion. Zinc is effectively immobilized in sediment as organic and sulphide complexes. Exposed zinc corrodes and rapidly dilutes to background concentrations. Because zinc is unpalatable, it is unlikely to be ingested by marine mammals.
- Sediment and water quality testing in Dabob Bay found that metal concentrations met state water quality criteria and were similar to background levels in other non-urban areas of Puget Sound.

Results of Analysis.
The Draft EIS/OEIS analyses concluded that there would be no impacts to marine mammals and no adverse effects to ESA-listed species or their critical habitat with the release of the small quantities of lead, copper, plastic, or other materials into the proposed extended range sites.

The Navy is Committed to Minimizing Potential Non-Acoustic Effects on the Marine Environment

The Navy takes its commitment to environmental stewardship seriously as it undertakes NUWC Keyport activities. We have prepared the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS to assess NUWC Keyport activities in Washington State waters and outside 12 nm. This analysis process gives the Navy the opportunity to assess its activities to ensure that the benefits of recent scientific and technological advances are applied toward minimizing environmental effects.

EFFECTS FROM VESSEL INTERACTIONS

Activities Potentially Affecting Marine Mammals and ESA-Listed Species.
The Navy evaluated NUWC Keyport activities and how vessels such as unmanned undersea vehicles, test ships/boats, and torpedoes could affect marine mammals; interactions between marine mammals and targets, inert mines, as well as equipment operations were also analyzed. Interactions between vessels involved in NUWC Keyport activities and with fishing (Traditional, private, and commercial) and recreational (personal and tourism) boating interests were also evaluated.

Results of Analysis.
Based on the analysis and the implementation of protective measures, there would be no impacts to marine mammals from vessel interactions during Range Complex activities. As part of its range operations and procedures, NUWC Keyport implements measures to avoid interactions between its vessels and marine mammals. For example, NOAA-trained personnel are posted as lookouts on range craft and at the Range Operations Center during activities to ensure that sensitive marine mammals, such as whales, are protected.

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MINIMIZING POTENTIAL EFFECTS ON THE ENVIRONMENT

NUWC Keyport manages its range sites to meet its current and future requirements while protecting natural and cultural resources and minimizing effects on the environment. As a responsible environmental steward, NUWC Keyport is concerned about the potential effects of its activities on the environment and is committed to complying with all applicable federal laws, regulations and policies.

The Navy is preparing the NAVSEA NUWC Keyport Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential effects of the Proposed Action and alternatives on environmental, cultural and socioeconomic resources in and around the Range Complex. The EIS/OEIS process also provides an opportunity for the Navy to openly review and assess its current and planned activities in a comprehensive manner to ensure that the benefits of operational, scientific, and technological advances are applied toward minimizing effects.

EVALUATING RESOURCES

The natural resources in and around the NAVSEA NUWC Keyport Range Complex are enjoyed by many for their livelihood, recreation, and aesthetics. The waters and coastal areas around the Range Complex are popular for sport fishing, diving, shipwreck exploration and other recreational activities such as boating or kayaking. Navy activities and public recreational activities have coexisted in the Range Complex for decades. The Navy's protective measures for public safety minimize inconveniences to public interests and help ensure continued safe and cooperative coexistence. NUWC Keyport range operators recognize the potential for Navy activities to affect the community and local industries, so they take proactive steps to minimize these effects. As part of preparing this Draft EIS/OEIS, the Navy carefully evaluated potential effects of its current and proposed activities on:

Terrestrial Wildlife: Potential for localized, temporary disturbance of wildlife; no takes of listed species or effects on bald eagles anticipated.

Marine Flora and Invertebrates: Minor benthic habitat disturbance; no impact on eelgrass or invertebrate populations.

Fish: Minor, temporary habitat disturbance but minimal to no effects on any fish populations or Essential Fish Habitat.

Marine Mammals: Collisions, adverse effects of expended materials (e.g., ingestion, entanglement) considered very unlikely, no takes anticipated.

Sediments and Water Quality: Localized, temporary effects due to expended materials would be handled by procedure.

Cultural Resources: No impacts to known archaeological sites or shipwrecks. NUWC Keyport would continue established communication protocols with Tribes.

Recreation, Land and Shoreline Use: Little change to existing conditions. Areas of activity would be temporarily off-limits.

Public Health and Safety: Proposed activities are not inherently dangerous, and pose little risk to the public.

Socioeconomics and Environmental Justice: No change to socioeconomic conditions, no disproportionate effects on minorities.

Air Quality: Pollutant emissions would be below *de minimis* levels.

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The Navy assessed the potential impacts of testing activities including Unmanned Undersea Vehicles (UUVs), torpedoes, and inert mine detection.

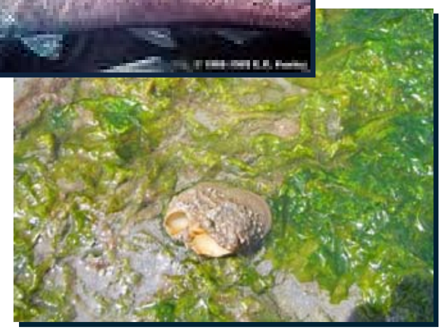
STATUTORY AND REGULATORY COMPLIANCE:

National Environmental Policy Act and EO 12114

The Draft EIS/OEIS prepared in compliance. Draft conclusions are that no long-term or large-scale adverse impacts would occur. Findings and Record of Decision will follow consideration of public input.

Marine Mammal Protection Act

The Navy is consulting with the National Marine Fisheries Service to obtain a Letter of Authorization for anticipated harassment to marine mammals.



Magnuson-Stevens Fisheries Conservation Management Act

The Navy completed an Essential Fish Habitat (EFH) Assessment and concluded that any effects would be minimal and temporary and would not appreciably diminish the quality or quantity of EFH for any managed species.

Endangered Species Act

The Navy is consulting with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service for federally listed species.

Coastal Zone Management Act

The Navy is coordinating with the Washington Department of Ecology for a Coastal Consistency Determination.

Clean Air Act

No impacts to regional air quality are found.

Clean Water Act

Minimal, temporary impacts to water quality may occur.

National Historic Preservation Act

No impacts to cultural resources are found.

Migratory Bird Treaty Act

No adverse effects on migratory bird populations are found.

Bald and Golden Eagle Protection Act

No disturbances to nesting or roosting bald eagles are found.

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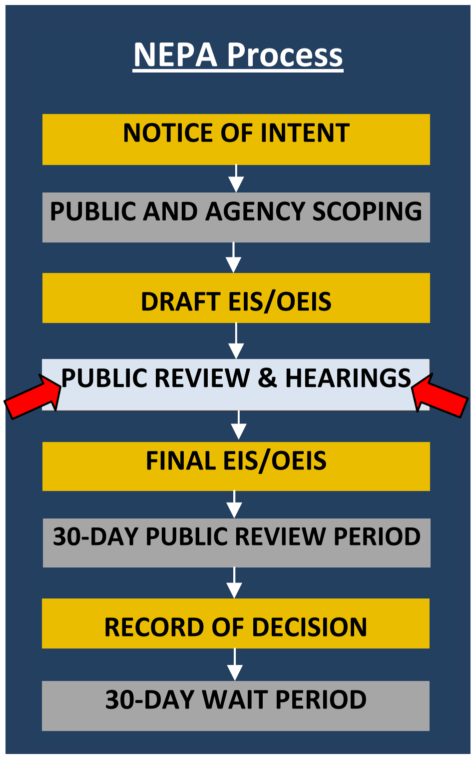
NAVSEA NUWC Keyport Range Complex Extension

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)



Federal Environmental Regulations

Federal regulations govern activities that may affect the environment, including Navy testing and evaluation activities. The Navy complies with applicable environmental regulations, including:

National Environmental Policy Act (NEPA)

NEPA of 1969 established national policies and goals for the protection of the environment. Its procedural requirements direct all Federal agencies to give appropriate consideration to the environmental effects of their decision-making prior to the action taking place and to prepare detailed environmental statements on any action that may significantly affect the quality of the environment.

Executive Order 12114, Environmental Effects Abroad of Major Federal Actions

Enacted by President Carter in 1979, this Executive Order requires Federal agencies to consider the impacts of actions that may affect the environment outside the 12-nautical miles of U.S. Territorial waters.

Marine Mammal Protection Act (MMPA) as amended

MMPA of 1972 prohibits the 'take' of marine mammals in U.S. waters and on land, and by U.S. citizens on the high seas. A 'take' is an action that results in an injury or a disturbance of a marine mammal's critical behavior. The Secretary of Commerce has the authority, upon request, to authorize the unintentional taking of marine mammals incidental to activities. For military readiness activities, the determination of impacts on marine mammal species or stocks includes considerations of "personal safety, practicality of implementation, and impact on the effectiveness of the military readiness activity (National Defense Authorization Act, 2003)."

Endangered Species Act (ESA)

Established in 1973 to preserve the nation's natural heritage by conserving wildlife species, ESA sets out requirements to be followed by Federal agencies with regard to potential impacts of any action on endangered or threatened species and their critical habitat.

National Marine Sanctuaries Act (NMSA)

NMSA authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities as national marine sanctuaries (e.g., Olympic Coast).

Coastal Zone Management Act (CZMA)

As a Federal-State partnership, CZMA provides for the preservation, protection, development, restoration and enhancement of the nation's coastal zone resources.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act provides for the conservation and management of U.S. fishery resources. In 1996, the Act was reauthorized and amended by the Sustainable Fisheries Act to include habitat conservation provisions in the form of "Essential Fish Habitat" designation and protection.

The Navy has prepared the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS to assess the effects of the Navy's current and evolving test requirements and range activities conducted by NUWC Keyport. The NAVSEA NUWC Keyport Range Complex is composed of three distinct range sites: the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The proposal provides for extending the operational areas associated with each of the three range sites and includes small increases in the average annual number of days of testing at the Keyport Range Site and the QUTR Site.

Visit our website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

The NEPA process emphasizes the importance of community involvement during the development of an EIS/OEIS.

Community involvement

The Navy is holding four public hearings on the findings in the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS and to solicit public comment. In addition to holding public hearings, the Navy is consulting with Native American Tribes, Nations, and Councils potentially affected by the Navy proposal. At each public hearing, informational poster stations and Navy project team representatives are available to provide the public with an opportunity to learn more about the NEPA process, the Proposed Action, alternatives, and the Navy's environmental stewardship programs and protective measures. Government agencies, organizations, and the public will have the opportunity to provide oral or written comments at the public hearings or to provide written comments throughout the public review period. The Navy will consider each of the comments received in the NAVSEA NUWC Keyport Range Complex Extension Final EIS/OEIS.

Your involvement is important!

To encourage your input, public hearings for the Draft EIS/OEIS are being held at at four locations in counties potentially affected by the Proposed Action and alternatives.

Wednesday, October 1
Naval Undersea Museum
610 Dowell Street
Keyport, WA 98345

Thursday, October 2
North Mason Sr. High
200 E. Campus Dr.
Belfair, WA 98528

Monday, October 6
Gray's Harbor Fire District #8
4 1st St. N.
Pacific Beach, WA 98571

Tuesday, October 7
Quilcene Public Schools
Multi-Purpose Room
294715 Highway 101
Quilcene, WA 98376

A paper copy of the Draft EIS/OEIS is available for review at local libraries.

You may visit our website to download the environmental documents currently available for review (e.g., the Draft EIS/OEIS). Copies of the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS are also available for review at the following libraries:

Aberdeen Timberland Library, 121 E. Market St., Aberdeen, WA 98520
Hoodsport Timberland Library, 40 N. Schoolhouse Hill Rd., Hoodsport, WA 98548
Jefferson County Rural Library District, 620 Cedar Ave., Port Hadlock, WA 98339
Kitsap Regional Library, 1301 Sylvan Way, Bremerton, WA 98310
North Mason Timberland Library, 23081 NE State Rt. 3, Belfair, WA 98528
Ocean Shores Public Library, P.O. Box 669, Ocean Shores, WA 98569
Port Townsend Public Library, 1220 Lawrence St., Port Townsend, WA 98368
Poulsbo Branch Library, 700 N.E. Lincoln, Poulsbo, WA 98370
Port Orchard Public Library, 87 Sidney Ave., Port Orchard, WA 98366
Quinault Indian Nation Tribal Library, P.O. Box 189, Taholah, WA 98587
Skokomish Tribal Center, N. 80 Tribal Center Road, Shelton, WA 98584

Comments may be submitted several ways.

You may provide your comments in one of the following ways:

- Submit oral and/or written comments at the public hearings,
- Mail comments to the address below, and
- Submit comments electronically at our website.

All comments should be submitted no later than October 27, 2008, for consideration in the NAVSEA NUWC Keyport Range Complex Extension Final EIS/OEIS. The website listed below also serves as a source for background information and links to related environmental topics for those who want to learn more.

The Navy Wants Your Input!

Public involvement is a fundamental part of the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS development and the Navy wants and appreciates your comments.

Comments on the Draft EIS/OEIS will be accepted via mail or the project web site. All comments should be submitted no later than October 27, 2008 to ensure consideration in the Final NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS.

For more information or to submit comments, please contact:

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

NAVSEA NUWC Keyport Range Complex Extension

Public Hearing Comment Sheet

Location:________________________________

Date: __________________________________

NAVSEA KEYPORT Undersea Warfare Center Division

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Public Hearing Comment Sheet

Thank you for providing your comments on the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. Please provide comments no later than October 27, 2008. They may be submitted in the following ways: 1) by filling out this comment sheet and placing it in the drop box provided at each hearing meeting; 2) by providing oral comments at one of the public hearings; and 3) by sending comments via postal service to the address below.

******Please Print—Additional space is provided on back******

1. **Name** ____
2. **Address** ____
3. **Please check here ☐ if you would like to be on the mailing list.**
4. **Please check here ☐ if you would like your name/address kept private.**
5. **Would you like to receive a hard copy ☐ or CD ☐ of the *Final EIS/OEIS*?**

Please Note: Comments will be published in the Final EIS/OEIS. The name, city, and state locations of persons making comments will appear in the Final EIS/OEIS. Specific address information of commenters and meeting attendees will not be printed in the Final EIS/OEIS, but will be used to create a mailing list for the document.

Please give this form to one of the Navy Representatives, place in the drop box, or mail by October 27, 2008 to:

Mrs. Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Visit our website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

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APPENDIX B:
EFFECTS OF MID AND HIGH FREQUENCY SONARS ON FISH

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Effects of Mid- and High-Frequency Sonars on Fish

Arthur N. Popper

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Contract N66604-07M-6056
Naval Undersea Warfare Center Division
Newport, Rhode Island

February 21, 2008

1 - Introduction

The purpose of this Report is to provide an understanding of what is known and not known about the effects of human-generated (anthropogenic) sound on fish, with particular reference to mid- and high-frequency sonars,[1] other high frequency sources, and by explosives, as used by the U.S. Navy during its operations. Since there are few, if any, data on the impacts of these particular signals on fish, it is not possible to have specific answers about possible effects of specific sources of current interest.

Indeed, it should be noted that the data on effects of sound on fish is still very limited, and this is particularly the case with regard to studies that have gone through scientific peer review. There are many more reports and documents, often referred to as "gray literature," that discuss other experiments. However, these have generally not gone through the rigors of scientific peer review, and they only appear as reports and/or on the web. Because of the lack of scientific review, the information presented in gray literature is often open to question with regard to the validity and usefulness of the reported results and conclusions.

In this Report, emphasis will be placed upon peer-reviewed studies in the scientific literature. However, due to the dearth of such studies, a number of gray literature reports will be cited, but in each case, the author of this Report has done his own review of the literature and is reasonably comfortable with the analysis of the data presented.

1.1 Organization of the Report

The first part of this Report provides background on fish hearing and use of sound. This background is needed to set into context how and why human-generated sounds may have an affect on fish. This is followed by a discussion of our current knowledge of the effects of sound on fish, with a review of the literature that is most relevant to the issues of current concern to the Navy. Finally, there is a discussion of potential impacts of specific Navy sources. However, this section is relatively short since, with the exception of mid-frequency sonar, almost nothing is known about the effects of specific sources on fish. While outside of the scope of this report per se, a small section is included that considers effects of human-generated sound on invertebrates since these organisms make up such a large part of the marine ecosystem.

1.2 Fish

Since "fish" encompass by far the largest group of vertebrate animals, it is important to give a brief introduction as to what is meant by "fish" in the context of this Report. The term "fish" generally refers to three groups of vertebrates. These include: (a) the Agnatha or jawless vertebrates; (b) the cartilaginous fishes; and (c) the bony fishes. The Agnatha are a small group of very ancient vertebrates that primarily includes lamprey. It is not clear whether lamprey even

[1] For the purpose of this report, mid frequency is defined as 1-10 kilohertz (kHz) and high frequency as 10-100 kHz.

hear, and it is highly unlikely that they ever are found in significant numbers in areas of any Navy activity. They are not considered in this report, but background on their ear structure (which may only be used for the sense of balance and response to gravity) is provided by Popper and Hoxter (1987).

The cartilaginous fishes, or elasmobranchs, include sharks and rays and their relatives. Virtually nothing is known about effects of human-generated sound on cartilaginous fishes, but there is concern about potential effects since these animals are integral to the ecosystem in many parts of the marine environment. There are also some data, as discussed later in the Report (page 17), that some species will swim towards low-frequency human-generated sounds that resemble the sounds produced by struggling prey.

The bony fishes are the group that most people associate with the term "fish." Bony fishes include most of the species of aquatic vertebrates, including the majority of the species of fish that are consumed by humans.[2] These species are often of considerable economic and ecological concern. Unless otherwise stated, the term "fish" in this Report will refer to bony fish.

2 - Background on Fish Hearing

2.1 How Fish Sense Their Environment

Fishes, like other vertebrates, have a variety of different sensory systems that enable them to glean information from the world around them (see volumes by Atema et al., 1988 and by Collin and Marshall, 2003 for thorough reviews of fish sensory systems). While each of the sensory systems may have some overlap in providing a fish with information about a particular stimulus (e.g., an animal might see and hear a predator), different sensory systems may be most appropriate to serve an animal in a particular situation. Thus, vision is often most useful when a fish is close to the source of the signal, in daylight, and when the water is clear. However, vision does not work well at night, or in deep waters. Chemical signals can be highly specific (e.g., a particular pheromone used to indicate danger). However, chemical signals travel slowly in still water, and diffusion of the chemicals depends upon currents and so chemical signals are not directional and, in many cases, they may diffuse quickly to a non-detectable level. As a consequence, chemical signals may not be effective over long distances.

In contrast, acoustic signals in water travel very rapidly, travel great distances without substantially attenuating (declining in level) in open water, and they are highly directional. Thus, acoustic signals provide the potential for two animals that are some distance apart to communicate quickly (reviewed in Zelick et al., 1999; Popper et al., 2003).

Since sound is potentially such a good source of information, fishes have evolved two sensory systems to detect acoustic signals, and many species use sound for communication (e.g., mating, territorial behavior – see Zelick et al., 1999 for review). The two systems are the ear, for detection of sound above perhaps 20 hertz (Hz) to 1 kHz or more, and the lateral line for

[2] E.g., tuna, salmon, cod, herring, Pollack, and many others.

detection of hydrodynamic signals (water motion) from less than 1 Hz to perhaps 100 or 200 Hz. The inner ear in fish functions very much like the ear found in all other vertebrates, including mammals.[3] The lateral line, in contrast, is only found in fish and a few amphibian (frogs) species. It consists of a series of receptors along the body of the fish. Together, the ear and lateral line are often referred to as the octavolateralis system.

2.2 Sound in Water

The basic physical principles of sound in water are the same as sound in air.[4] Any sound source produces both pressure waves and actual motion of the medium particles. However, whereas in air the actual particle motion attenuates very rapidly and is often inconsequential even a few centimeters from a sound source, particle motion travels (propagates) much further in water due to the much greater density of water than air. One therefore often sees reference to the "acoustic near field" and the "acoustic far field" in the literature on fish hearing, with the former referring to the particle motion component of the sound and the latter the pressure. There is often the misconception that the near field component is only present close to the source. Indeed, all propagating sound in water has both pressure and particle motion components, but after some distance, often defined as the point at a distance of wavelength of the sound divided by 2 pi ($\lambda/2\pi$), the pressure component of the signal dominates, though particle motion is still present and potentially important for fish (e.g., Rogers and Cox, 1988, Kalmijn, 1988, 1989). For a 500 Hz signal, this point is about 0.5 m from the source.[5]

The critical point to note is that fish detect both pressure and particle motion, whereas terrestrial vertebrates generally only detect pressure. Fish directly detect particle motion using the inner ear (see below). Pressure signals, however, are initially detected by the gas-filled swim bladder or other bubble of air in the body.[6] The air bubble then vibrates and therefore serves as a small sound source which "reradiates" (or resends) the signal to the inner ear as a near field particle motion. Note, the ear can only detect particle motion directly, and it needs the air bubble to produce particle motion from the pressure component of the signal.

What follows is that if a fish is able to only detect particle motion, it is most sensitive to sounds when the source is nearby due to the substantial attenuation of the particle motion signal as it propagates away from the sound source. As the signal level gets lower (further from the source), the signal ultimately gets below the minimum level detectable by the ear (the threshold). Fish

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[3] Fish have an inner ear which is very much like the ear in terrestrial vertebrates, though there are many organizational details that are different. Fish do not, however, have, or need, an outer or middle ear since the role of these structures in terrestrial vertebrates is to funnel sound to the ear and overcome the impedance difference between air and the fluids (water) of the inner ear. Since fish live in water, there is no impedance difference to overcome. The most fundamentally important similarity between ears of all vertebrates is that sound is converted (transduced) from mechanical to electrical energy by the sensory hair cells that are common in all vertebrates.
[4] For discussions on underwater sound, see Rogers and Cox 1988; Kalmijn 1988, 1989.
[5] The wavelength of a sound in water is about 1,500 m/sec (it varies depending on salinity, depth, temperature, etc.). The wavelength is defined as 1500/frequency which means for a 500 Hz signal the wavelength is 3 m. For a 100 Hz signal the wavelength is 15 m and the near field transition point would be 15/6.28 = ~2.8 m.
[6] These may be found in the head and they are often very close to the ear. Such bubbles are found in a few species, most notably the fresh water bubble-nest builders (Anabantidae) and elephant-nosed fishes (Mormyridae).

that detect both particle motion and pressure generally are more sensitive to sound than are fish that only detect particle motion. This is the case since the pressure component of the signal attenuates much less over distance than does the particle motion, although both particle motion and pressure are always present in the signal as it propagates from the source.

One very critical difference between particle motion and pressure is that fish pressure signals are not directional. Thus, for fish, as to any observer with a single pressure detector,[7] pressure does not appear to come from any direction (e.g., Popper et al., 2003; Fay, 2005). In contrast, particle motion is highly directional and this is detectable by the ear itself. Accordingly, fish appear to use the particle motion component of a sound field to glean information about sound source direction. This makes particle motion an extremely important signal to fish.

Since both pressure and particle motion are important to fish, it becomes critical that in design of experiments to test the effects of sound on fish (and fish hearing in general), the signal must be understood not only in terms of its pressure levels, but also in terms of the particle motion component. This has not been done in most experiments on effects of human-generated sound to date, with the exception of one study on effects of seismic airguns on fish (Popper et al., 2005).

2.3 What do Fish Hear?

Basic data on hearing provides information about the range of frequencies that a fish can detect, and the lowest sound level that an animal is able to detect at a particular frequency. This level is often called the "threshold.[8]" Sounds that are above threshold are detectable by fish. It therefore follows that if a fish can hear a biologically irrelevant human-generated sound (e.g., sonar, ship noise), such sound might interfere with the ability of fish to detect other biologically relevant signals. In effect, anthropogenic sounds and explosions may affect behavior, and result in short and long-term tissue damage, but only at significantly high levels. Importantly, to date there has been not any experimental determination of an association of such effects from military mid- and high-frequency active sonars.

[7] While fish have two ears, they only have a single pressure receptor – the swim bladder. The energy reradiated from the swim bladder is sent equally to both ears, and so the fish has, in effect, only one pressure receptor. In contrast, the primary mechanism for detection of sound source direction in mammals and many other terrestrial vertebrates in air, where the sound speed is about one-fifth that of water, is to "compare" the signals at the two ears and then use the differences in the signals (e.g., time of arrival, phase, intensity) to "compute" the direction of a sound source.
[8] While the threshold is an important concept, and it is used throughout the literature in measuring the lowest level of a sound or other signal detectable by an animal, it needs to be noted that a threshold is a statistical concept that is based on the lowest value of a signal that is detectable some *percent of the time*. Very often, for fish, hearing thresholds are the lowest levels at which sound is detected 50% of the time. In other words, whereas a fish will detect a particular signal 50% of the time, it will not detect the same signal 50% of the time. Variation in threshold is well known for all animals and for all senses. Variation often reflects momentary changes in the detecting structure, in the motivation of the animal, and innumerable other factors.

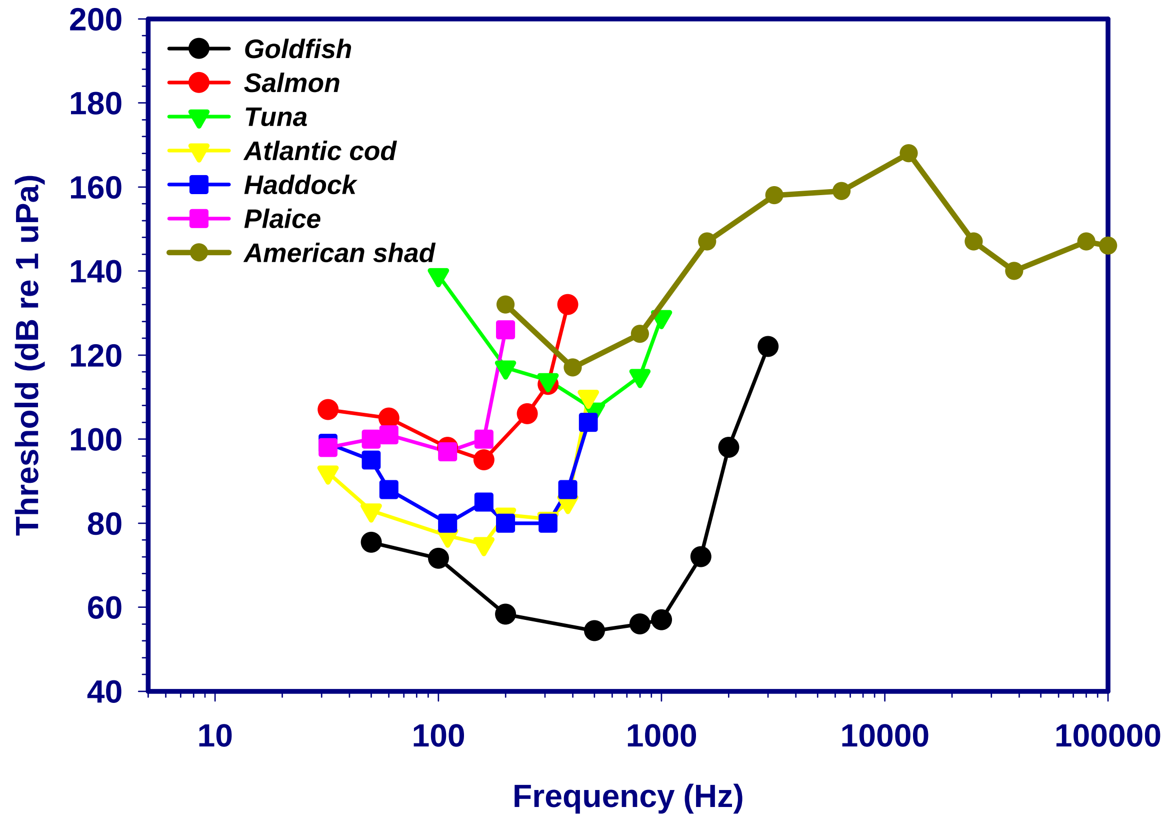

Figure 1: Hearing curves (audiograms) for select teleost fishes (see Fay, 1988 and Nedwell et al., 2004 for data). Goldfish and American shad are species with specializations that enhance hearing sensitivity and/or increase the range of sounds detectable by the animal. The other species are hearing generalists. Most of these data were obtained using methods where fish were conditioned to respond to a sound when it was present. Each data point represents the lowest sound level (threshold) the species could detect at a particular frequency. Data for American shad are truncated at 100 kHz so as to keep the size of the graph reasonable, but it should be noted that this species can hear sounds to at least 180 kHz (Mann et al., 1997). Note that these data represent pressure thresholds, despite the fact that some of the species (e.g., salmon, tuna) are primarily sensitive to the particle motion component of a sound field, something that was not generally measured at the time of the studies.

Hearing thresholds have been determined for perhaps 100 of the more than 29,000[9] living fish species (Fig. 1) (see Fay, 1988; Popper et al., 2003; Ladich and Popper, 2004; Nedwell et al., 2004 for data on hearing thresholds). These studies show that, with few exceptions, fish cannot hear sounds above about 3-4 kHz, and that the majority of species are only able to detect sounds to 1 kHz or even below. In contrast, a healthy young human can detect sounds to about 20 kHz, and dolphins and bats can detect sounds to well over 100 kHz. There have also been studies on a few species of cartilaginous fish, with results suggesting that they detect sounds to no more than 600 or 800 Hz (e.g., Fay, 1988; Casper et al., 2003).

Besides being able to detect sounds, a critical role for hearing is to be able to discriminate between different sounds (e.g., frequency and intensity), detect biologically relevant sounds in

[9] See www.fishbase.org for latest counts.

the presence of background noises, and determine the direction and location of a sound source in the space around the animal. While data are available on these tasks for only a few fish species, all species studied appear to be able to discriminate sounds of different intensities and frequencies (reviewed in Fay and Megela-Simmons, 1999; Popper et al., 2003) and perform sound source localization (reviewed in Popper et al., 2003; Fay, 2005).

Fish are also able to detect signals in the presence of background noise (reviewed in Fay and Megela-Simmons, 1999; Popper et al., 2003). The results of these studies show that fish hearing is affected by the presence of background noise that is in the same general frequency band as the biologically relevant signal. In other words, if a fish has a particular threshold for a biologically relevant sound in a quiet environment, and a background noise that contains energy in the same frequency range is introduced, this will decrease the ability of the fish to detect the biologically relevant signal. In effect, the threshold for the biologically relevant signal will become poorer.

The significance of this finding is that if background noise is increased, such as a result of human-generated sources, it may be harder for a fish to detect the biologically relevant sounds that it needs to survive.

2.4 Sound Detection Mechanisms

While bony and cartilaginous fish have no external structures for hearing, such as the human pinna (outer ear), they do have an inner ear which is similar in structure and function to the inner ear of terrestrial vertebrates. The outer and middle ears of terrestrial vertebrates serve to change the impedance of sound traveling in air to that of the fluids of the inner ear. However, since fishes already live in a fluid environment, there is no need for impedance matching to stimulate the inner ear. At the same time, since the fish ear and body are the same density as water, they will move along with the sound field. While this might result in the fish not detecting the sound, the ear also contains very dense calcareous structures, the otoliths,[10] which move at a different amplitude and phase from the rest of the body. This provides the mechanism by which fish hear.

The ear of a fish has three semicircular canals that are involved in determining the angular movements of the fish. The ear also has three otolith organs, the saccule, lagena, and utricle, that are involved in both determining the position of the fish relative to gravity and detection of sound and information about such sounds. Each of the otolith organs contains an otolith that lies in close proximity to a sensory epithelium.

The sensory epithelium (or macula) in each otolith organ of fish contains mechanoreceptive sensory hair cells that are virtually the same as found in the mechanoreceptive cells of the lateral line (see page 11) and in the inner ear of terrestrial vertebrates. All parts of the ear have the same kind of cell to detect movement, whether it be movement caused by sound or movements of the head relative to gravity.

[10] Cartilaginous fish, some more primitive bony fishes, and all terrestrial vertebrates including humans have otoconia rather than otoliths. Otoconia and otoliths are both made of crystals of calcium carbonate, but whereas these are fused in bony fish into a structure called the otolith, otoconia are smaller masses that lie in a gelatinous matrix.

2.5 Hearing Generalists and Specialists

Very often, fish are referred to as "hearing generalists" (or non-specialists) or "hearing specialists" (e.g., Fay, 1988; Popper et al., 2003; Ladich and Popper, 2004). Hearing generalists generally detect sound to no more than 1 to 1.5 kHz, whereas specialists are generally able to detect sounds to above 1.5 kHz (see Fig. 1, page 8). And, in the frequency range of hearing that the specialists and generalists overlap, the specialists generally have lower thresholds than generalists, meaning that they can detect quieter (lower intensity) sounds. Furthermore, it has often been suggested that generalists only detect the particle motion component of the sound field, whereas the specialists detect both particle motion and pressure (see Popper et al., 2003).

However, while the terms hearing generalist and specialist have been useful, it is now becoming clear that the dichotomy between generalists and specialists is not very distinct. Instead, investigators are now coming to the realization that many species that do not hear particularly well still detect pressure as well as particle motion and pressure. However, these species often have poorer pressure detection than those fishes that have a wider hearing bandwidth and greater sensitivity (see Popper and Schilt, 2008).

It is important to note that hearing specialization is not limited to just a few fish taxa. Instead, there are hearing specialists that have evolved in many very diverse fish groups. Moreover, there are instances where one species hears very well while a very closely related species does not hear well. The only "generalizations" that one can make is that all cartilaginous fish are likely to be hearing generalists, while all otophysan fishes (goldfish, catfish, and relatives) are hearing specialists. It is also likely that bony fish without an air bubble such as a swim bladder (see below) are, like cartilaginous fishes, hearing generalists. These fish include all flatfish, some tuna, and a variety of other taxonomically diverse species.

2.6 Ancillary Structures for Hearing Specializations

All species of fish respond to sound by detecting relative motion between the otoliths and the sensory hair cells. However, many species, and most effectively the hearing specialists, also detect sounds using the air-filled swim bladder in the abdominal cavity. The swim bladder is used for a variety of different functions in fish. It probably evolved as a mechanism to maintain buoyancy in the water column,[11] but later evolved to have multiple functions.

The other two roles of the swim bladder are in sound production and hearing (e.g., Zelick et al., 1999; Popper et al., 2003). In sound production, the air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and serves as a radiator of the sound into the water (see Zelick et al., 1999).

[11] Fish can adjust the volume of gas in the swim bladder and make themselves neutrally buoyant at any depth in the water. In this way, they do not have to expend extra energy to maintain their vertical position.

For hearing, the swim bladder serves to re-radiate sound energy to the ear. This happens since the air in the swim bladder is of a very different density than the rest of the fish body. Thus, in the presence of sound the air starts to vibrate. The vibrating gas re-radiates energy which then stimulates the inner ear by moving the otolith relative to the sensory epithelium. However, in species that have the swim bladder some distance from the ear, any re-radiated sound attenuates a great deal before it reaches the ear. Thus, these species probably do not detect the pressure component of the sound field as well as fish where the swim bladder comes closer to the ear.

In contrast, hearing specialists always have some kind of acoustic coupling between the swim bladder and the inner ear to reduce attenuation and assure that the signal from the swim bladder gets to the ear. In the goldfish and its relatives, the otophysan fishes, there is a series of bones, the Weberian ossicles, which connect the swim bladder to the ear. When the walls of the swim bladder vibrate in a sound field, the ossicles move and carry the sound directly to the inner ear. Removal of the swim bladder in these fish results in a drastic loss of hearing range and sensitivity (reviewed in Popper et al., 2003).

Besides species with Weberian ossicles, other fishes have evolved a number of different strategies to enhance hearing. For example, the swim bladder may have one or two anterior projections that actually contact one of the otolith organs. In this way, the motion of the swim bladder walls directly couples to the inner ear of these species (see discussion in Popper et al., 2003).

2.7 Lateral Line

The lateral line system is a specialized sensory receptor found on the body that enables detection of the hydrodynamic component of a sound field or other water motions relative to the fish (reviewed in Coombs and Montgomery, 1999; Webb et al., 2008). The lateral line is most sensitive to stimuli that occur within a few body lengths of the animal and to signals that are from below 1 Hz to a few hundred Hz (Coombs and Montgomery, 1999; Webb et al., 2008). The lateral line is involved with schooling behavior, where fish swim in a cohesive formation with many other fish and it is also involved with detecting the presence of near-by moving objects, such as food. Finally, the lateral line is an important determinant of current speed and direction, providing useful information to fishes that live in streams or where tidal flows dominate.

The only study on the effect of exposure to sound on the lateral line system suggests no effect on these sensory cells by very intense pure tone signals (Hastings et al., 1996). However, since this study was limited to one (freshwater) species and only to pure tones, extrapolation to other sounds is not warranted and further work needs to be done on any potential lateral line effects on other species and with other types of sounds.

3 - Overview of Fish Hearing Capabilities

3.1 Introduction

Determination of hearing capability has only been done for fewer than 100 of the more than 29,000 fish species (Fay, 1988; Popper et al., 2003; Ladich and Popper, 2004; Nedwell et al., 2004). Much of this data is summarized in Table 1 (page 18) for species of marine fish that have been studied and that could potentially be in areas where sonar or other Navy sound sources might be used. This data set, while very limited, suggests that the majority of marine species are hearing generalists, although it must be kept in mind that there are virtually no data for species that live at great ocean depths and it is possible that such species, living in a lightless environment, may have evolved excellent hearing to help them get an auditory "image" of their environment (e.g., Popper, 1980).

While it is hard to generalize as to which fish taxa are hearing generalists or specialists since specialists have evolved in a wide range of fish taxa (see, for example, Holocentridae and Sciaenidae in Table 1, page 18), there may be some broad generalizations as to hearing capabilities of different groups. For example, it is likely that all, or the vast majority of species in the following groups would have hearing capabilities that would include them as hearing generalists. These include: cartilaginous fishes (Casper et al., 2003; Casper and Mann, 2006; Myrberg, 2001), scorpaeniforms (i.e., scorpionfishes, searobins, sculpins) (Tavolga and Wodinsky, 1963), scombrids (i.e., albacores, bonitos, mackerels, tunas) (Iversen, 1967; Iversen, 1969; Song et al., 2006), and more specifically, midshipman fish (*Porichthys notatus*) (Sisneros and Bass, 2003), Atlantic salmon (*Salmo salar*) (Hawkins and Johnstone, 1978) and other salmonids (e.g., Popper et al., 2007), and all toadfish in the family Batrachoididae (see Table 1 for species).

Marine hearing specialists include some Holocentridae ("soldierfish" and "squirrelfish") (Coombs and Popper, 1979) and some Sciaenidae (drums and croakers) (reviewed in Ramcharitar et al., 2006b) (see Table 1). In addition, all of the clupeids (herrings, shads, alewives, anchovies) are able to detect sounds to over 3 kHz. And, more specifically, members of the clupeid family Alosinae, which includes menhaden and shad, are able to detect sounds to well over 100 kHz (e.g., Enger, 1967; Mann et al., 2001; Mann et al., 2005).

3.2 Variability in Hearing Among Groups of Fish

Hearing capabilities vary considerably between different fish species (Fig. 1, page 8), and there is no clear correlation between hearing capability and environment, even though some investigators (e.g., Amoser and Ladich, 2005) have argued that the level of ambient noise in a particular environment might have some impact on hearing capabilities of a species. However, the evidence for this suggestion is very limited, and there are species that live in close proximity to one another, and which are closely related taxonomically, that have different hearing capabilities. This is widely seen within the family Sciaenidae, where there is broad diversity in hearing capabilities and hearing structures (data reviewed in Ramcharitar et al., 2006b). This is also seen in the family Holocentridae. In this group, the shoulderbar soldierfish (*Myripristis kuntee*) and the Hawaiian squirrelfish (*Sargocentron xantherythrum*) live near one another on the same reefs, yet *Sargocentron* detects sounds from below 100 Hz to about 800 Hz, whereas *Myripristis* is able to detect sounds from 100 Hz to over 3 kHz, and it can hear much lower intensity sounds than can *Sargocentron* (Coombs and Popper, 1979; see also Tavolga and Wodinsky, 1963).

Among all fishes studied to date, perhaps the greatest variability has been found within the economically important family Sciaenidae (i.e., drumfish, weakfish, croaker) where there is extensive diversity in inner ear structure and the relationship between the swim bladder and the inner ear (all data on hearing and sound production in Sciaenidae is reviewed in Ramcharitar et al., 2006b and so it is not reviewed in detail in this Report) (see hearing data in Table 1, page18). Specifically, the Atlantic croaker's (*Micropogonias undulatus*) swim bladder comes near the ear but does not actually touch it. However, the swim bladders in the spot (*Leiostomus xanthurus*) and black drum (*Pogonias cromis*) are further from the ear and lack anterior horns or diverticulae. These differences are associated with variation in both sound production and hearing capabilities (Ramcharitar et al., 2006b). Ramcharitar and Popper (2004) found that the black drum detects sounds from 0.1 to 0.8 kHz and was most sensitive between 0.1 and 0.5 kHz, while the Atlantic croaker detects sounds from 0.1 to 1.0 kHz and was most sensitive at 0.3 kHz. Additionally, Ramcharitar et al. (2006a) found that weakfish (*Cynoscion regalis*) is able to detect frequencies up to 2.0 kHz, while spot can hear only up to 0.7 kHz.

The sciaenid with the greatest hearing sensitivity discovered thus far is the silver perch (*Bairdiella chrysoura*), a species which has auditory thresholds similar to goldfish and which is able to respond to sounds up to 4.0 kHz (Ramcharitar et al., 2004). Silver perch swim bladders have anterior horns that terminate close to the ear.

3.3 Marine Hearing Specialists

The majority of marine fish studied to date are hearing generalists. However, a few species have been shown to have a broad hearing range suggesting that they are specialists. These include some holocentrids and sciaenids, as discussed above. There is also evidence, based on structure of the ear and the relationship between the ear and the swim bladder that at least some deep-sea species, including myctophids, may be hearing specialists (Popper, 1977, 1980), although it has not been possible to do actual measures of hearing on these fish from great depths.

The most significant studies have shown that all herring like fishes (order Clupeiformes) are hearing specialists and able to detect sounds to at least 3 – 4 kHz, and that some members of this order, in the sub-family Alosinae, are able to detect sounds to over 180 kHz (Fig. 1, page 8) (Mann et al. 1997, 1998, 2001, 2005; Gregory and Clabburn, 2003).[12] Significantly, there is evidence that detection of ultrasound (defined by the investigators as sounds over 20 kHz) in these species is mediated through one of the otolithic organs of the inner ear, the utricle (Higgs et al., 2004; Plachta et al., 2004). While there is no evidence from field studies, laboratory data leads to the suggestion that detection of ultrasound probably arose to enable these fish to hear the echolocation sounds of odontocete predators and avoid capture (Mann et al., 1998; Plachta and Popper, 2003). This is supported by field studies showing that several Alosinae clupeids avoid

[12] Wilson and Dill (2002) reported that Pacific herring (*Clupea pallasii*) responded to sounds to 140 kHz. However, Mann et al. (2005) found that they could only detect sound to about 5 kHz (as other non-ultrasound-detecting clupeids).

ultrasonic sources. These include the alewife (*Alosa pseudoharengus*) (Dunning et al., 1992; Ross et al., 1996), blueback herring (*A. aestivalis*) (Nestler et al., 2002), Gulf menhaden (*Brevoortia patronus*) (Mann et al., 2001), and American shad (*A. sapidissima*) (Mann et al. 1997, 1998, 2001). Thus, masking of ultrasound by mid- or high-frequency sonar could potentially affect the ability of these species to avoid predation.

Although few non-clupeid species have been tested for ultrasound (Mann et al., 2001), the only non-clupeid species shown to possibly be able to detect ultrasound is the cod (*Gadus morhua*) (Astrup and Møhl, 1993). However, in Astrup and Møhl's (1993) study it is feasible that the cod was detecting the stimulus using touch receptors that were over driven by very intense fish-finding sonar emissions (Astrup, 1999; Ladich and Popper, 2004). Nevertheless, Astrup and Møhl (1993) indicated that cod have ultrasound thresholds of up to 38 kHz at 185 to 200 dB re 1 μPa-m, which likely only allows for detection of odontocete's clicks at distances no greater than 10 to 30 m (33 to 98 ft) (Astrup, 1999).

Finally, while most otophysan species are freshwater, a few species inhabit marine waters. In the one study of such species, Popper and Tavolga (1981) determined that the hardhead sea catfish (*Ariopsis felis*) was able to detect sounds from 0.05 to 1.0 kHz, which is a narrower frequency range than that common to freshwater otophysans (i.e., above 3.0 kHz) (Popper et al., 2003). However, hearing sensitivity below about 500 Hz was much better in the hardhead sea catfish than in virtually all other hearing specialists studied to date (Table 1; Fay, 1988; Popper et al., 2003).

3.4 Marine Hearing Generalists

As mentioned above, investigations into the hearing ability of marine bony fishes have most often yielded results exhibiting a narrower hearing range and less sensitive hearing than specialists. This was first demonstrated in a variety of marine fishes by Tavolga and Wodinsky (1963), and later demonstrated in taxonomically and ecologically diverse marine species (reviews in Fay, 1988; Popper et al., 2003; Ladich and Popper, 2004).

By examining the morphology of the inner ear of bluefin tuna (*Thunnus thynnus*), Song et al. (2006) hypothesized that this species probably does not detect sounds to much over 1 kHz (if that high). This research concurred with the few other studies conducted on tuna species. Iversen (1967) found that yellowfin tuna (*T. albacares*) can detect sounds from 0.05 to 1.1 kHz, with best sensitivity of 89 dB (re 1 μPa) at 0.5 kHz. Kawakawa (*Euthynnus affinis*) appear to be able to detect sounds from 0.1 to 1.1 kHz but with best sensitivity of 107 dB (re 1 μPa) at 0.5 kHz (Iversen, 1969). Additionally, Popper (1981) looked at the inner ear structure of a skipjack tuna (*Katsuwonus pelamis*) and found it to be typical of a hearing generalist. While only a few species of tuna have been studied, and in a number of fish groups both generalists and specialists exist, it is reasonable to suggest that unless bluefin tuna are exposed to very high intensity sounds from which they cannot swim away, short- and long-term effects may be minimal or non-existent (Song et al., 2006).

Some damselfish have been shown to be able to hear frequencies of up to 2 kHz, with best sensitivity well below 1 kHz. Egner and Mann (2005) found that juvenile sergeant major damselfish (*Abudefduf saxatilis*) were most sensitive to lower frequencies (0.1 to 0.4 kHz), however, larger fish (greater than 50 millimeters) responded to sounds up to 1.6 kHz. Still, the sergeant major damselfish is considered to have poor sensitivity in comparison even to other hearing generalists (Egner and Mann, 2005). Kenyon (1996) studied another marine generalist, the bicolor damselfish (*Stegastes partitus*), and found responses to sounds up to 1.6 kHz with the most sensitive frequency at 0.5 kHz. Further, larval and juvenile Nagasaki damselfish (*Pomacentrus nagasakiensis*) have been found to hear at frequencies between 0.1 and 2 kHz, however, they are most sensitive to frequencies below 0.3 kHz (Wright et al., 2005, 2007). Thus, damselfish appear to be primarily generalists.

Female oyster toadfish (*Opsanus tau*) apparently use the auditory sense to detect and locate vocalizing males during the breeding season (e.g., Winn, 1967). Interestingly, female midshipman fish (*Porichthys notatus*) (in the same family as the oyster toadfish) go through a shift in hearing sensitivity depending on their reproductive status. Reproductive females showed temporal encoding up to 0.34 kHz, while non-reproductive females showed comparable encoding only up to 0.1 kHz (Sisneros and Bass, 2003).

The hearing capability of Atlantic salmon (*Salmo salar*) indicates relatively poor sensitivity to sound (Hawkins and Johnstone, 1978). Laboratory experiments yielded responses only to 580 Hz and only at high sound levels. The Atlantic salmon is considered to be a hearing generalist, and this is probably the case for all other salmonids studied to date based on studies of hearing (e.g., Popper et al., 2007; Wysocki et al., 2007) and inner ear morphology (e.g., Popper, 1976, 1977).

Furthermore, investigations into the inner ear structure of the long-spined bullhead[13] (*Taurulus bubalis*, order Scorpaeniformes) have suggested that these fishes have generalist hearing abilities, and this is supported by their lack of a swim bladder (Lovell et al., 2005). While it is impossible to extrapolate from this species to all members of this large group of taxonomically diverse fishes, studies of hearing in another species in this group, the leopard robin (*Prionotus scitulus*), suggest that it is probably not able to detect sound to much above 800 Hz, indicating that it would be a hearing generalist (Tavolga and Wodinsky, 1963). However, since the leopard sea robin has a swim bladder, and the long-spined bullhead does not, this illustrates the diversity of species in this order and makes extrapolation on hearing from these two fishes to all members of the group very difficult to do.

A number of hearing generalists can detect very low frequencies of sound.[14] Detection of very low frequencies, or infrasound,[15] was not investigated until fairly recently since most laboratory sound sources were unable to produce undistorted tones below 20 to 30 Hz. In addition, most earlier measures of fish hearing indicated a steadily declining sensitivity towards lower frequencies (Fay, 1988), suggesting that fish would not detect low frequencies. However, as has been pointed out in the literature, often the problem with measuring lower frequency hearing

[13] Lovell et al. (2005) refer to this species as the sea scorpion, but the "official" name according to www.fishbase.org is the long-spined bullhead. As pointed out on this web site, common names for the same species often differ throughout the world, making it very hard to compare species. When there is any chance of confusion with common names, the names at this authoritative web site are used.
[14] While most of the infrasound work has been done on marine species, a recent investigation has shown that a freshwater hearing specialist is also able to detect infrasound (Sonny et al., 2006).
[15] There is no specific definition of infrasound, but it is generally considered to be frequencies lower than detectable by humans – often below 30 Hz.

(e.g., below 50 or 100 Hz) was simply that the sound sources available (underwater loud speakers) were not capable of producing lower frequency sounds, or the acoustics of the tanks in which the studies were conducted prevented lower frequency sounds from being effectively used.

Infrasound sensitivity in fish was first demonstrated in the Atlantic cod (*Gadus morhua*) (Sand and Karlsen, 1986). This species can detect sounds down to about 10 Hz and is sensitive to particle motion of the sound field and not to pressure. Other species shown to detect infrasound include the plaice flatfish (*Pleuronectes platessa*) (Karlsen, 1992), and the European eel (*Anguilla anguilla*) (Sand et al., 2000).

The sensitivity of at least some species of fish to infrasound may theoretically provide the animals with a wide range of information about the environment than detection of somewhat higher frequencies. An obvious potential use for this sensitivity is detection of moving objects in the surroundings, where infrasound could be important in, for instance, courtship and prey-predator interactions. Juvenile salmonids display strong avoidance reactions to near-by infrasound (Knudsen et al., 1992, 1994), and it is reasonable to suggest that such behavior has evolved as a protection against predators.

More recently, Sand and Karlsen (2000) proposed the hypothesis that fish may also use the ambient infrasounds in the ocean, which are produced by things like waves, tides, and other large scale motions, for orientation during migration. This would be in the form of an inertial guidance system where the fish detect surface waves and other large scale infrasound motions as part of their system to detect linear acceleration, and in this way migrate long distances.

An important issue with respect to infrasound relates to the distance at which such signals are detected. It is clear that fish can detect such sounds. However, behavioral responses only seem to occur when fish are well within the acoustic near field of the sound source. Thus, it is likely that the responses are to the particle motion component of the infrasound.

3.5 Hearing Capabilities of Elasmobranchs and Other “Fish”

Bony fishes are not the only species that may be impacted by environmental sounds. The two other groups to consider are the jawless fish (Agnatha – lamprey) and the cartilaginous fishes (i.e., elasmobranchs; the sharks and rays). While there are some lamprey in the marine environment, virtually nothing is known as to whether they hear or not. They do have ears, but these are relatively primitive compared to the ears of other vertebrates. No one has investigated whether the ear can detect sound (reviewed in Popper and Hoxter, 1987).

The cartilaginous fishes are important parts of the marine ecosystem and many species are top predators. While there have been some studies on their hearing, these have not been extensive. However, available data suggests detection of sounds from 0.02 to 1 kHz, with best sensitivity at lower ranges (Myrberg, 2001; Casper et al., 2003; Casper and Mann, 2006). Though fewer than 10 elasmobranch species have been tested for hearing thresholds (reviewed in Fay, 1988), it is likely that all elasmobranchs only detect low-frequency sounds because they lack a swim bladder or other pressure detector. At the same time, the ear in a number of elasmobranch species whose hearing has not been tested is very large with numerous sensory hair cells (e.g., Corwin, 1981, 1989). Thus, it is possible that future studies will demonstrate somewhat better hearing in those species than is now known.

There is also evidence that elasmobranchs can detect and respond to human-generated sounds. Myrberg and colleagues did experiments in which they played back sounds and attracted a number of different shark species to the sound source (e.g., Myrberg et al, 1969, 1972, 1976; Nelson and Johnson, 1972). The results of these studies showed that sharks were attracted to pulsed low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey (or divers in the water). However, sharks are not known to be attracted by continuous signals or higher frequencies (which they cannot hear).

3.6 Data on Fish Hearing (Table)

Table 1 provides data on the hearing capabilities of all of the marine fish species that have been studied to date. However, before examining the data in the table, a number of important points must be made.

(1) In order to conform to the most recent taxonomic studies of the species, the table uses current scientific names for a number of species rather than the scientific names used at the time that the research paper was written. Source for names is www.fishbase.org.

(2) The data in the table were primarily compiled by two sources, Fay (1988) and Nedwell et al. (2004). Since the Nedwell et al. (2004) study was not published, the data were checked, where possible, against Fay (1988) or original sources.

(3) The data in the table for "best sensitivity" is only provided to give a sense of where the best hearing was for that species. However, since thresholds are often variable, this information should be used with utmost caution.

(4) It may generally be said that fish with a hearing range that only extends to 1.5 kHz are more likely to be hearing generalists, whereas fish with higher frequency hearing would be considered specialists.

(5) It is critical to note that comparison of the data in the table between species must be done with considerable caution. Most importantly, data were obtained in very different ways for the various species, and it is highly likely that different experimental methods yield different results in terms of range of hearing and in hearing sensitivity. Thus, data obtained using behavioral measures, such as those done by Tavolga and Wodinksy (1963) for a variety of marine fishes provide data in terms of what animals actually detected since the animals were required to do a behavioral task whenever they detected a sound.

In contrast, studies performed using auditory evoked potentials (AEP), often called auditory brainstem response (ABR), a very effective general measure of hearing that is being widely used today,[16] tends, in fishes, to generally provide results that indicate a somewhat narrower hearing range and possibly different sensitivity (thresholds) than obtained using behavioral methods. The difference is that ABR is a measure that does not involve any response on the part of the fish. Instead, ABR is a measure of the brainstem response and does not measure the integrated output of the auditory system (e.g. cortical process, decision making, etc.). Examples of data from ABR studies include the work of Casper et al. (2003) and Ramcharitar et al. (2004, 2006a).

(6) Many of the species, as shown, are hearing generalists and these species respond best primarily to particle motion rather than pressure, as discussed earlier. However, the vast majority of the species were tested with pressure signals and the particle motion signal was not calibrated. Thus, hearing sensitivity data, and hearing range, may be somewhat different if particle motion had been calibrated. Accordingly, while the table gives a general sense of hearing of different species, caution must be taken in extrapolation to other species, and in interpretation of the data.

As a consequence of these differences in techniques, as well as differences in sound fields used and differences in experimental paradigms, one must be extremely cautious in comparing data between different species when they were tested in different ways and/or in different laboratories. While general comparisons are possible (e.g., which species are generalists and which are specialists), more detailed comparisons, such as of thresholds, should be done with utmost caution since one investigator may have been measuring pressure and another particle motion. At the same time, it should be noted that when different species were tested in the same lab, using the same experimental approach, it is possible to make comparative statements about hearing among the species used since all would have been subject to the same sound field.

Table 1. Marine fish hearing sensitivity. Data were compiled from reviews in Fay (1988) and Nedwell et al. (2004). See the very important caveats about the data in the text. For a number of additional species, we can only surmise about hearing capabilities from morphological data. These data are shown in gray, with a suggestion as to hearing capabilities based only on morphology. Scientific names marked with an asterisk have a different name in the literature. The updated names come from www.fishbase.org.

Family	Description of Family	Common Name	Scientific Name	Hearing Range (Hz) Low	Hearing Range (Hz) High	Best Sensitivity (Hz)	Reference
Albulidae	Bonefishes	Bonefish	*Albula vulpes*	100	700	300	Tavolga, 1974a
Anguillidae	Eels	European eel	*Anguilla anguilla*	10	300	40-100	Jerkø et al., 1989
Ariidae	Catfish	Hardhead sea catfish	*Ariopsis felis* [17]	50	1,000	100	Popper and Tavolga, 1981
Batrachoididae	Toadfishes	Midshipman [18]	*Porichthys notatus*	65	385		Sisneros, 2007
		Oyster toadfish	*Opsanus tau*	100	800	200	Fish and Offutt, 1972

[16] Significantly, ABR is used for studies on hearing in groups as diverse as sharks, reptiles, and birds. But, its widest use is probably for a rapid and reliable assessment of hearing in newborn humans in many states in the U.S.
[17] Formerly *Arius felis*
[18] Data obtained using saccular potentials, a method that does not necessarily reveal the full bandwidth of hearing.

Family	Description of Family	Common Name	Scientific Name	Hearing Range (Hz) Low	High	Best Sensitivity (Hz)	Reference
		Gulf toadfish	*Opsanus beta*			<1,000	Remage-Healy et al., 2006
Clupeidae	Herrings, shads, menhaden, sardines	Alewife	*Alosa pseudoharengus*		120+		Dunning et al., 1992
		Blueback herring	*Alosa aestivalis*		120+		Dunning et al., 1992
		American shad	*Alosa sapidissima*	0.1	180	200-800 and 25-150	Mann et al., 1997
		Gulf menhaden	*Brevoortia patronus*		100+		Mann et al., 2001
		Bay anchovy	*Anchoa mitchilli*		4,000		Mann et al., 2001
		Scaled sardine	*Harengula jaguana*		4,000		Mann et al., 2001
		Spanish sardine	*Sardinella aurita*		4,000		Mann et al., 2001
		Pacific herring	*Clupea pallasii*	100	5,000		Mann et al., 2005
Chondrichthyes [Class]	Rays, sharks, skates	Data are for several different species		200	1,000		See Fay, 1988; Casper et al., 2003
Cottidae	Sculpins	Long-spined bullhead	*Taurulus bubalis*				Lovell et al., 2005
Gadidae	Cods, gadiforms, grenadiers, hakes	Atlantic Cod	*Gadus morhua*	2	500	20	Chapman and Hawkins, 1973; Sand and Karlsen, 1986
		Ling	*Molva molva*	60	550	200	Chapman, 1973
		Pollack	*Pollachius pollachius*	40	470	60	Chapman, 1973
		Haddock	*Melanogrammus aeglefinus*	40	470	110-300	Chapman, 1973
Gobidae	Gobies	Black goby	*Gobius niger*	100	800		Dijkgraaf, 1952
Holocentridae	Squirrelfish and soldierfish	Shoulderbar soldierfish	*Myripristis kuntee*	100	3,000	400-500	Coombs and Popper, 1979
		Hawaiian squirrelfish	*Sargocentron xantherythrum*[*]	100	800		Coombs and Popper, 1979
		Squirrelfish	*Holocentrus adscensionis*[*]	100	2,800	600-1,000	Tavolga and Wodinsky, 1963
		Dusky squirrelfish	*Sargocentron vexillarium*[*]	100	1,200	600	Tavolga and Wodinsky, 1963
Labridae	Wrasses	Tautog	*Tautoga onitis*	10	500	37 - 50	Offutt, 1971

Family	Description of Family	Common Name	Scientific Name	Hearing Range (Hz) Low	Hearing Range (Hz) High	Best Sensitivity (Hz)	Reference
		Blue-head wrasse	*Thalassoma bifasciatum*	100	1,300	300 – 600	Tavolga and Wodinksy, 1963
Lutjanidae	Snappers	Schoolmaster snapper	*Lutjanus apodus*	100	1,000	300	Tavolga and Wodinksy, 1963
Myctophidae[19]	Lanternfishes	Warming's lanternfish	*Ceratoscopelus warmingii*	Specialist			Popper, 1977
Pleuronectidae	Flatfish[20]	Dab	*Limanda limanda*	30	270	100	Chapman and Sand, 1974
		European plaice	*Pleuronectes platessa*	30	200	110	
Pomadasyidae	Grunts	Blue striped grunt	*Haemulon sciurus*	100	1,000		Tavolga and Wodinsky, 1963
Pomacentridae	Damselfish[21]	Sergeant major damselfish	*Abudefduf saxatilis*	100	1,600	100-400	Egner and Mann, 2005
		Bicolor damselfish	*Stegastes partitus*	100	1,000	500	Myrberg and Spires, 1980
		Nagasaki damselfish	*Pomacentrus nagasakiensis*	100	2,000	<300	Wright et al., 2005, 2007
		Threespot damselfish	*Stegatus planifrons**	100	1,200	500-600	Myrberg and Spires, 1980
		Longfish damselfish	*Stegatus diencaeus**	100	1,200	500-600	Myrberg and Spires, 1980
		Honey gregory	*Stegatus diencaeus**	100	1,200	500-600	Myrberg and Spires, 1980
		Cocoa damselfish	*Stegatus variabilis**	100	1,200	500	Myrberg and Spires, 1980
		Beaugregory[22]	*Stegatus leucostictus**	100	1,200	500-600	Myrberg and Spires, 1980
		Dusky damselfish	*Stegastes adustus**[23]	100	1,200	400-600	Myrberg and Spires, 1980
Salmonidae	Salmons	Atlantic salmon	*Salmo salar*	<100	580		Hawkins and Johnstone, 1978; Knudsen et al., 1994
Sciaenidae	Drums, weakfish, croakers	Atlantic croaker	*Micropogonias undulatus*	100	1,000	300	Ramcharitar and Popper, 2004

[19] Several other species in this family also showed saccular specializations suggesting that the fish would be a hearing specialist. However, no behavioral or physiological data are available.
[20] Note, data for these species should be expressed in particle motion since it has no swim bladder. See Chapman and Sand, 1974 for discussion.
[21] Formerly all members of this group were *Eupomocentrus*. Some have now been changed to *Stegatus* and are so indicated in this table (as per www.fishbase.org).
[22] Similar results in Tavolga and Wodinsky, 1963.
[23] Formerly *Eupomacentrus dorsopunicans*.

Family	Description of Family	Common Name	Scientific Name	Hearing Range (Hz) Low	High	Best Sensitivity (Hz)	Reference
		Spotted seatrout	*Cynoscion nebulosus*	Generalist			Ramcharitar et al., 2001
		Southern kingcroaker	*Menticirrhus americanus*	Generalist			Ramcharitar et al., 2001
		Spot	*Leiostomus xanthurus*	200	700	400	Ramcharitar et al., 2006a
		Black drum	*Pogonias cromis*	100	800	100-500	Ramcharitar and Popper, 2004
		Weakfish	*Cynoscion regalis*	200	2,000	500	Ramcharitar et al., 2006a
		Silver perch	*Bairdiella chrysoura*	100	4,000	600-800	Ramcharitar et al., 2004
		Cubbyu	*Pareques acuminatus*	100	2,000	400-1,000	Tavolga and Wodinsky, 1963
Scombridae	Albacores, bonitos, mackerels, tunas	Bluefin tuna	*Thunnus thynnus*	Generalist			Song et al., 2006
		Yellowfin tuna	*Thunnus albacares*	500	1,100		Iversen, 1967
		Kawakawa	*Euthynnus affinis*	100	1,100	500	Iversen, 1969
		Skipjack tuna	*Katsuwonus pelamis*	Generalist			Popper, 1977
Serranidae	Seabasses, groupers	Red hind	*Epinephelus guttatus*	100	1,100	200	Tavolga and Wodinsky,1963
Sparidae	Porgies	Pinfish	*Lagodon rhomboides*	100	1,000	300	Tavolga, 1974b
Triglidae	Scorpionfishes, searobins, sculpins	Leopard searobin	*Prionotus scitulus*	100	~800	390	Tavolga and Wodinsky, 1963

4 - Effects of Human-Generated Sound on Fish

4.1 Introduction

There have been very few studies on the effects that human-generated sound may have on fish. These have been reviewed in a number of places (e.g., NRC, 1994, 2003; Popper, 2003; Popper et al., 2004; Hastings and Popper, 2005), and some more recent experimental studies have provided additional insight into the issues (e.g., Govoni et al., 2003; McCauley et al., 2003; Popper et al., 2005, 2007; Song et al., submitted). Most investigations, however, have been in the gray literature (non peer-reviewed reports – see Hastings and Popper, 2005 for an extensive critical review of this material). While some of these studies provide insight into effects of sound on fish, as mentioned earlier in this Report, the majority of the gray literature studies often lack appropriate controls, statistical rigor, and/or expert analysis of the results.

There are a wide range of potential effects on fish that range from no effect at all (e.g., the fish does not detect the sound or it “ignores” the sound) to immediate mortality. In between these extremes are a range of potential effects that parallel the potential effects on marine mammals that were illustrated by Richardson et al. (1995). These include, but may not be limited to:

a. No effect behaviorally or physiologically: The animal may not detect the signal, or the signal is not one that would elicit any response from the fish.
b. Small and inconsequential behavioral effects: Fish may show a temporary “awareness” of the presence of the sound but soon return to normal activities.
c. Behavioral changes that result in the fish moving from its current site: This may involve leaving a feeding or breeding ground. This affect may be temporary, in that the fish return to the site after some period of time (perhaps after a period of acclimation or when the sound terminates), or permanent.
d. Temporary loss of hearing (often called Temporary Threshold Shift – TTS): This recovers over minutes, hours, or days.
e. Physical damage to auditory or non-auditory tissues (e.g., swim bladder, blood vessels, brain): The damage may be only temporary, and the tissue “heals” with little impact on fish survival, or it may be more long-term, permanent, or may result in death. Death from physical damage could be a direct effect of the tissue damage or the result of the fish being more subject to predation than a healthy individual.

Studies on effects on hearing have generally been of two types. In one set of studies, the investigators exposed fish to long-term increases in background noise to determine if there are changes in hearing, growth, or survival of the fish. Such studies were directed at developing some understanding of how fish might be affected if they lived in an area with constant and increasing shipping or in the presence of a wind farm, or in areas where there are long-term acoustic tests. Other similar environments might be aquaculture facilities or large marine aquaria. In most of these studies examining long-term exposure, the sound intensity was well below any that might be expected to have immediate damage to fish (e.g., damage tissues such as the swim bladder or blood vessels).

In the second type of studies, fish were exposed to short duration but high intensity signals such as might be found near a high intensity sonar, pile driving, or seismic airgun survey. The investigators in such studies were examining whether there was not only hearing loss and other long-term effects, but also short-term effects that could result in death to the exposed fish.

4.2 Effects of Long-Duration Increases in Background Sounds on Fish

Effects of long-duration relatively low intensity sounds (e.g., below 170 – 180 dB re 1 μPa received level ([RL]) indicate that there is little or no effect of long-term exposure on hearing generalists (e.g., Scholik and Yan, 2001; Amoser and Ladich, 2003; Smith et al., 2004a,b; Wysocki et al., 2007). The longest of these studies exposed young rainbow trout (*Oncorhynchus mykiss*), to a level of noise equivalent to one that fish would experience in an aquaculture facility (e.g., on the order of 150 dB re 1 μPa RL) for about nine months. The investigators found no effect on hearing or on any other measures including growth and effects on the immune system as compared to fish raised at 110 dB re 1 μPa RL. The sound level used in the study would be equivalent to ambient sound in the same environment without the presence of pumps and other noise sources of an aquaculture facility (Wysocki et al., 2007).

Studies on hearing specialists have shown that there is some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., Scholik and Yan, 2002; Smith et al., 2004b, 2006). Smith et al. (2004a, 2006) investigated the goldfish (*Carassius auratus*). They exposed fish to noise at 170 dB re 1 μPa and there was a clear relationship between the level of the exposure sound and the amount of hearing loss. There was also a direct correlation of level of hearing loss and the duration of exposure, up to 24-hours, after which time the maximum hearing loss was found.

Similarly, Wysocki and Ladich (2005) investigated the influence of noise exposure on the auditory sensitivity of two freshwater hearing specialists, the goldfish and the lined Raphael catfish (*Platydoras costatus*), and on a freshwater hearing generalist, a sunfish (*Lepomis gibbosus*). Baseline thresholds showed greatest hearing sensitivity around 0.5 kHz in the goldfish and catfish and at 0.1 kHz in the sunfish. For the hearing specialists (goldfish and catfish), continuous white noise of 130 dB re 1 μPa RL resulted in a significant threshold shift of 23 to 44 dB. In contrast, the auditory thresholds in the hearing generalist (sunfish) declined by 7 to 11 dB.

In summary, and while data are limited to a few freshwater species, it appears that some increase in ambient noise level, even to above 170 dB re 1 μPa does not permanently alter the hearing ability of the hearing generalist species studied, even if the increase in sound level is for an extended period of time. However, this may not be the case for all hearing generalists, though it is likely that any temporary hearing loss in such species would be considerably less than for specialists receiving the same noise exposure. But, it is critical to note that more extensive data are needed on additional species, and if there are places where the ambient levels exceed 170 – 180 dB, it would be important to do a quantitative study of effects of long-term sound exposure at these levels.

It is also clear that there is a larger temporary hearing loss in hearing specialists. Again, however, extrapolation from the few freshwater species to other species (freshwater or marine) must be done with caution until there are data for a wider range of species, and especially species with other types of hearing specializations than those found in the species studied to date (all of which are otophysan fishes and have the same specializations to enhance hearing).

4.3 Effects of High Intensity Sounds on Fish

There is a small group of studies that discusses effects of high intensity sound on fish. However, as discussed in Hastings and Popper (2005), much of this literature has not been peer reviewed, and there are substantial issues with regard to the actual effects of these sounds on fish. More recently, however, there have been two studies of the effects of high intensity sound on fish that, using experimental approaches, provided insight into overall effects of these sounds on hearing and on auditory and non-auditory tissues. One study tested effects of seismic airguns, a highly impulsive and intense sound source, while the other study examined the effects of SURTASS LFA sonar. Since these studies are the first that examined effects on hearing and physiology, they will be discussed in some detail. These studies not only provide important data, but also suggest ways in which future experiments need to be conducted. This discussion will be followed by a brief overview of other studies that have been done, some of which may provide a small degree of insight into potential effects of human-generated sound on fish.

4.3.1 Effects of Seismic Airguns on Fish

Popper et al. (2005; Song et al., submitted) examined the effects of exposure to a seismic airgun array on three species of fish found in the Mackenzie River Delta near Inuvik, Northwest Territories, Canada. The species included a hearing specialist, the lake chub (*Couesius plumbeus*), and two hearing generalists, the northern pike (*Esox lucius*), and the broad whitefish (*Coregonus nasus*) (a salmonid). In this study, fish in cages were exposed to 5 or 20 shots from a 730 in^3 (12,000 cc) calibrated airgun array. And, unlike earlier studies, the received exposure levels were not only determined for RMS sound pressure level, but also for peak sound levels and for SELs (e.g., average mean peak SPL 207 dB re 1 μPa RL; mean RMS sound level 197 dB re 1 μPa RL; mean SEL 177 dB re 1 $\mu Pa^2 s$).

The results showed a temporary hearing loss for both lake chub and northern pike, but not for the broad whitefish, to both 5 and 20 airgun shots. Hearing loss was on the order of 20 to 25 dB at some frequencies for both the northern pike and lake chub, and full recovery of hearing took place within 18 hours after sound exposure. While a full pathological study was not conducted, fish of all three species survived the sound exposure and were alive more than 24 hours after exposure. Those fish of all three species had intact swim bladders and there was no apparent external or internal damage to other body tissues (e.g., no bleeding or grossly damaged tissues), although it is important to note that the observer in this case (unlike in the following LFA study) was not a trained pathologist. Recent examination of the ear tissues by an expert pathologist showed no damage to sensory hair cells in any of the fish exposed to sound (Song et al., submitted).

A critical result of this study was that it demonstrated differences in the effects of airguns on the hearing thresholds of different species. In effect, these results substantiate the argument made by Hastings et al. (1996) and McCauley et al. (2003) that it is difficult to extrapolate between species with regard to the effects of intense sounds.

4.3.2 Effects of SURTASS LFA Sonar on Fish

Popper et al. (2007) studied the effect of SURTASS LFA on hearing, the structure of the ear, and select non-auditory systems in the rainbow trout (*Oncorhynchus mykiss*) and channel catfish (*Ictalurus punctatus*) (also Halvorsen et al., 2006).

The SURTASS LFA sonar study was conducted in an acoustic free-field environment that enabled the investigators to have a calibrated sound source and to monitor the sound field throughout the experiments. In brief, experimental fish were placed in a test tank, lowered to depth, and exposed to LFA sonar for 324 or 648 seconds, an exposure duration that is far greater than any fish in the wild would get since, in the wild, the sound source is on a vessel moving past the far slower swimming fish. For a single tone, the maximum RL was approximately 193 dB re 1 μPa at 196 Hz and the level was uniform within the test tank to within approximately ±3 dB. The signals were produced by a single SURTASS LFA sonar transmitter giving an approximate source level of 215 dB. Following exposure, hearing was measured in the test animals. Animals were also sacrificed for examination of auditory and non-auditory tissues to determine any non-hearing effects. All results from experimental animals were compared to results obtained from baseline control and control animals.

A number of results came from this study. Most importantly, no fish died as a result of exposure to the experimental source signals. Fish all appeared healthy and active until they were sacrificed or returned to the fish farm from which they were purchased. In addition, the study employed the expertise of an expert fish pathologist who used double-blind methods to analyze the tissues of the fish exposed to the sonar source, and compared these to control animals. The results clearly showed that there were no pathological effects from sound exposure including no effects on all major body tissues (brain, swim bladder, heart, liver, gonads, blood, etc.). There was no damage to the swim bladder and no bleeding as a result of LFA sonar exposure. Furthermore, there were no short- or long-term effects on ear tissue (Popper et al., 2007 for figures; also Kane et al., in prep.).

Moreover, behavior of caged fish after sound exposure was no different than that prior to tests. It is critical to note, however, that behavior of fish in a cage in no way suggests anything about how fish would respond to a comparable signal in the wild. Just as the behavior of humans exposed to a noxious stimulus might show different behavior if in a closed room as compared to being out-of-doors, it is likely that the behaviors shown by fish to stimuli will also differ, depending upon their environment.

The study also incorporated effects of sound exposure on hearing both immediately post exposure and for several days thereafter to determine if there were any long-term effects, or if hearing loss showed up at some point post exposure. Catfish and some specimens of rainbow trout showed 10-20 dB of hearing loss immediately after exposure to the LFA sonar when compared to baseline and control animals; however another group of rainbow trout showed no hearing loss. Recovery in trout took at least 48 hours, but studies could not be completed. The different results between rainbow trout groups is difficult to understand, but may be due to developmental or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours.

4.3.3 Additional Sonar Data

While there are no other data on the effects of sonar on fish, there are two recent unpublished reports of some relevance since it examined the effects on fish of a mid-frequency sonar (1.5 to

6.5 kHz) on larval and juvenile fish of several species (Jørgensen et al., 2005; Kvadsheim and Sevaldsen, 2005). In this study, larval and juvenile fish were exposed to simulated sonar signals in order to investigate potential effects on survival, development, and behavior. The study used herring (*Clupea harengus*) (standard lengths 2 to 5 cm), Atlantic cod (*Gadus morhua*) (standard length 2 and 6 cm), saithe (*Pollachius virens*) (4 cm), and spotted wolffish (*Anarhichas minor*) (4 cm) at different developmental stages.

Fish were placed in plastic bags 3 m from the sonar source and exposed to between four and 100 pulses of 1-second duration of pure tones at 1.5, 4 and 6.5 kHz. Sound levels at the location of the fish ranged from 150 to 189 dB. There were no effects on fish behavior during or after exposure to sound (other than some startle or panic movements by herring for sounds at 1.5 kHz) and there were no effects on behavior, growth (length and weight), or survival of fish kept as long as 34 days post exposure. All exposed animals were compared to controls that received similar treatment except for actual exposure to the sound. Excellent pathology of internal organs showed no damage as a result of sound exposure. The only exception to almost full survival was exposure of two groups of herring tested with sound pressure levels (SPLs) of 189 dB, where there was a post-exposure mortality of 20 to 30 percent. While these were statistically significant losses, it is important to note that this sound level was only tested once and so it is not known if this increased mortality was due to the level of the test signal or to other unknown factors.

In a follow-up unpublished analysis of these data, Kvadsheim and Sevaldsen (2005) sought to understand whether the mid-frequency continuous wave (CW) signals used by Jørgensen et al. (2005) would have a significant impact on larvae and juveniles in the wild exposed to this sonar. The investigators concluded that the extent of damage/death induced by the sonar would be below the level of loss of larval and juvenile fish from natural causes, and so no concerns should be raised. The only issue they did suggest needs to be considered is when the CW signal is at the resonance frequency of the swim bladders of small clupeids. If this is the case, the investigators predict (based on minimal data that is in need of replication) that such sounds might increase the mortality of small clupeids that have swim bladders that would resonate.

4.3.4 Other High Intensity Sources

A number of other sources have been examined for potential effects on fish. These have been critically and thoroughly reviewed recently by Hastings and Popper (2005) and so only brief mention will be made of a number of such studies.

One of the sources of most concern is pile driving, as occurs during the building of bridges, piers, off-shore wind farms, and the like. There have been a number of studies that suggest that the sounds from pile driving, and particularly from driving of larger piles, kill fish that are very close to the source. The source levels in such cases often exceed 230 dB re 1 μPa (peak) and there is some evidence of tissue damage accompanying exposure (e.g., Caltrans, 2001, 2004; reviewed in Hastings and Popper, 2005). However, there is reason for concern in analysis of such data since, in many cases the only dead fish that were observed were those that came to the surface. It is not clear whether fish that did not come to the surface survived the exposure to the sounds, or died and were carried away by currents.

There are also a number of gray literature experimental studies that placed fish in cages at different distances from the pile driving operations and attempted to measure mortality and tissue damage as a result of sound exposure. However, in most cases the studies' (e.g., Caltrans, 2001, 2004; Abbott et al., 2002, 2005; Nedwell et al., 2003) work was done with few or no controls, and the behavioral and histopathological observations done very crudely (the exception being Abbott et al., 2005). As a consequence of these limited and unpublished data, it is not possible to know the real effects of pile driving on fish.

In a widely cited unpublished report, Turnpenny et al. (1994) examined the behavior of three species of fish in a pool in response to different sounds. While this report has been cited repeatedly as being the basis for concern about the effects of human-generated sound on fish, there are substantial issues with the work that make the results unusable for helping understand the potential effects of any sound on fish, including mid- and high-frequency sounds. The problem with this study is that there was a complete lack of calibration of the sound field at different frequencies and depths in the test tank, as discussed in detail in Hastings and Popper (2005). The issue is that in enclosed chambers that have an interface with air, such as tanks and pools used by Turnpenny et al., the sound field is known to be very complex and will change significantly with frequency and depth. Thus, it is impossible to know the stimulus that was actually received by the fish. Moreover, the work done by Turnpenny et al. was not replicated by the investigators even within the study, and so it is not known if the results were artifact, or were a consequence of some uncalibrated aspects of the sound field that cannot be related, in any way, to human-generated high intensity sounds in the field, at any frequency range.

Several additional studies have examined effects of high intensity sounds on the ear. While there was no effect on ear tissue in either the SURTASS LFA study (Popper et al., 2007) or the study of effects of seismic airguns on hearing (Popper et al., 2005; Song et al., submitted), three earlier studies suggested that there may be some loss of sensory hair cells due to high intensity sources. However, none of these studies concurrently investigated effects on hearing or non-auditory tissues. Enger (1981) showed some loss of sensory cells after exposure to pure tones in the Atlantic cod. A similar result was shown for the lagena of the oscar (*Astronotus oscellatus*), a cichlid fish, after an hour of continuous exposure (Hastings et al., 1996). In neither study was the hair cell loss more than a relatively small percent of the total sensory hair cells in the hearing organs.

Most recently, McCauley et al. (2003) showed loss of a small percent of sensory hair cells in the saccule (the only end organ studied) of the pink snapper (*Pagrus auratus*), and this loss continued to increase (but never to become a major proportion of sensory cells) for up to at least 53 days post exposure. It is not known if this hair cell loss, or the ones in the Atlantic cod or oscar, would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in each otolithic organ (Popper and Hoxter, 1984; Lombarte and Popper, 1994) and only a small portion were affected by the sound. The question remains as to why McCauley et al. (2003) found damage to sensory hair cells while Popper et al. (2005) did not. The problem is that there are so many differences in the studies, including species, precise sound source, spectrum of the sound (the Popper et al. 2005 study was in relatively shallow water with poor low-frequency propagation), that it is hard to even speculate.

Beyond these studies, there have also been questions raised as to the effects of other sound sources such as shipping, wind farm operations, and the like. However, there are limited or no data on actual effects of the sounds produced by these sources on any aspect of fish biology.

4.3.4 Intraspecific Variation in Effects

One unexpected finding in several of the recent studies is that there appears to be variation in the effects of sound, and on hearing, that may be a correlated with environment, developmental history, or even genetics.

During the aforementioned LFA sonar study on rainbow trout, Popper et al. (2007) found that some fish showed a hearing loss, but other animals, obtained a year later but from the same supplier and handled precisely as the fish used in the earlier part of the study, showed no hearing loss. The conclusion reached by Popper et al. (2007) was that the differences in responses may have been related to differences in genetic stock or some aspect of early development in the two groups of fish studied.

The idea of a developmental effect was strengthened by findings of Wysocki et al. (2007) who found differences in hearing sensitivity of rainbow trout that were from the same genetic stock, but that were treated slightly differently in the egg stage. This is further supported by studies on hatchery-reared Chinook salmon (*Oncorhynchus tshawytscha*) which showed that some animals from the same stock and age class had statistical differences in their hearing capabilities that was statistically correlated with differences in otolith structure (Oxman et al., 2007). While a clear correlation could not be made between these differences in otolith structure and specific factors, there is strong reason to believe that the differences resulted from environmental effects during development.

The conclusion one must reach from these findings is that there is not only variation in effects of intense sound sources on different species, but that there may also be differences based on genetics or development. Indeed, one can go even further and suggest that there may ultimately be differences in effects of sound on fish (or lack of effects) that are related to fish age as well as development and genetics since it was shown by Popper et al. (2005) that identical seismic airgun exposures had very different effects on hearing in young-of-the-year northern pike and sexually mature animals.

4.4 Effects of Anthropogenic Sound on Behavior

There have been very few studies of the effects of anthropogenic sounds on the behavior of wild (unrestrained) fishes. This includes not only immediate effects on fish that are close to the source but also effects on fish that are further from the source.

Several studies have demonstrated that human-generated sounds may affect the behavior of at least a few species of fish. Engås et al. (1996) and Engås and Løkkeborg (2002) examined movement of fish during and after a seismic airgun study although they were not able to actually observe the behavior of fish per se. Instead, they measured catch rate of haddock and Atlantic cod as an indicator of fish behavior. These investigators found that there was a significant decline in catch rate of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) that lasted for several days after termination of airgun use. Catch rate subsequently returned to normal. The conclusion reached by the investigators was that the decline in catch rate resulted from the fish moving away from the fishing site as a result of the airgun sounds. However, the investigators did not actually observe behavior, and it is possible that the fish just changed depth. Another alternative explanation is that the airguns actually killed the fish in the area, and the return to normal catch rate occurred because of other fish entering the fishing areas.

More recent work from the same group (Slotte et al., 2004) showed parallel results for several additional pelagic species including blue whiting and Norwegian spring spawning herring.[24] However, unlike earlier studies from this group, Slotte et al. used fishing sonar to observe behavior of the local fish schools. They reported that fishes in the area of the airguns appeared to go to greater depths after the airgun exposure compared to their vertical position prior to the airgun usage. Moreover, the abundance of animals 30-50 km away from the ensonification increased, suggesting that migrating fish would not enter the zone of seismic activity. It should be pointed out that the results of these studies have been refuted by Gausland (2003) who, in a non peer-reviewed study, suggested that catch decline was from factors other than exposure to airguns and that the data were not statistically different than the normal variation in catch rates over several seasons.

Similarly Skalski et al. (1992) showed a 52% decrease in rockfish (*Sebastes* sp.) catch when the area of catch was exposed to a single airgun emission at 186-191 dB re 1 µPa (mean peak level) (see also Pearson et al., 1987, 1992). They also demonstrated that fishes would show a startle response to sounds as low as 160 dB, but this level of sound did not appear to elicit decline in catch.

Wardle et al. (2001) used a video system to examine the behaviors of fish and invertebrates on a coral reef in response to emissions from seismic airguns that were carefully calibrated and measured to have a peak level of 210 dB re 1 µPa at 16 m from the source and 195 dB re 1 µPa at 109 m from the source. They found no substantial or permanent changes in the behavior of the fish or invertebrates on the reef throughout the course of the study, and no animals appeared to leave the reef. There was no indication of any observed damage to the animals.

Culik et al. (2001) and Gearin et al. (2000) studied how noise may affect fish behavior by looking at the effects of mid-frequency sound produced by acoustic devices designed to deter marine mammals from gillnet fisheries. Gearin et al. (2000) studied responses of adult sockeye salmon (*Oncorhynchus nerka*) and sturgeon (*Acipenser* sp.) to pinger sounds. They found that fish did not exhibit any reaction or behavior change to the onset of the sounds of pingers that produced broadband energy with peaks at 2 kHz or 20 kHz. This demonstrated that the alarm was either inaudible to the salmon and sturgeon, or that neither species was disturbed by the mid-

[24] Scientific names for neither species was given in publication.

frequency sound (Gearin et al., 2000). Based on hearing threshold data (Table 1), it is highly likely that the salmonids did not hear the sounds.[25]

Culik et al. (2001) did a very limited number of experiments to determine catch rate of herring (*Clupea harengus*) in the presence of pingers producing sounds that overlapped the frequency range of hearing of herring (2.7 kHz to over 160 kHz[26]). They found no change in catch rate in gill nets with or without the higher frequency (> 20 kHz) sounds present, although there was an *increase* in catch rate with the signals from 2.7 kHz to 19 kHz (a different source than the higher frequency source). The results could mean that the fish did not "pay attention" to the higher frequency sound or that they did not hear it, but that lower frequency sounds may be attractive to fish. At the same time, it should be noted that there were no behavioral observations on the fish, and so how the fish actually responded when they detected the sound is not known.

4.5 Masking

Any sound detectable by a fish can have an impact on behavior by preventing the fish from hearing biologically important sounds including those produced by prey or predators (Myrberg, 1980; Popper et al., 2003). This inability to perceive biologically relevant sounds as a result of the presence of other sounds is called masking. Masking may take place whenever the received level of a signal *heard by an animal* exceeds ambient noise levels or the hearing threshold of the animal. Masking is found among all vertebrate groups, and the auditory system in all vertebrates, including fishes, is capable of limiting the effects of masking signals, especially when they are in a different frequency range than the signal of biological relevance (Fay, 1988; Fay and Megela-Simmons, 1999).

One of the problems with existing fish masking data is that the bulk of the studies have been done with goldfish, a freshwater hearing specialist. The data on other species are much less extensive. As a result, less is known about masking in non-specialist and marine species. Tavolga (1974a, b) studied the effects of noise on pure-tone detection in two non-specialists and found that the masking effect was generally a linear function of masking level, independent of frequency. In addition, Buerkle (1968, 1969) studied five frequency bandwidths for Atlantic cod in the 20 to 340 Hz region and showed masking in all hearing ranges. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean have masking effects in cod, haddock, and Pollock, and similar results were suggested for several sciaenid species by Ramcharitar and Popper (2004). Thus, based on limited data, it appears that for fish, as for mammals, masking may be most problematic in the frequency region of the signal of the masker. Thus, for mid-frequency sonars, which are well outside the range of hearing of most all fish species, there is little likelihood of masking taking place for biologically relevant signals to fish since the fish will not hear the masker.

There have been a few field studies which may suggest that masking could have an impact on wild fish. Gannon et al. (2005) showed that bottlenose dolphins (*Tursiops truncatus*) move

[25] Unpublished work in the laboratory of the author of this Report also indicates that these sounds are undetectable by sturgeon.
[26] Two different devices were used, one with a range of 2.7 to 19 kHz and another with a range of 20 to 160 kHz.

toward acoustic playbacks of the vocalization of Gulf toadfish (*Opsanus beta*). Bottlenose dolphins employ a variety of vocalizations during social communication including low-frequency pops. Toadfish may be able to best detect the low-frequency pops since their hearing is best below 1 kHz, and there is some indication that toadfish have reduced levels of calling when bottlenose dolphins approach (Remage-Healey et al., 2006). Silver perch have also been shown to decrease calls when exposed to playbacks of dolphin whistles mixed with other biological sounds (Luczkovich et al., 2000). Results of the Luczkovich et al. (2000) study, however, must be viewed with caution because it is not clear what sound may have elicited the silver perch response (Ramcharitar et al., 2006a).

Of considerable concern is that human-generated sounds could mask the ability of fish to use communication sounds, especially when the fish are communicating over some distance. In effect, the masking sound may limit the distance over which fish can communicate, thereby having an impact on important components of the behavior of fish. For example, the sciaenids, which are primarily inshore species, are probably the most active sound producers among fish, and the sounds produced by males are used to "call" females to breeding sights (Ramcharitar et al., 2001; reviewed in Ramcharitar et al., 2006a). If the females are not able to hear the reproductive sounds of the males, this could have a significant impact on the reproductive success of a population of sciaenids.

Also potentially vulnerable to masking is navigation by larval fish, although the data to support such an idea are still exceedingly limited. There is indication that larvae of some species may have the potential to navigate to juvenile and adult habitat by listening for sounds emitted from a reef (either due to animal sounds or non-biological sources such as surf action) (e.g., Higgs, 2005). In a study of an Australian reef system, the sound signature emitted from fish choruses was between 0.8 and 1.6 kHz (Cato, 1978) and could be detected by hydrophones 5 to 8 km (3 to 4 NM) from the reef (McCauley and Cato, 2000). This bandwidth is within the detectable bandwidth of adults and larvae of the few species of reef fish that have been studied (Kenyon, 1996; Myrberg, 1980). At the same time, it has not been demonstrated conclusively that sound, or sound alone, is an attractant of larval fish to a reef, and the number of species tested has been very limited. Moreover, there is also evidence that larval fish may be using other kinds of sensory cues, such as chemical signals, instead of, or alongside of, sound (e.g., Atema et al., 2002; Higgs et al., 2005).

Finally, it should be noted that even if a masker prevents a larval (or any) fish from hearing biologically relevant sounds for a short period of time (e.g., while a sonar-emitting ship is passing), this may have no biological effect on the fish since they would be able to detect the relevant sounds before and after the masking, and thus would likely be able to find the source of the sounds.

4.6 Stress

Although an increase in background sound may cause stress in humans,[27] there have been few studies on fish (e.g., Smith et al., 2004a; Remage-Healey et al., 2006; Wysocki et al., 2006, 2007). There is some indication of physiological effects on fish such as a change in hormone levels and altered behavior in some (Pickering, 1981; Smith et al., 2004a, b), but not all, species tested to date (e.g., Wysocki et al., 2007). Sverdrup et al., 1994 found that Atlantic salmon subjected to up to 10 explosions to simulate seismic blasts released primary stress hormones, adrenaline and cortisol, as a biochemical response. There was no mortality. All experimental subjects returned to their normal physiological levels within 72 hours of exposure. Since stress affects human health, it seems reasonable that stress from loud sound may impact fish health, but available information is too limited to adequately address the issue.

4.7 Eggs and Larvae

One additional area of concern is whether high intensity sounds may have an impact on eggs and larvae of fish. Eggs and larvae do not move very much and so must be considered as a stationary object with regard to a moving navy sound source. Thus, the time for impact of sound is relatively small since there is no movement relative to the navy vessel.

There have been few studies on effects of sound on eggs and larvae (reviewed extensively in Hastings and Popper, 2005) and there are no definitive conclusions to be reached. At the same time, many of the studies have used non-acoustic mechanical signals such as dropping the eggs and larvae or subjecting them to explosions (e.g., Jensen and Alderice 1983, 1989; Dwyer et al., 1993). Other studies have placed the eggs and/or larvae in very small chambers (e.g., Banner and Hyatt, 1973) where the acoustics are not suitable for comparison with what might happen in a free sound field (and even in the small chambers, results are highly equivocal).

Several studies did examine effects of sounds on fish eggs and larvae. One non peer-reviewed study using sounds from 115-140 dB (re 1 µPa, peak) on eggs and embryos in Lake Pend Oreille (Idaho) reported normal survival or hatching, but few data were provided to evaluate the results (Bennett et al., 1994). In another study, Kostyuchenko (1973) reported damage to eggs of several marine species at up to 20 m from a source designed to mimic seismic airguns, but few data were given as to effects. Similarly, Booman et al. (1996) investigated the effects of seismic airguns on eggs, larvae, and fry and found significant mortality in several different marine species (Atlantic cod, saithe, herring) at a variety of ages, but only when the specimens were within about 5 m of the source. The most substantial effects were to fish that were within 1.4 m of the source. While the authors suggested damage to some cells such as those of the lateral line, few data were reported and the study is in need of replication. Moreover, it should be noted that the eggs and larvae were very close to the airgun array, and at such close distances the particle velocity of the signal would be exceedingly large. However, the received sound pressure and particle velocity were not measured in this study.

[27] The data here are very complex, and there are many variables in understanding how sound may stress humans, or any animal. The variables include sound level, duration, frequency spectrum, physiological state of the animal, and innumerable other factors. Thus, extrapolation from human stress effects to other organisms is highly problematic and should be done with only the most extreme caution.

4.8 Conclusions - Effects

The data obtained to date on effects of sound on fish are very limited both in terms of number of well-controlled studies and in number of species tested. Moreover, there are significant limits in the range of data available for any particular type of sound source. And finally, most of the data currently available has little to do with actual behavior of fish in response to sound in their normal environment. There is also almost nothing known about stress effects of any kind(s) of sound on fish.

4.8.1 Mortality and Damage to Non-auditory Tissues

The results to date show only the most limited mortality, and then only when fish are very close to an intense sound source. Thus, whereas there is evidence that fish within a few meters of a pile driving operation will potentially be killed, very limited data (and data from poorly designed experiments) suggest that fish further from the source are not killed, and may not be harmed. It should be noted, however, that these and other studies showing mortality (to any sound source) need to be extended and replicated in order to understand the effects of the most intense sound on fish.

It is also becoming a bit clearer (again, albeit from very few studies) that those species of fish tested at a distance from the source where the sound level is below source level, show no mortality and possibly no long-term effects. Of course, it is recognized that it is very difficult to extrapolate from the data available (e.g., Popper et al., 2005, 2007) since only a few sound types have been tested, and even within a single sound type there have to be questions about effects of multiple exposures and duration of exposure. Still, the results to date are of considerable interest and importance, and clearly show that exposure to many types of loud sounds may have little or no affect on fish. And, if one considers that the vast majority of fish exposed to a loud sound are probably some distance from a source, where the sound level has attenuated considerably, one can start to predict that only a very small number of animals in a large population will ever be killed or damaged by sounds.

4.8.2 Effects on Fish Behavior

The more critical issue, however, is the effect of human-generated sound on the behavior of wild animals, and whether exposure to the sounds will alter the behavior of fish in a manner that will affect its way of living – such as where it tries to find food or how well it can find a mate. With the exception of just a few field studies, there are no data on behavioral effects, and most of these studies are very limited in scope and all are related to seismic airguns. Because of the limited ways in which behavior of fish in these studies were “observed” (often by doing catch rates, which tell nothing about how fish really react to a sound), there really are no data on the most critical questions regarding behavior.

Indeed, the fundamental questions are how fish behave during and after exposure to a sound as compared to their "normal" pre-exposure behavior. This requires observations of a large number of animals over a large area for a considerable period of time before and after exposure to sound sources, as well as during exposure. Only with such data is it possible to tell how sounds affect overall behavior (including movement) of animals.

4.8.3 Increased Background Sound

In addition to questions about how fish movements change in response to sounds, there are also questions as to whether any increase in background sound has an effect on more subtle aspects of behavior, such as the ability of a fish to hear a potential mate or predator, or to glean information about its general environment. There is a body of literature that shows that the sound detection ability of fish can be "masked" by the presence of other sounds within the range of hearing of the fish. Just as a human has trouble hearing another person as the room they are in gets noisier, it is likely that the same effect occurs for fish (as well as all other animals). In effect, acoustic communication and orientation of fish may potentially be restricted by noise regimes in their environment that are within the hearing range of the fish.

While it is possible to suggest behavioral effects on fish, there have been few laboratory, and no field, studies to show the nature of any effects of increased background noise on fish behavior. At the same time, it is clear from the literature on masking in fish, as for other vertebrates, that the major effect on hearing is when the added sound is within the hearing range of the animal. Moreover, the bulk of the masking effect is at frequencies around that of the masker. Thus, a 2 kHz masker will only mask detection of sounds around 2 kHz, and a 500 Hz masker will primarily impact hearing in a band around 500 Hz.

As a consequence, if there is a background sound of 2 kHz, as might be expected from some mid-frequency sonars, and the fish in question does not hear at that frequency, there will be no masking, and no affect on any kind of behavior. Moreover, since the bulk of fish communication sounds are well below 1 kHz (e.g., Zelick et al., 1999), even if a fish is exposed to a 2 kHz masker which affects hearing at around 2 kHz, detection of biologically relevant sounds (e.g., of mates) will not be masked.

Indeed, many of the human-generated sounds in the marine environment are outside the detection range of most species of marine fish studied to date (see Fig. 1, page 8, and Table 1, page 18). In particular, it appears that the majority of marine species have hearing ranges that are well below the frequencies of the mid- and high-frequency range of the operational sonars used in Navy exercises, and therefore, the sound sources do not have the potential to mask key environmental sounds. The few fish species that have been shown to be able to detect mid- and high-frequencies, such as the clupeids (herrings, shads, and relatives), do not have their best sensitivities in the range of the operational sonars. Additionally, vocal marine fish largely communicate below the range of mid- and high-frequency levels used in Navy exercises.

4.8.4 Implications of Temporary Hearing Loss (TTS)

Another related issue is the impact of temporary hearing loss, referred to as temporary threshold shift (TTS), on fish. This effect has been demonstrated in several fish species where investigators used exposure to either long-term increased background levels (e.g., Smith et al., 2004a) or intense, but short-term, sounds (e.g., Popper et al., 2005), as discussed above. At the same time, there is no evidence of permanent hearing loss (e.g., deafness), often referred to in the mammalian literature as permanent threshold shift (PTS), in fish. Indeed, unlike in mammals where deafness often occurs as a result of the death and thus permanent loss of sensory hair cells, sensory hair cells of the ear in fish are replaced after they are damaged or killed (Lombarte et al., 1993; Smith et al., 2006). As a consequence, any hearing loss in fish may be as temporary as the time course needed to repair or replace the sensory cells that were damaged or destroyed (e.g., Smith et al., 2006).

TTS in fish, as in mammals, is defined as a recoverable hearing loss. Generally there is recovery to normal hearing levels, but the time-course for recovery depends on the intensity and duration of the TTS-evoking signal. There are no data that allows one to "model" expected TTS in fish for different signals, and developing such a model will require far more data than currently available. Moreover, the data would have to be from a large number of fish species since there is so much variability in hearing capabilities and in auditory structure.

A fundamentally critical question regarding TTS is how much the temporary loss of hearing would impact survival of fish. During a period of hearing loss, fish will potentially be less sensitive to sounds produced by predators or prey, or to other acoustic information about their environment. The question then becomes how much TTS is behaviorally significant for survival. However, there have yet to be any studies that examine this issue.

At the same time, the majority of marine fish species are hearing generalists and so cannot hear mid- and high-frequency sonar. Thus, there is little or no likelihood of there being TTS as a result of exposure to these sonars, or any other source above 1.5 kHz. It is possible that mid-frequency sonars are detectable by some hearing specialists such as a number of sciaenid species and clupeids. However, the likelihood of TTS in these species is small since the duration of exposure of animals to a moving source is probably very low since exposure to a maximum sound level (generally well below the source level) would only be for a few seconds as the navy vessel moves by.

4.8.5 Stress

While the major questions on effects of sound relate to behavior of fish in the wild, a more subtle issue is whether the sounds potentially affect the animal through increased stress. In effect, even when there are no apparent direct effects on fish as manifest by hearing loss, tissue damage, or changes in behavior, it is possible that there are more subtle effects on the endocrine or immune systems that could, over a long period of time, decrease the survival or reproductive success of animals. While there have been a few studies that have looked at things such as cortisol levels in response to sound, these studies have been very limited in scope and in species studied.

4.8.6 *Eggs and Larvae*

Finally, while eggs and larvae must be of concern, the few studies of the effects of sounds on eggs and larvae do not lead to any conclusions with how sound would impact survival. And of the few potentially useful studies, most were done with sources that are very different than sonar. Instead, they employed seismic airguns or mechanical shock. While a few results suggest some potential effects on eggs and larvae, such studies need to be replicated and designed to ask direct questions about whether sounds, and particularly mid- and high-frequency sounds, would have any potential impact on eggs and larvae.

5 - Explosives and Other Impulsive Signals

5.1 Effects of Impulsive Sounds

There are few studies on the effects of impulsive sounds on fish, and no studies that incorporated mid- or high-frequency signals. The most comprehensive studies using impulsive sounds are from seismic airguns, as discussed on page 24 (e.g., Popper et al., 2005; Song et al., submitted). Additional studies have included those on pile driving (reviewed in Hastings and Popper, 2005) and explosives (e.g., Yelverton et al., 1975; Keevin et al., 1997; Govoni et al., 2003; reviewed in Hastings and Popper, 2005).

As discussed earlier in this report, the airgun studies on very few species resulted in a small hearing loss in several species, with complete recovery within 18 hours (Popper et al., 2005). Other species showed no hearing loss with the same exposure. There appeared to be no effects on the structure of the ear (Song et al., submitted), and a limited examination of non-auditory tissues, including the swim bladder, showed no apparent damage (Popper et al., 2005). One other study of effects of an airgun exposure showed some damage to the sensory cells of the ear (McCauley et al., 2003), but it is hard to understand the differences between the two studies. However, the two studies had different methods of exposing fish, and used different species. There are other studies that have demonstrated some behavioral effects on fish during airgun exposure used in seismic exploration (e.g., Pearson et al., 1987, 1992; Engås et al., 1996; Engås and Løkkeborg, 2002; Slotte et al., 2004), but the data are limited and it would be very difficult to extrapolate to other species, as well as to other sound sources.

5.2 Explosive Sources

A number of studies have examined the effects of explosives on fish. These are reviewed in detail in Hastings and Popper (2005). One of the real problems with these studies is that they are highly variable and so extrapolation from one study to another, or to other sources, such as those used by the Navy, is not really possible. While many of these studies show that fish are killed if they are near the source, and there are some suggestions that there is a correlation between size of the fish and death (Yelverton et al., 1975), little is known about the very important issues of non-mortality damage in the short- and long-term, and nothing is known about effects on behavior of fish.

The major issue in explosives is that the gas oscillations induced in the swim bladder or other air bubble in fishes caused by high sound pressure levels can potentially result in tearing or rupturing of the chamber. This has been suggested to occur in some (but not all) species in several gray literature unpublished reports on effects of explosives (e.g., Aplin, 1947; Coker and Hollis, 1950; Gaspin, 1975; Yelverton et al., 1975), whereas other published studies do not show such rupture (e.g., the very well done peer reviewed study by Govoni et al., 2003). Key variables that appear to control the physical interaction of sound with fishes include the size of the fish relative to the wavelength of sound, mass of the fish, anatomical variation, and location of the fish in the water column relative to the sound source (e.g., Yelverton et al., 1975; Govoni et al., 2003).

Explosive blast pressure waves consist of an extremely high peak pressure with very rapid rise times (< 1 ms). Yelverton et al. (1975) exposed eight different species of freshwater fish to blasts of 1-lb spheres of Pentolite in an artificial pond. The test specimens ranged from 0.02 g (guppy) to 744 g (large carp) body mass and included small and large animals from each species. The fish were exposed to blasts having extremely high peak overpressures with varying impulse lengths. The investigators found what appears to be a direct correlation between body mass and the magnitude of the "impulse," characterized by the product of peak overpressure and the time it took the overpressure to rise and fall back to zero (units in psi-ms), which caused 50% mortality (see Hastings and Popper, 2005 for detailed analysis).

One issue raised by Yelverton et al. (1975) was whether there was a difference in lethality between fish which have their swim bladders connected by a duct to the gut and fish which do not have such an opening.[28] The issue is that it is potentially possible that a fish with such a connection could rapidly release gas from the swim bladder on compression, thereby not increasing its internal pressure. However, Yelverton et al. (1975) found no correlation between lethal effects on fish and the presence or lack of connection to the gut.

While these data suggest that fishes with both types of swim bladders are affected in the same way by explosive blasts, this may not be the case for other types of sounds, and especially those with longer rise or fall times that would allow time for a biomechanical response of the swim bladder (Hastings and Popper, 2005). Moreover, there is some evidence that the effects of explosives on fishes without a swim bladder are less than those on fishes with a swim bladder (e.g., Gaspin, 1975; Geortner et al., 1994; Keevin et al., 1997). Thus, if internal damage is, even in part, an indirect result of swim bladder (or other air bubble) damage, fishes without this organ may show very different secondary effects after exposure to high sound pressure levels. Still, it must be understood that the data on effects of impulsive sources and explosives on fish are limited in number and quality of the studies, and in the diversity of fish species studied. Thus, extrapolation from the few studies available to other species or other devices must be done with the utmost caution.

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[28] Fish with the swim bladder connected to the gut "gulp" air from the surface to fill the swim bladder, and can quickly release air via that route when there are pressure changes. Fishes without such a connection have no way of quickly releasing gas when there is a rapid change in pressure, and this leads to the hypothesis that the change in pressure could burst the swim bladder.

In a more recent published report, Govoni et al. (2003) found damage to a number of organs in juvenile pinfish (*Lagodon rhomboids*) and spot (*Leiostomus xanthurus*) when they were exposed to submarine detonations at a distance of 3.6 m, and most of the effects, according to the authors, were sublethal. Effects on other organ systems that would be considered irreversible (and presumably lethal) only occurred in a small percentage of fish exposed to the explosives. Moreover, there was virtually no effect on the same sized animals when they were at a distance of 7.5 m, and more pinfish than spot were affected.

Based upon currently available data it is not possible to predict specific effects of Navy impulsive sources on fish. At the same time, there are several results that are at least suggestive of potential effects that result in death or damage. First, there are data from impulsive sources such as pile driving and seismic airguns that indicate that any mortality declines with distance, presumably because of lower signal levels. Second, there is also evidence from studies of explosives (Yelverton et al. 1975) that smaller animals are more affected than larger animals. Finally, there is also some evidence that fish without an air bubble, such as flatfish and sharks and rays, are less likely to be affected by explosives and other sources than are fish with a swim bladder or other air bubble.

Yet, as indicated for other sources, the evidence of short- and long-term behavioral effects, as defined by changes in fish movement, etc., is non-existent. Thus, we still do not know if the presence of an explosion or an impulsive source at some distance, while not physically harming a fish, will alter its behavior in any significant way.

6 - Effects of Sounds on Invertebrates

While invertebrates are not the focus of this Report, it is useful to give some consideration to potential effects of mid- and high-frequency sounds on these animals since they make up a major portion of the aquatic biomass. At the same time, one problem is that the role of sound in the lives of most invertebrates, and the potential impact of human-generated sound on survival or behavior, is unknown, and few studies have been done on effects of human generated sound on invertebrates.

6.1 Invertebrate Hearing Overview

Very little is known about sound detection and use of sound by invertebrates (see Budelmann, 1992a, b; Popper et al., 2001, for reviews). The limited data shows that some crabs are able to detect sound, and there has been the suggestion that some other groups of invertebrates are also able to detect sounds. In addition, cephalopods (octopus and squid) and decapods (lobster, shrimp, and crab) are thought to sense low-frequency sound (Budelmann, 1992b). Packard et al. (1990) reported sensitivity to sound vibrations between 1-100 Hz for three species of cephalopods. Wilson et al. (2007) documents a lack of physical or behavioral response for squid exposed to experiments using high intensity sounds designed to mimic killer whale echolocation signals. In contrast, McCauley et al. (2000) reported that caged squid would show behavioral responses when exposed to sounds from a seismic airgun.

There has also been the suggestion that invertebrates do not detect pressure since few, if any, have air cavities that would function like the fish swim bladder in responding to pressure. It is important to note that some invertebrates, and particularly cephalopods, have specialized end organs, called statocysts, for determination of body and head motions that are similar in many ways to the otolithic end organs of fish. The similarity includes these invertebrates having sensory cells which have some morphological and physiological similarities to the vertebrate sensory hair cell, and the "hairs" from the invertebrate sensory cells are in contact with a structure that may bear some resemblance to vertebrate otolithic material (reviewed in Budelmann, 1992a, b). As a consequence of having statocysts, it is possible that these species could be sensitive to particle displacement (Popper et al., 2001).

It is also important to note that invertebrates may have other organs that potentially detect the particle motion of sound, the best known of which are special water motion receptors known as chordotonal organs (e.g., Budelmann, 1992a). These organs facilitate the detection of potential predators and prey and provide environmental information such as the movement of tides and currents. Indeed, fiddler crab (*Uca* sp.) and spiny lobster (*Panulirus* sp.) have both been shown to use chordotonal organs to respond to nearby predators and prey.

Like fish, some invertebrate species produce sound, with the possibility that it is used for communication. Sound is used in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Popper et al., 2001). Well known sound producers include lobsters (*Panulirus* sp.) (Latha et al., 2005) and snapping shrimp (*Alpheus heterochaelis*) (Heberholz and Schmitz, 2001). Of all marine invertebrates, perhaps the one best known to produce sound are the snapping shrimp (Heberholz and Schmitz, 2001). Snapping shrimp are found in oceans all over the world and make up a significant portion of the ambient noise budget in many locales (Au and Banks, 1998).

6.2 Effects of Sound on Invertebrates

McCauley et al. (2000) found evidence that squid exposed to seismic airguns show a behavioral response including inking. However, these were caged animals, and it is not clear how unconfined animals may have responded to the same signal and at the same distances used. In another study, Wilson et al. (2007) played back echolocation clicks of killer whales to two groups of squid (*Loligo pealeii*) in a tank. The investigators observed no apparent behavioral effects or any acoustic debilitation from playback of signals up to 199 to 226 dB re 1 μPa. It should be noted, however, that the lack of behavioral response by the squid may have been because the animals were in a tank rather than being in the wild.

In another report on squid, Guerra et al. (2004) claimed that dead giant squid turned up around the time of seismic airgun operations off of Spain. The authors suggested, based on analysis of carcasses, that the damage to the squid was unusual when compared to other dead squid found at other times. However, the report presents conclusions based on a correlation to the time of finding of the carcasses and seismic testing, but the evidence in support of an effect of airgun activity was totally circumstantial. Moreover, the data presented showing damage to tissue is highly questionable since there was no way to differentiate between damage due to some external cause (e.g., the seismic airgun) and normal tissue degradation that takes place after death, or due to poor fixation and preparation of tissue. To date, this work has not been published in peer-reviewed literature, and detailed images of the reportedly damaged tissue are also not available.

There has been a recent and unpublished study in Canada that examined the effects of seismic airguns on snow crabs[29] (DFO, 2004). However, the results of the study were not at all definitive, and it is not clear whether there was an effect on physiology and reproduction of the animals.

There is also some evidence that an increased background noise (for up to three months) may affect at least some invertebrate species. Lagardère (1982) demonstrated that sand shrimp (*Crangon crangon*) exposed in a sound proof room to noise that was about 30 dB above ambient for three months demonstrated decreases in both growth rate and reproductive rate. In addition, Lagardère and Régnault (1980) showed changes in the physiology of the same species with increased noise, and that these changes continued for up to a month following the termination of the signal.

Finally, there was a recently published statistical analysis that attempted to correlate catch rate of rock lobster[30] in Australia over a period of many years with seismic airgun activity (Parry and Gason, 2006). The results, while not examining any aspects of rock lobster behavior or doing any experimental study, suggested that there was no effect on catch rate from seismic activity.

7 - General Conclusions

As discussed elsewhere in this Report, the extent of data, and particularly scientifically peer-reviewed data, on the effects of high intensity sounds on fish is exceedingly limited. Some of these limitations include:

a. Types of sources tested;
b. Effects of individual sources as they vary by such things as intensity, repetition rate, spectrum, distance to the animal, etc.;
c. Number of species tested with any particular source;
d. The ability to extrapolate between species that are anatomically, physiologically, and/or taxonomically, different;
e. Potential differences, even within a species as related to fish size (and mass) and/or developmental history;
f. Differences in the sound field at the fish, even when studies have used the same type of sound source (e.g., seismic airgun);
g. Poor quality experimental design and controls in many of the studies to date;
h. Lack of behavioral studies that examine the effects on, and responses of, fish in their natural habitat to high intensity signals;

[29] Probably *Chionoecetes* sp., but not indicated in this unpublished report at the time of writing this Report.
[30] Possibly *Jasus edwardsii*, but not indicated in paper.

i. Lack of studies on how sound may impact stress, and the short- and long-term effects of acoustic stress on fish; and
j. Lack of studies on eggs and larvae that specifically use sounds of interest to the Navy.

At the same time, in considering potential sources that are in the mid- and high-frequency range, a number of potential effects are clearly eliminated. Most significantly, since the vast majority of fish species studied to date are hearing generalists and cannot hear sounds above 500 to 1,500 Hz (depending upon the species), there are not likely to be behavioral effects on these species from higher frequency sounds.

Moreover, even those marine species that may hear above 1.5 kHz, such as a few sciaenids and the clupeids (and relatives), have relatively poor hearing above 1.5 kHz as compared to their hearing sensitivity at lower frequencies. Thus, it is reasonable to suggest that even among the species that have hearing ranges that overlap with some mid- and high-frequency sounds, it is likely that the fish will only actually hear the sounds if the fish and source are very close to one another. And, finally, since the vast majority of sounds that are of biological relevance to fish are below 1 kHz (e.g., Zelick et al., 1999; Ladich and Popper, 2004), even if a fish detects a mid- or high-frequency sound, these sounds will not mask detection of lower frequency biologically relevant sounds.

Thus, a reasonable conclusion, even without more data, is that there will be few, and more likely no, impacts on the behavior of fish.

At the same time, it is possible that very intense mid- and high-frequency signals, and particularly explosives, could have a physical impact on fish, resulting in damage to the swim bladder and other organ systems. However, even these kinds of effects have only been shown in a few cases in response to explosives, and only when the fish has been very close to the source. Such effects have never been shown to any Navy sonar. Moreover, at greater distances (the distance clearly would depend on the intensity of the signal from the source) there appears to be little or no impact on fish, and particularly no impact on fish that do not have a swim bladder or other air bubble that would be affected by rapid pressure changes.

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Summary of literature considered and eliminated from review

Material not dealt with

The following was in the original report. I looked at the citation (Young, 1991) and it is hard to interpret since there are no real data given and no references. It is impossible to determine if the conclusions are valid, and it is my opinion that the Navy would be remiss in using this without full analysis. Moreover, as pointed out in Young (1991) there are a lot of extrapolations regarding going from 1 pound detonations, which were apparently used in experiments, to larger bombs, and there are so many variables (water depth, etc.) that reaching conclusions would be difficult to do, even if we had the original data.

Also did not deal with the following since the report deals with sound and these are explosives.

In fisheries science, it has been found that if carefully deployed, explosives can serve to quantitative sample small areas without greatly damaging the habitat structure (Continental Shelf, Inc., 2004). This is largely because lethal shock waves attenuate rapidly. Nonetheless, explosives are rarely used to sample fishes due to safety and public perception issues.

There currently is no set threshold for determining effects to fish from explosives other than mortality models. Fish that are located in the water column, close to the source of detonation could be injured, killed, or disturbed by the impulsive sound and possibly temporarily leave the area. Continental Shelf Inc. (2004) presented a few generalities from studies conducted to determine effects associated with removal of offshore structures (e.g., oil rigs) in the Gulf of Mexico. Their findings revealed that at very close range, underwater explosions are lethal to most fish species regardless of size, shape, or internal anatomy. For most situations, cause of death in fishes has been massive organ and tissue damage and internal bleeding. At longer range, species with gas-filled swimbladders (e.g., snapper, cod, and striped bass) are more susceptible than those without swimbladders (e.g., flounders and other flatfish, some tunas. Studies also suggest that larger fishes are generally less susceptible to death or injury than small fishes. Moreover, elongated forms that are round in cross-section are less at risk than deep-bodied forms; and orientation of fish relative to the shock wave may affect the extent of injury. Open water pelagic fish (e.g., mackerel) also seem to be less affected than reef fishes. The results of most studies are dependent upon specific biological, environmental, explosive, and data recording factors.

APPENDIX C:
ACOUSTIC MODELING TECHNICAL REPORT

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APPENDIX C: ACOUSTIC MODELING TECHNICAL REPORT

C.1 BACKGROUND AND OVERVIEW

All marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

The Endangered Species Act of 1973 (ESA) provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of their ecosystems. A "species" is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. There are marine mammals, already protected under MMPA, listed as either endangered or threatened under ESA, and afforded special protections.

Actions involving sound in the water include the potential to harass marine animals in the surrounding waters. Demonstration of compliance with MMPA and the ESA, using best available science, has been assessed using criteria and thresholds accepted or negotiated, and described here.

Sections of the MMPA (16 U.S.C. 1361 *et seq*.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity, other than commercial fishing, within a specified geographical region. Through a specific process, if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

The Secretary of Commerce may grant the authorization for incidental takings if National Marine Fisheries Service (NMFS) finds that the taking will have no more than a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking, and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth.

NMFS has defined “negligible impact” in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

Subsection 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The National Defense Authorization Act of 2004 (NDAA) (Public Law 108-136) removed the small numbers limitation and amended the definition of “harassment” as it applies to a military readiness activity to read as follows:

> (i) *any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or*
> (ii) *any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral pat terns, including, bu t not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandone d or significantly altered [Level B Harassment].*

The primary potential impact to marine mammals from underwater acoustics is Level B harassment from noise. For non-explosive sound sources, Level B Harassment includes behavioral modifications resulting from repeated noise exposures (below TTS) to the same animals over a relatively short period. Cetaceans exposed to Energy Levels (ELs) of 195 dB re 1 μPa^2-s up to 215 dB re 1 μPa^2-s are assumed to experience TTS. At 215 dB re 1 μPa^2-s, Cetaceans are assumed to experience PTS. Table C-1 gives the thresholds of interest for the animals present in the NAVSEA NUWC Keyport Range Complex.

Table C-1. Thresholds of Interest for NAVSEA NUWC Keyport Range Complex

Threshold Type (Acoustic Sources)	Threshold Level
Permanent Threshold Shift (PTS)—Cetaceans	215 dB
Permanent Threshold Shift (PTS)—Steller Sea Lion	226 dB
Permanent Threshold Shift (PTS)—Elephant Seal	224 dB
Permanent Threshold Shift (PTS)—Harbor Seal	203 dB
Temporary Threshold Shift (TTS)—Cetaceans	195 dB
Temporary Threshold Shift (TTS)—Steller Sea Lion	206 dB
Temporary Threshold Shift (TTS)— Elephant Seal	204 dB
Temporary Threshold Shift (TTS)— Harbor Seal	183 dB
Behavioral Harassment (Primary)	Risk Function

The sound sources will be located in an area that is inhabited by species listed as threatened or endangered under the Endangered Species Act (ESA, 16 USC §§ 1531-1543). Operation of the sound sources, that is, transmission of acoustic signals in the water column, could potentially cause harm or harassment to listed species.

"Harm," defined under ESA regulations, is "…an act which actually kills or injures…" (50 CFR 222.102) listed species. "Harassment" is an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

Level A harassment criteria and thresholds under MMPA are appropriate to apply as "harm" criteria and thresholds under ESA. Analysis that predicts Level A harassment under MMPA will occur as a result of the proposed action would correspond to harm to listed species under ESA. Consequently, Level B harassment criteria and thresholds under MMPA are appropriate to apply as harassment criteria and thresholds under ESA.

If a federal agency determines that its proposed action "may affect" a listed species, it is required to consult, either formally or informally, with the appropriate regulator. There is no permit issuance under ESA, rather consultation among the cognizant federal agencies under § 7 of the ESA. Such consultations would likely to conclude favorably, subject to requirements that the activity will not appreciably reduce the likelihood of the species' survival and recovery, and impacts are minimized and mitigated. If appropriate, Navy would initiate formal interagency consultation by submitting a Biological Assessment to NMFS, detailing the proposed action's potential effects on listed species and their designated critical habitats. Consultation would conclude with NMFS' issuance of a Biological Opinion that addresses the issues of whether the project can be expected to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

C.2 ACOUSTIC SOURCES

A wide variety of systems/equipment that utilize narrowband acoustic sources are employed at the NAVSEA NUWC Keyport Range Complex. Eight have been selected as representative of the types of operating in this range and are described in Table C-2. Take estimates for these acoustic sources are calculated and reported on a per-run basis.

Table C-2. Representative Acoustic Sources Employed in NAVSEA NUWC Keyport Range Complex

Source Designation	Source Description	Frequency Class	Takes Reported
S1	Sub-bottom profiler	Mid-frequency	Per 4-hour run
S2	UUV source	High frequency	Per 2-hour run
S3	REMUS Modem	Mid-frequency	Per 2-hour run
S4	REMUS-SAS-HF	High frequency	Per 2-hour run
S5	Range Target	Mid-frequency	Per 20-minute run
S6	Test Vehicle 1	High-frequency	Per 10-minute-run
S7	Test Vehicle 2	High-frequency	Per 10-minute-run
S8	Test Vehicle 3	High-frequency	Per 10-minute-run

The acoustic modeling that is necessary to support the take estimates for each of these acoustic sources relies upon a generalized description of the manner of the acoustic source's operating modes. This description includes the following:

- "Effective" energy source level – The total energy across the band of the source, scaled by the pulse length (10 $\log_{10}$ [pulse length]).
- Source depth – Depth of the source in meters. Each source was modeled in the middle of the water column.
- Nominal frequency – Typically the center band of the source emission. These are frequencies that have been reported in open literature and are used to avoid classification issues. Differences between these nominal values and actual source frequencies are small enough to be of little consequence to the output impact volumes.
- Source directivity – The source beam is modeled as the product of a horizontal beam pattern and a vertical beam pattern. Sound paths experience reflection that results in a new path with significant remaining sound upon surface reflection and, to a lesser extent, with bottom reflection. These reflections change the vertical, but not the horizontal angle. More importantly, the sound speed varies with depth, so sound refracts vertically. Therefore, features of the sound speed profile, especially surface ducts and shadow zones, depend on the vertical (and not the horizontal) angles at which the sound travels. A false sampling of the vertical angle can create imaginary shadow zones or place too much or too little sound in the surface duct.

  For modeling purposes sound speed is assumed locally constant in a horizontal plane and is not refracted horizontally. Also, horizontal angles do not affect the interaction of sound with the features of the sound velocity profile such as a surface duct. Thus, the horizontal angle does not change, because it is neither refracted, nor is it affected by surface or bottom reflections.

  Two parameters define the horizontal beam pattern:

  - Horizontal beam width – Width of the source beam (degrees) in the horizontal plane (assumed constant for all horizontal steer directions).

- Horizontal steer direction – Direction in the horizontal in which the beam is steered relative to the direction in which the platform is heading

The horizontal beam has constant response across the width of the beam and with flat, 20-dB down sidelobes. (Note that steer directions ϕ, $-\phi$, $180^o - \phi$, and $180^o + \phi$ all produce equal impact volumes.)

Similarly, two parameters define the vertical beam pattern:

- Vertical beam width – Width of the source beam (degrees) in the vertical plane measured at the 3-dB down point. (The width is that of the beam steered towards broadside and not the width of the beam at the specified vertical steer direction.)
- Vertical steer direction – Direction in the vertical plane that the beam is steered relative to the horizontal (upward looking angles are positive).

To avoid sharp transitions that a rectangular beam might introduce, the power response at vertical angle θ is

$$\max \{ \sin^2 [n(\theta_s - \theta)] / [n \sin (\theta_s - \theta)]^2, \ 0.01 \}$$

where $n = 180^o / \theta_w$ is the number of half-wavelength-spaced elements in a line array that produces a main lobe with a beam width of θ_w. θ_s is the vertical beam steer direction.

- Ping spacing – Distance between pings. For most sources this is generally just the product of the speed of advance of the platform and the repetition rate of the acoustic source. Animal motion is generally of no consequence as long as the source motion is greater than the speed of the animal (nominally, three knots). For stationary (or nearly stationary) sources, the "average" speed of the animal is used in place of the platform speed. The attendant assumption is that the animals are all moving in the same constant direction.

These parameters are defined for each of the acoustic sources in Table C-3.

Table C-3. Description of Representative Acoustic Sources Used at NAVSEA NUWC Keyport Range Complex

Source Designation	Center Freq	Source Level *(dB re 1 µPa @ 1 m)*	Emission Spacing	Vertical Directivity	Horizontal Directivity
S1	4.5 kHz	207 dB	0.2 m	20 deg	20 deg
S2	15 kHz	205 dB	1.9 m	30 deg	50 deg
S3	10 kHz	186 dB	45 m	60 deg	360 deg
S4	150 kHz	220 dB	1.9 m	9 deg	15 deg
S5	5 kHz	233 dB	93 m	60 deg	360 deg
S6	20 kHz	233 dB	45 m	20 deg	60 deg
S7	25 kHz	230 dB	540 m	20 deg	60 deg
S8	30 kHz	233 dB	617 m	20 deg	60 deg

C.3 ENVIRONMENTAL PROVINCES

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. In turn, propagation loss as a function of range responds to a number of environmental parameters:

- water depth
- sound speed variability throughout the water column
- bottom geo-acoustic properties, and

- wind speed

Due to the importance that propagation loss plays in Anti-Submarine Warfare (ASW), the Navy has over the last four to five decades invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases of these environmental parameters, most of which are accepted as standards for all Navy modeling efforts.

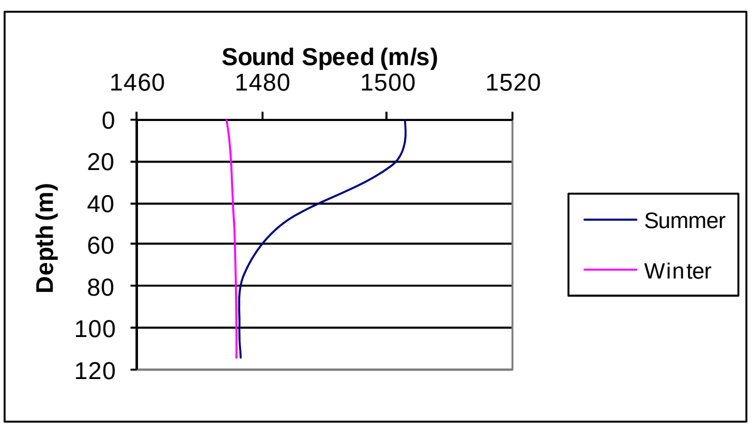
- Water depth – Digital Bathymetry Data Base Variable Resolution (DBDBV)
- Sound speed – Generalized Digital Environmental Model (GDEM)
- Bottom loss – Low-Frequency Bottom Loss (LFBL), Sediment Thickness Database, and High-Frequency Bottom Loss (HFBL), and
- Wind speed – U.S. Navy Marine Climatic Atlas of the World

Representative environmental parameters are selected for each of the three operating areas: DBRC Site, Keyport Range Site, and QUTR Site. Sources of local environmental-acoustic properties were supplemented with Navy Standard OAML data to determine model inputs for: bathymetry, sound-speed, and sediment properties.

The DBRC and Keyport range sites are located inland with limited water-depth variability: the maximum water depth in DBRC site is approximately 200 meters; the maximum in the Keyport range is approximately 20 meters. The QUTR Site, on the other hand, is located seaward of the US West Coast with depths greater than a kilometer.

Sound speed profiles for winter and summer from the OAML open-ocean database are presented in Figure C-1. The winter profile is a classic half-channel (sound speed monotonically increasing with depth). The summer profile consists of a shallow surface duct over a modest thermocline. Individual profiles taken from World Ocean Data Base (National Oceanographic Data Center 2005) for DBRC and Keyport range sites are generally consistent with these open-ocean profiles. Some of these profiles exhibit some effects of additional fresh-water near the surface; others have a little warmer surface layer than this summer profile. However, the truncated deep-water profiles are adequately representative of the inland ranges.

Figure C-1. Typical Sound Speed Profiles



The bottom type in the QUTR Site varies consistently with water depth. The shallower depths (less than 500 meters) tend to have sandy bottoms (HFBL class = 2); the deeper depths tend to be silt (HFBL class = 8)

The sediment type of the DBRC and Keyport range sites that we used for our modeling were different from those found in the Low Frequency Bottom Loss (LFBL) database or implied by the High-Frequency Bottom Loss (HFBL) database. Although the water depth of these areas can be greater that 50 m, the LFBL database assigned them the default "coarse sand" sediment type that was assigned to areas with water depth less than 50 m (Vidmar and Monet 1994). Core data from these areas were collected as part or environmental monitoring (Llanso et al. 1998). Cores 14 and 15 from the northern parts of the DBRC site area indicated sediments with sands and silty sands. We assigned a silty sand sediment type to these areas (HFBL class = 2). Core 304R from the southern part of the DBRC site area indicated sediments with clay. We assigned a clay-silt sediment type (HFBL class = 4) to this area taking into account the transition from the more sandy northern area to the clay of the southern area. These assignments are consistent with the observation (Helton, 1976) that the boundary area between the northern and southern areas had sediments that were mostly mud with a small amount of sand. The Keyport area did not have any cores in the study area but had three cores surrounding the area: core 308R to the northwest indicated sand sediment; core 69 to the northeast indicated sand and silty sand sediments; and core 34 to the south indicated a clay sediment. Given the surrounding cores we assigned a sand-silt-clay sediment type to this area (HFBL class = 4).

For all 3 sites (Keyport, DBRC, and QUTR), average wind speed was used to estimate a corresponding sea state (Summer: 8 knots [sea state of 1.6], Winter: 14 knots [sea state of 2.8]).

The resulting environmental provinces used in this analysis are listed by range in Tables C-4 through C-6.

Table C-4. Keyport Environmental Provinces

Province Number	Water Depth (m)	HFBL Class
K1	10	4
K2	20	4

Table C-5. DBRC site Environmental Provinces

Province Number	Water Depth (m)	HFBL Class
D1	10	2
D2	20	2
D3	50	2
D4	100	2
D5	200	2
D6	10	4
D7	20	4
D8	50	4
D9	100	4
D10	200	4

Table C-6. QUTR Site Environmental Provinces

Province Number	Water Depth (m)	HFBL Class
Q1	10	2
Q2	20	2
Q3	50	2
Q4	100	2
Q5	200	2
Q6	500	8
Q7	1000	8
Q8	2000	8

Each of the ranges has an existing boundary and one or more alternative extensions. The Keyport range has a proposed extension to the east and south of the existing boundaries. In addition to the existing DBRC site boundary, there is one extension to the south and another extension to the south and the north. The QUTR Site is expanded into a much larger deep-water region with three alternative surf zones (Kalaloch, Ocean City and Pacific Beach). The distribution of the environmental provinces across these various alternatives is provided in Tables C-7 through C-15.

Table C-7. Distribution of Environments in Existing Keyport Range

Province Number	Frequency of Occurrence
K1	66.90 %
K2	33.10 %

Table C-8. Distribution of Environments in Extended Keyport Range

Province Number	Frequency of Occurrence
K1	64.00 %
K2	36.00 %

Table C-9. Distribution of Environments in Existing DBRC Site

Province Number	Frequency of Occurrence
D1	3.22 %
D2	7.76%
D3	38.58 %
D4	40.10 %
D5	10.34 %

Table C-10. Distribution of Environments in DBRC Site with Southern Extension

Province Number	Frequency of Occurrence
D1	2.31 %
D2	5.57 %
D3	27.69 %
D4	28.78 %
D5	7.42 %
D6	0.26 %
D7	0.77 %
D8	4.05 %
D9	21.04 %
D10	2.11 %

Table C-11. Distribution of Environments in DBRC Site with Northern and Southern Extensions

Province Number	Frequency of Occurrence
D1	2.21 %
D2	6.06 %
D3	30.22 %
D4	27.48 %
D5	7.09 %
D6	0.24 %
D7	0.74 %
D8	3.86 %
D9	20.09 %
D10	2.01 %

Table C-12. Distribution of Environments in Existing QUTR Site

Province Number	Frequency of Occurrence
Q3	64.10 %
Q4	35.90 %

Table C-13. Distribution of Environments in Extended QUTR Site with Kalaloch Surf Zone

Province Number	Frequency of Occurrence
Q1	0.24 %
Q2	2.70 %
Q3	15.51 %
Q4	17.41 %
Q5	7.94 %
Q6	10.56 %
Q7	28.02 %
Q8	17.62 %

Table C-14. Distribution of Environments in Extended QUTR Site with Ocean City Surf Zone

Province Number	Frequency of Occurrence
Q1	0.14 %
Q2	2.80 %
Q3	15.51 %
Q4	17.41 %
Q5	7.94 %
Q6	10.56 %
Q7	28.02 %
Q8	17.62 %

Table C-15. Distribution of Environments in New QUTR Site with Pacific Beach Surf Zone

Province Number	Frequency of Occurrence
Q1	0.07 %
Q2	2.77 %
Q3	15.91 %
Q4	17.34 %
Q5	7.91 %
Q6	10.52 %
Q7	27.92 %
Q8	17.56 %

C.4 IMPACT VOLUMES AND IMPACT RANGES

C.4.1 Overview of Impact Volumes for Active Sonars

Many naval actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. Given fixed harassment metrics and thresholds, the number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

The expected impact volume associated with a particular activity is defined as the expected volume of water in which some acoustic metric exceeds a specified threshold. The product of this volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. There are two acoustic metrics for sonar effects: an energy term (energy flux density) or a pressure term (peak pressure). The thresholds associated with each of these metrics define the levels at which the animals exposed will experience some degree of harassment (ranging from behavioral change to hearing loss).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range is defined as the maximum range at which a particular threshold is exceeded for a single source emission.

The two measures of potential harm to the marine wildlife due to acoustic source operations are the accumulated (summed over all source emissions) energy flux density received by the animal over the duration of the activity, and the peak pressure (loudest sound received) by the animal over the duration of the activity.

Regardless of the type of source, estimating the number of animals that may be harassed in a particular environment entails the following steps.

- Each source emission is modeled according to the particular operating mode of the acoustic source. The "effective" energy source level is computed by integrating over the bandwidth of the source, and scaling by the pulse length. The location of the source at the time of each emission must also be specified.
- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL data are sampled at the typical depth(s) of the source and at the nominal center frequency of the source.
- The accumulated energy and maximum sound pressure level (SPL) are sampled over a volumetric grid within the waters surrounding a source action. At each grid point, the received signal from each source emission is modeled as the source level reduced by the appropriate propagation loss from the location of the source at the time of each emission to

that grid point. The maximum SPL field is calculated by taking the maximum level of the received signal over all emissions, and the energy field is calculated by summing the energy of the signal over all emissions, and adjusting for pulse length.

- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point for which the appropriate metric exceeds that threshold. For maximum SPL, calculation of the expected volume represented by each grid point depends on the maximum SPL at that point, and requires an extra step to apply the risk function. This process is described in section A.5.
- Finally, the number of takes is estimated as the product (scalar or vector, depending upon whether an animal density depth distribution is available) of the impact volume and the animal densities.

This section describes in detail the process of computing impact volumes for active acoustic sources. The relevant assumptions associated with this approach and the limitations that are implied are also presented. The final step, using the impact volumes to compute the number of harassments, is discussed in subsection A.6.

C.4.2 Computing Impact Volumes

This section provides a detailed description of the approach taken to compute impact volumes for active sonars. Included in this discussion are:

- Identification of the underwater propagation model used to compute transmission loss data, a listing of the source-related inputs to that model, and a description of the output parameters that are passed to the energy accumulation algorithm.
- Definitions of the parameters describing each sonar type.
- Description of the algorithms and sampling rates associated with the energy accumulation algorithm.

C.4.2.1 Transmission Loss Calculations

Transmission loss (TL) data are pre-computed for each of two seasons in each of the environmental provinces described in the previous subsection using the Gaussian Ray Bundle (GRAB) propagation loss model (Keenan et al. 2000). The TL output consists of a parametric description of each significant eigenray (or propagation path) from source to a grid point. The description of each eigenray includes the departure angle from the source (used to model the source vertical directivity later in this process), the propagation time from the source to the grid point (used to make corrections to absorption loss for minor differences in frequency and to incorporate a surface-image interference correction at low frequencies), and the transmission loss suffered along the eigenray path.

The sources' center frequencies used in the TL calculations are specified in Table C-16.

Table C-16. TL Frequency by Source Type

SOURCE	FREQUENCY
S1	4.5 kHz
S2	15 kHz
S3	10 kHz
S4	150 kHz
S5	5 kHz
S6	20 kHz
S7	25 kHz
S8	30 kHz

It is important to note that for low-power and very high-frequency systems impact ranges are short, and any propagation modeling approach will yield approximately spherical spreading plus absorption. Hence, most short-range cases produce impact volumes virtually independent of location.

The eigenray data for a single GRAB model run are sampled at uniform increments in range out to a maximum range for a specific "grid point" (or "target" in GRAB terminology) depth. Multiple GRAB runs are made to sample the animal depth dependence. The depth and range sampling parameters are summarized in Table C-17.

Table C-17. TL Depth and Range Sampling Parameters by Acoustic Source Type

Source	Range Step	Depth Step
S1	10 m	5 m to 1 km, 10 m thereafter
S2	10 m	5 m to 1 km, 10 m thereafter
S3	10 m	5 m to 1 km, 10 m thereafter
S4	10 m	5 m to 1 km, 10 m thereafter
S5	10 m	5 m to 1 km, 10 m thereafter
S6	10 m	5 m to 1 km, 10 m thereafter
S7	10 m	5 m to 1 km, 10 m thereafter
S8	10 m	5 m to 1 km, 10 m thereafter

Although GRAB provides the option of including the effect of source directivity in its eigenray output, this capability is not exercised. By preserving data at the eigenray level, this allows source directivity to be applied later in the process and results in fewer TL calculations.

C.4.2.2 Energy Summation

The summation of energy flux density over multiple pings in a range-independent environment requires less calculation than the risk function computations for the SPL metric. A volumetric grid that covers the waters in and around the area of acoustic source operation is initialized. The source then begins its set of pings. For the first ping, the TL from the source to each grid point is determined (summing the appropriate eigenrays after they have been modified by the vertical beam pattern), the "effective" energy source level is reduced by that TL, and the result is added to the accumulated energy flux density at that grid point. After each grid point has been updated, the accumulated energy at grid points in each depth layer is compared to the specified threshold. If the accumulated energy exceeds that threshold, then the incremental volume represented by that grid point is added to the impact volume for that depth layer. Once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for one ping.

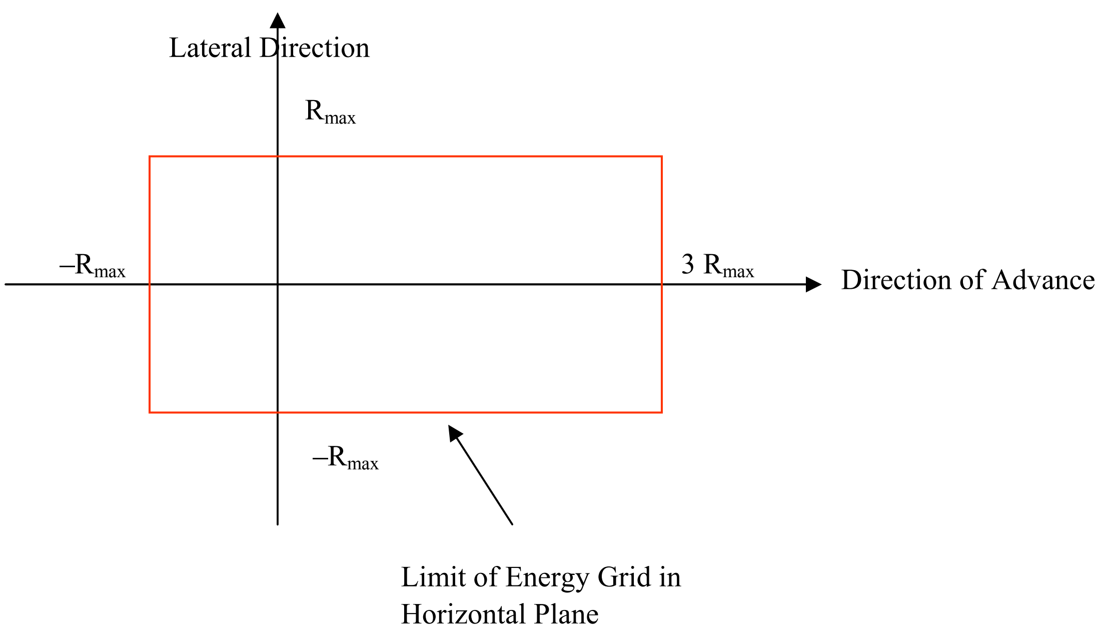
The source is then moved along one of the axes in the horizontal plane by the specified ping separation range and the second ping is processed in a similar fashion. Again, once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for two pings. This procedure continues until the maximum number of pings specified has been reached.

Selecting the size of the volumetric grid over which to accumulate energy requires balancing of two considerations. The volume must be large enough to contain all volumetric cells for which the accumulated energy is likely to exceed the threshold but not so large as to make the energy accumulation computationally unmanageable.

Determining the size of the volumetric grid begins with an iterative process to determine the lateral extent to be considered. Unless otherwise noted, throughout the selection process the source is treated as omni directional and the only animal depth that is considered is the TL target depth that is closest to the source depth (placing source and receiver at the same depth is generally an optimal TL geometry).

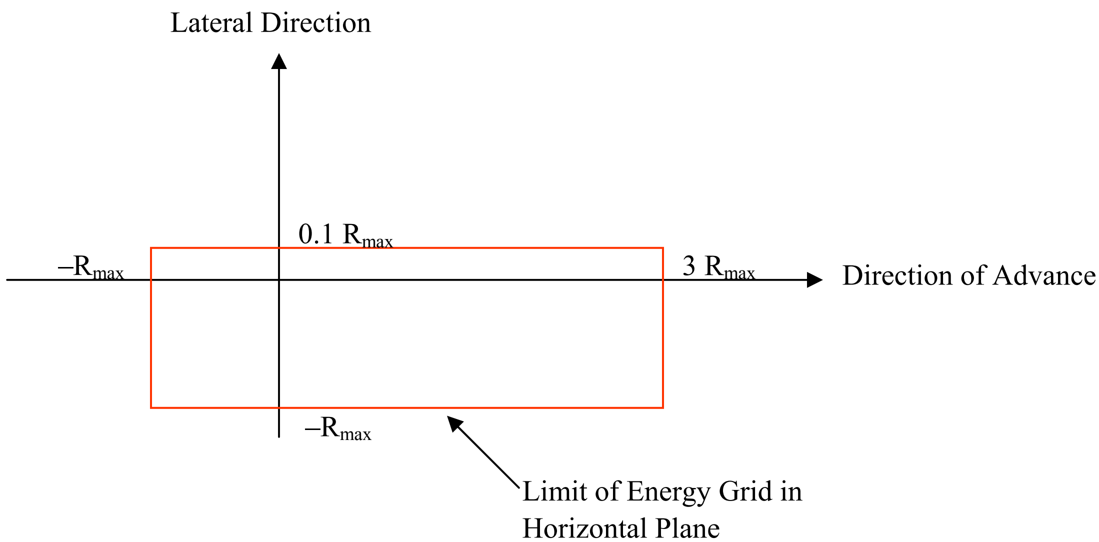
The first step is to determine the impact range (R_{MAX}) for a single ping. The impact range in this case is the maximum range at which the effective energy source level reduced by the transmission loss is greater than the threshold. Next, the source is moved along a straight-line track and energy flux density is accumulated at a point that has a CPA range of R_{MAX} at the mid-point of the source track. That total energy flux density summed over all pings is then compared to the prescribed threshold. If it is greater than the threshold (which, for the first R_{MAX}, it must be) then R_{MAX} is increased by ten percent, the accumulation process is repeated, and the total energy is again compared to the threshold. This continues until R_{MAX} grows large enough to ensure that the accumulated energy flux density at that lateral range is less than the threshold. The lateral range dimension of the volumetric grid is then set at twice R_{MAX}, with the grid centered along the source track. In the direction of advance for the source, the volumetric grid extends of the interval from [–R_{MAX}, 3 R_{MAX}] with the first source position located at zero in this dimension. Note that the source motion in this direction is limited to the interval [0, 2 R_{MAX}]. Once the source reaches 2 R_{MAX} in this direction, the incremental volume contributions have approximately reached their asymptotic limit and further pings add essentially the same amount. This geometry is demonstrated in Figure C-2 below.

Figure C-2. Horizontal Plane of Volumetric Grid for Omni Directional Source.



If the source is directive in the horizontal plane, then the lateral dimension of the grid may be reduced and the position of the source track adjusted accordingly. For example, if the main lobe of the horizontal source beam is limited to the starboard side of the source platform, then the port side of the track is reduced substantially as demonstrated in Figure C-3.

Figure C-3. Horizontal Plane of Volumetric Grid for Starboard Beam Source.

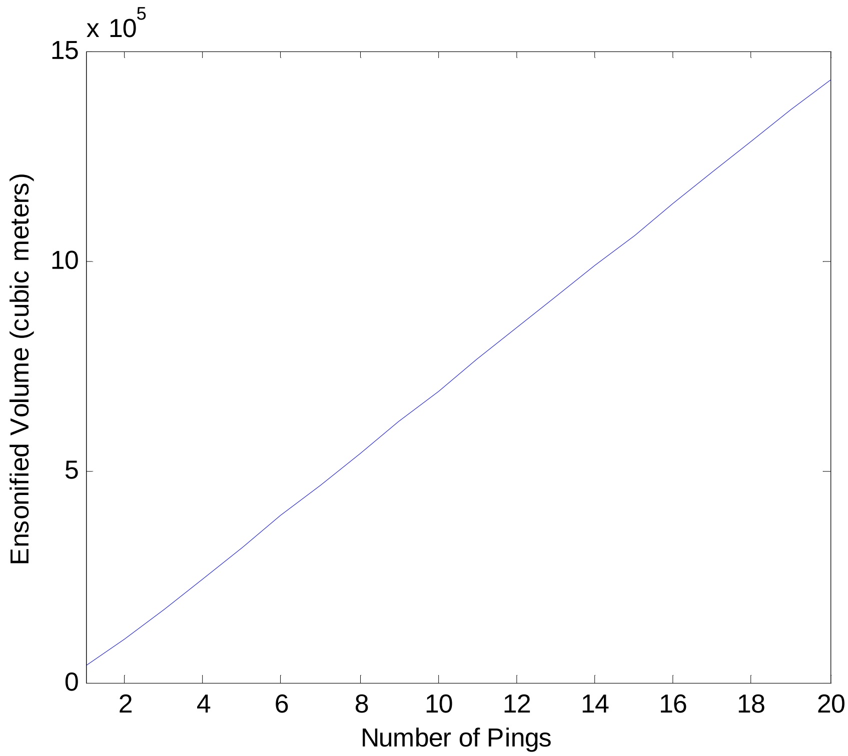


Once the extent of the grid is established, the grid sampling can be defined. In both dimensions of the horizontal plane the sampling rate is approximately $R_{MAX}/100$. The round-off error associated with this sampling rate is roughly equivalent to the error in a numerical integration to determine the area of a circle with a radius of R_{MAX} with a partitioning rate of $R_{MAX}/100$ (approximately one percent). The depth-sampling rate of the grid is comparable to the sampling rates in the horizontal plane but discretized to match an actual TL sampling depth. The depth-sampling rate is also limited to no more that ten meters to ensure that significant TL variability over depth is captured.

C.4.2.3 Impact Volume per Run

The impact volume for a acoustic source moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases varies with a number of parameters but eventually approaches some asymptotic limit. Beyond that point the increase in impact volume becomes essentially linear as depicted in Figure C-4.

Figure C-4. 195 dB Volume by Ping for S5 in Environment 4, between 47.5 m and 52.5 m

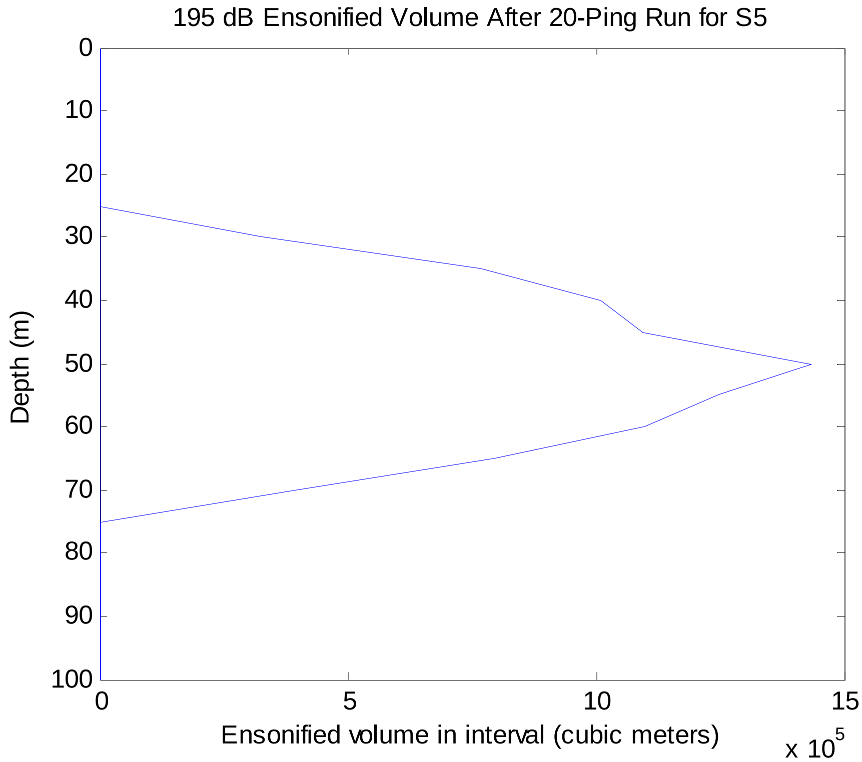


The value of the ensonification after the last ping in the run is reached gives the impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the run's impact volume vector, v_n, which contains the hourly impact volumes by depth for province n. Figure C-5 provides an example of an hourly impact volume vector for the same situation as Figure C-4.

C.4.2.4 Impact Volume by Region

As discussed in A.3, all the Keyport existing and proposed ranges are made up of a combination of twenty environmental provinces. Some, such as the existing Keyport Range, only two of the environments are found, and in some, such as DBRC with northern and southern extensions, up to ten are found. In any of the alternatives, the per-run impact volume vector for operations involving any particular source at a given site is a linear combination of the twenty impact volume vectors with the weighting determined by the distribution of those twenty environmental provinces within that site. Unique impact volume vectors for winter and summer are calculated for each type of source and each metric/threshold combination.

Figure C-5. Example of an Impact Volume Vector



C.5 RISK FUNCTION: THEORETICAL AND PRACTICAL IMPLEMENTATION

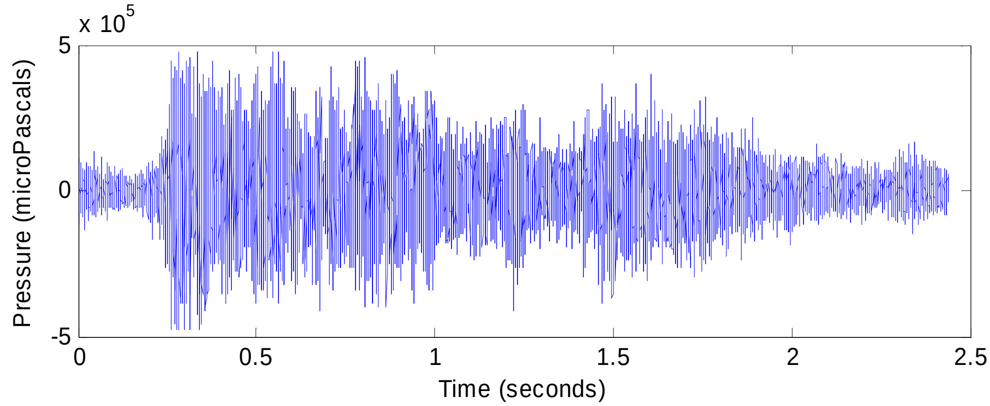
This section discusses the recent addition of a risk function threshold to acoustic effects analysis procedure. This approach includes two parts, a new metric, and a function to map exposure level under the new metric to probability of harassment. What these two parts mean, how they affect exposure calculations, and how they are implemented are the objects of discussion.

C.5.1 Thresholds and Metrics

The term "thresholds" is broadly used to refer to both thresholds and metrics. The difference, and the distinct roles of each in effects analyses, will be the foundation for understanding the risk-function approach, putting it in perspective, and showing that, conceptually, it is similar to past approaches.

Sound is a pressure wave, so at a certain point in space, sound is simply rapidly changing pressure. Pressure at a point is a function of time. Define p(t) as pressure (in micropascals) at a given point at time t (in seconds); this function is called a "time series." Figure C-6 gives the time series of the first "hallelujah" in Handel's Hallelujah Chorus.

Figure C-6. Time Series



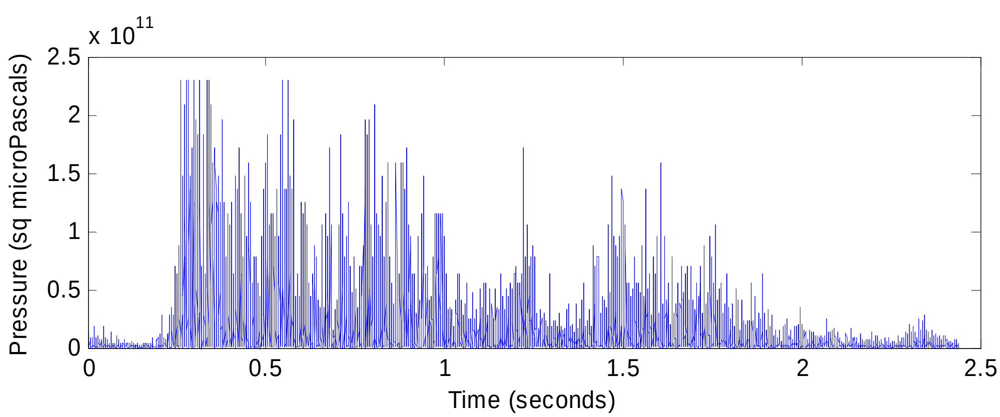
The time-series of a source can be different at different places. Therefore, sound, or pressure, is not only a function of time, but also of location. Let the function p(t), then be expanded to p(t;x,y,z) and denote the time series at point (x,y,z) in space. Thus the series in Figure C-7, p(t) is for a given point (x,y,z). At a different point in space, it would be different.

Assume that the location of the source is (0,0,0) and this series is recorded at (0,10,-4). The time series above would be p(t;0,10,-4) for $0<t<2.5$.

As in Figure C-6, pressure can be positive or negative, but usually the function is squared so it is always positive, this makes integration meaningful. Figure C-7 is $p^2(t;0,10,-4)$

The metric chosen to evaluate the sound field at the end of this first "hallelujah" determines how the time series is summarized from thousands of points, as in Figure C-7, to a single value for each point (x,y,z) in the space. The metric essentially "boils down" the four dimensional p(t,x,y,z) into a three dimensional function m(x,y,z) by dealing with time. There is more than one way to summarize the time component, so there is more than one metric.

Figure C-7. Time Series Squared



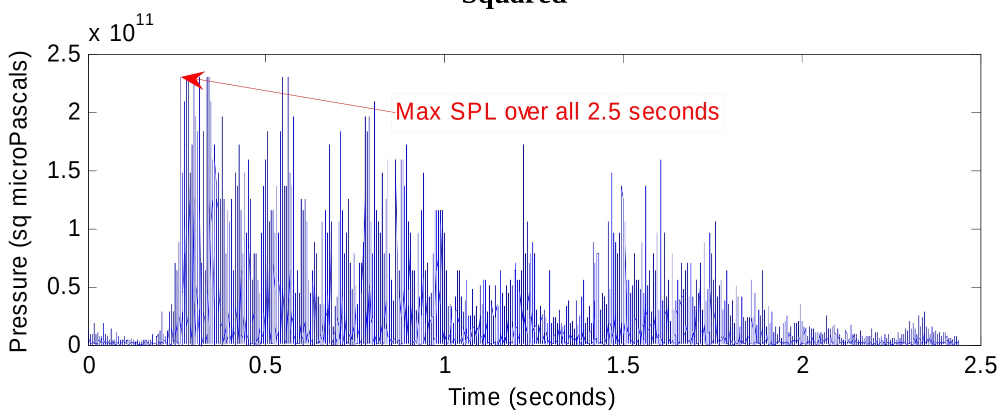
C.5.1.1 Max SPL

One way to summarize $p^2(t;x,y,z)$ to one number over the 2.5 seconds is to only report the maximum value of the function over time or,

$$SPL_{\max} = \max\{p^2(t,x,y,z)\} \text{ for } 0<t<2.5$$

The $SPL_{\max}$ for this snippet of the Hallelujah Chorus is $2.3\times10^{11}\ \mu Pa^2$ and occurs at 0.2825 seconds, as shown in Figure C-8.

Figure C-8. Max SPL of Time Series Squared



C.5.1.2 Integration

$SPL_{\max}$ is not necessarily influenced by the duration of the sound (2.5 seconds in this case). Integrating the function over time does take this duration into account. A simple integration of $p^2(t;x,y,z)$ over t is common and usually called "energy."

$$Energy = \int_0^T p^2(t,x,y,z)dt$$

where T is the maximum time of interest, in this case 2.5. The energy for this snippet of the Hallelujah Chorus is 1.24 x 10^{11} µPa^2-s .

After p(t) is determined (i.e., when the stimulus is over), propagation models can be used to determine p(t;x,y,z) for every point in the vicinity and for a given metric. Define

$m_a(x,y,z,T) =$ value of metric "a" at point (x,y,z) after time T

So,

$$m_{energy}(x,y,z;T) = \int_0^T p(t)^2\,dt$$

$$m_{\max SPL}(x,y,z;T) = \max(p(t)) \text{ over } [0,T]$$

Since modeling is concerned with the effects of an entire event, T is usually implicitly defined: a number that captures the duration of the event. This means that $m_a(x, y, z)$ is assumed to be measured over the duration of the received signal.

C.5.1.3 Three Dimensions Versus Two Dimensions

To further reduce the calculation burden, it is possible to reduce the domain of $m_a(x, y, z)$ to two dimensions by defining $m_a(x, y) = \max\{m_a(x, y, z)\}$ over all z. This reduction is not used for this analysis, which is exclusively three-dimensional.

C.5.1.4 Threshold

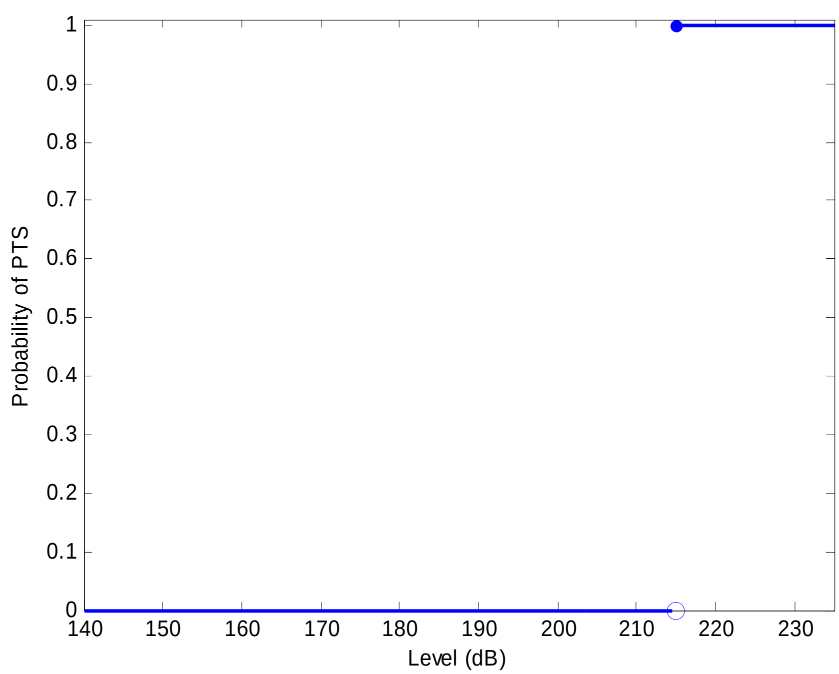
For a given metric, a threshold is a function that gives the probability of exposure at every value of m_a. This threshold function will be defined as

$$D(m_a(x, y, z)) = \Pr(\textit{effect at } m_a(x, y, z))$$

The domain of D is the range of $m_a(x, y, z)$, and its range is the number of thresholds.

An example of threshold functions is the Heaviside (or unit step) function, currently used to determine permanent and temporary threshold shift (PTS and TTS) in cetaceans. For PTS, the metric is $m_{energy}(x, y, z)$, defined above, and the threshold function is a Heaviside function with a discontinuity at 215 dB, shown in Figure C-9.

Figure C-9. PTS Heaviside Threshold Function



Mathematically, this D is defined as:

$$D(m_{energy}) = \begin{cases} 0 \ for \ m_{energy} < 215 \\ 1 \ for \ m_{energy} \geq 215 \end{cases}$$

Any function can be used for D, as long as its range is in [0,1]. The risk functions use "Feller" functions (defined below) instead of Heaviside functions, and use the maximum SPL metric instead of the energy metric. While a Heaviside function is specified by a single parameter, the discontinuity, a Feller function requires three parameters: the basement, the distance between basement and 50% effect, and the steepness parameter. Mathematically, these Feller risk functions are defined as

$$D(m_{\max SPL}) = \begin{cases} \dfrac{1}{1+\left(\dfrac{K}{m-B}\right)^{A}} \ for \ m_a > B \\ 0 \ for \ m_{\max SPL} \leq B \end{cases}$$

---

where B=cutoff (or basement), K=the difference in dB between the level that causes 50% harassment, and A="steepness" factor. Alternatively this equation can be written as follows:

$$R = \frac{1-\left(\dfrac{L-B}{K}\right)^{-A}}{1-\left(\dfrac{L-B}{K}\right)^{-2A}}$$

for D=R and *m*=L and for the case *m*>B. This mathematical function is used to predict MMPA Level B behavioral harassment as adapted from the solution in Feller (1968) and as used in DON (2001), per CNO N45 direction. The risk function used for odontocetes and pinnipeds uses the parameters B=120, K=45, and A=10. For mysticetes, the parameters used were B=120, K=45, and A=8. Harbor porpoises are a special case. Though the metric for their behavioral harassment is SPL, their risk function is a Heaviside function with a discontinuity at 120 dB SPL. In this analysis, this is the only species that uses a step function is used to determine the threshold for behavioral harassment.

The curve resulting from the risk function input parameter for odontocetes (except harbor porpoises) and pinnipeds is shown as Figure C-10. The curve resulting from the risk function input parameters for mysticetes is provided as Figure C-11.

Figure C-10. Risk Function Curve for Odontocetes (toothed whales except harbor porpoises) and Pinnipeds

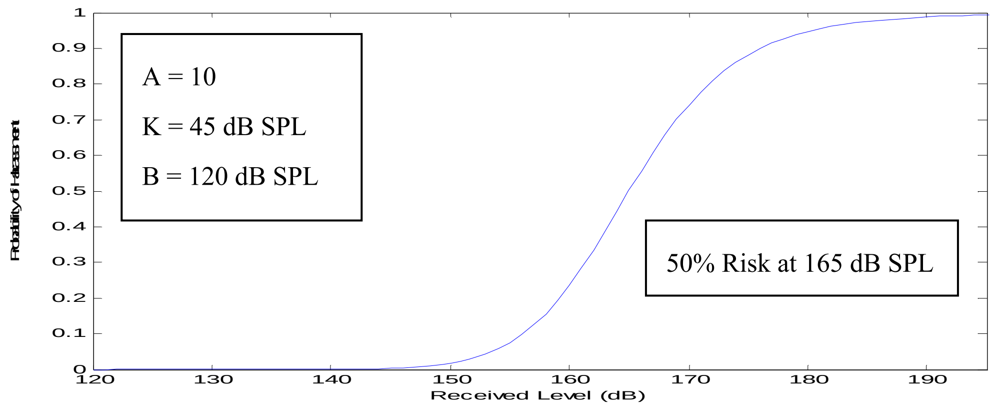
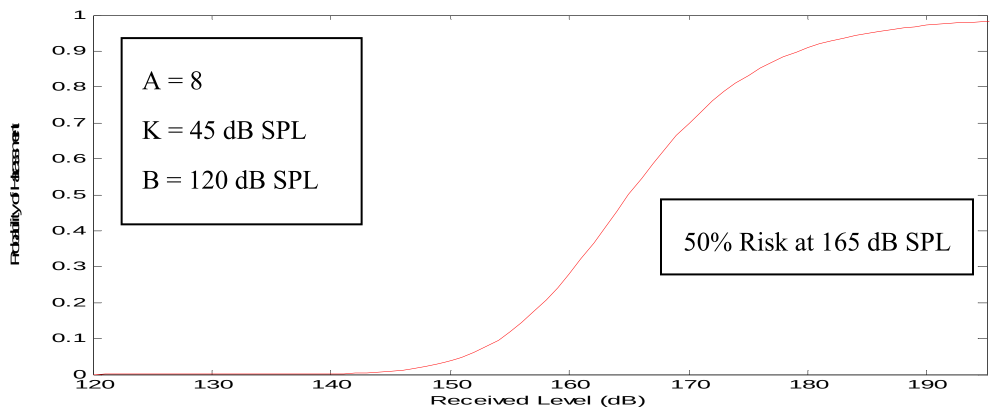


Figure C-11. Risk Function Curve for Mysticetes (Baleen Whales)



Harbor porpoise PTS and TTS are the same as other odontocetes. For behavioral exposure estimates the risk function is a step function at 120 dB SPL.

C.5.1.5 Multiple Metrics and Thresholds

It is possible to have more than one metric, and more than one threshold in a given metric. For example, in this document, killer whales have two metrics (energy and max SPL), and three thresholds (two for energy, one for max SPL). The energy thresholds are Heaviside functions, as described above, with discontinuities at 215 and 195 for PTS and TTS respectively. The max SPL variable-level threshold determines behavioral harassment, and is defined by the odontocete risk function (described above, with B=120, K=45, and A=10).

C.5.2 Calculation of Expected Exposures

Determining the number of expected exposures for disturbance is the object of this analysis.

$$\text{Expected exposures in volume V: e(V)} = \int_V \rho(V) D(m_a(V)) dV$$

For this analysis, $m_a = m_{\max SPL}$, so

$$\int_V \rho(V) D(m_a(V) dV = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \rho(x,y,z) D(m_{\max SPL}(x,y,z)) dxdydz$$

In this analysis, the densities are constant over the x/y plane, and the z dimension is always negative, so this reduces to

$$\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$$

C.5.3 Numeric Implementation

Numeric integration of $\int_{-\infty}^{\infty} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$ can be involved because, although the bounds are infinite, D is non-negative out to 120 dB, which, depending on the environmental specifics, can drive propagation loss calculations and their numerical integration out to over 100 km.

The first step in the solution is to separate out the x/y-plane portion of the integral:

$$\text{Define f(z)=} \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdy\,.$$

Calculation of this integral is the most involved and time consuming part of the calculation. Once it is complete,

$$\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz = \int_{-\infty}^{0} \rho(z) f(z) dz\,,$$

which, when numerically integrated, is a simple dot product of two vectors.

Thus, the calculation of f(z) requires the majority of the computation resources for the numerical integration. The rest of this section presents a brief outline of the steps to calculate f(z) and preserve the results efficiently.

The concept of numerical integration is, instead of integrating over continuous functions, to sample the functions at small intervals and sum the samples to approximate the integral. The smaller the size of the intervals, the closer the approximation, but the longer the calculation, so a balance between accuracy and time is determined in the decision of step size. For this analysis, z is sampled in 5 meter steps to 1000 meters in depth and 10 meter steps to 2000 meters, which is the limit of animal depth in this analysis.

The step size for x is 5 meters, and y is sampled with an interval that increases as the distance from the source increases. Mathematically,

$$z \in Z = \{0,5,...1000,1010,...,2000\}$$
$$x \in X = \{0,\pm5,...,\pm5k\}$$
$$y \in Y = \{0,\pm5(1.005)^0,5\pm(1.005)^1,\pm5(1.005)^2,...,5(1.005)^j\}$$

for integers k,j, which depend on the propagation distance from the source. For this analysis, k=20,000 and j=600

With these steps, $f(z_0)=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}D(m_{\max SPL}(x,y,z_0))dxdy$ is approximated as

$$\sum_{z\in Y}\sum_{x\in X}D(m_{\max SPL}(x,y,z_0))\Delta x\Delta y$$

where x,y are defined as above.

This calculation must be repeated for each $z_0 \in Z$, to build the discrete function f(z).

With the calculation of f(z) complete, the integral of its product with $\rho(z)$ must be calculated to complete evaluation of

$$\int_{-\infty}^{\infty}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}D(m_{\max SPL}(x,y,z))dxdydz=\int_{-\infty}^{0}\rho(z)f(z)dz$$

Since f(z) is discrete, and $\rho(z)$ can be readily made discrete, $\int_{-\infty}^{0}\rho(z)f(z)dz$ is approximated numerically as $\sum_{z\in Z}\rho(z)f(z)$, a dot product.

C.5.3.1 Preserving Calculations for Future Use

Calculating f(z) is the most time-consuming part of the numerical integration, but the most time-consuming portion of the entire process is calculating $m_{\max SPL}(x,y,z)$ over the area range required to reach the basement value. The calculations usually require propagation estimates out to over 65 km, and those estimates, with the beam pattern, are used to construct a sound field that extends 65 km x 65 km = 4225 sq km (km^2), with a calculation at the steps for every value of x and y, defined above. This is repeated for each depth, to a maximum of 2000 meters.

Saving the entire $m_{\max SPL}$ for each z is unrealistic, requiring great amounts of time and disk space. Instead, the different levels in the range of $m_{\max SPL}$ are sorted into 0.5 dB wide bins; the volume of water at each bin level is taken from $m_{\max SPL}$, and associated with its bin. Saving this, the amount of water ensonified at each level, at 0.5 dB resolution, preserves the ensonification information without using the space and time required to save $m_{\max SPL}$ itself. Practically, this is a histogram of occurrence of level at each depth, with 0.5 dB bins. Mathematically, this is simply defining the discrete functions $V_z(L)$, where $L = \{.5a\}$ for every positive integer a, for all $z \in Z$. These functions, or histograms, are saved for future work. The information lost by saving only the histograms is *where* in space the different levels occur, although *how often* they occur is saved. But the thresholds (risk functions) are purely a function of level, not location, so this information is sufficient to calculate f(z).

Applying the risk function to the histograms is a dot product:

$$\sum_{\ell \in L_1} D(\ell) V_{z_0}(\ell) \approx \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z_0))dxdy$$

Once the histograms are saved, neither $m_{\max SPL}(x,y,z)$ nor f(z) must be recalculated to generate $\int_{-\infty}^{0}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdydz$ for a new threshold function.

For the interested reader, the following section includes an in-depth discussion of the method, software, and other details of the f(z) calculation.

C.5.3.2 Software Detail

The risk function metric uses the Feller function to determine the probability that an animal is affected by a given sound pressure level, and the minimum level at which harassment could occur. The acoustic quantity of interest is the maximum sound pressure level experienced over multiple pings in a range-independent environment. The procedure for calculating the impact volume at a given depth is relatively simple. In brief, given the sound pressure level of the source and the transmission loss (TL) curve, the sound pressure level is calculated on a volumetric grid. For a given depth, volume associated with a sound pressure level interval is calculated. Then, this volume is multiplied by the probability that an animal will be affected by that sound pressure level. This gives the impact volume for that depth, that can be multiplied by the animal densities at that depth, to obtain the number of animals affected at that depth. The process repeats for each depth to construct the impact volume as a function of depth.

The case of a single emission of acoustic source energy, one ping, illustrates the computational process in more detail. First, the sound pressure levels are segregated into a sequence of bins that cover the range encountered in the area. The sound pressure levels are used to define a volumetric grid of the local sound field. The impact volume for each depth is calculated as follows: for each depth in the volumetric grid, the sound pressure level at each x/y plane grid point is calculated using the sound pressure level of the source, the TL curve, the horizontal beam pattern of the source, and the vertical beam patterns of the source. The sound pressure levels in this grid become the bins in the volume histogram. Figure C-12 shows a volume histogram for a low-power sonar. Level bins are 0.5 dB in width and the depth is 50 meters in an environment with water depth of 100 meters. The oscillatory structure at very low levels is due the flattening of the TL curve at long distances from the source, which magnifies the fluctuations of the TL as a function of range. The expected impact volume for a given level at a given depth is calculated by multiplying the volume in each level bin by the risk function at that level. Total expected impact volume for a given depth is the sum of these expected volumes. Figure C-13 is an example of the impact volume as a function of depth at a water depth of 100 meters.

Figure C-12. Example of a Volume Histogram

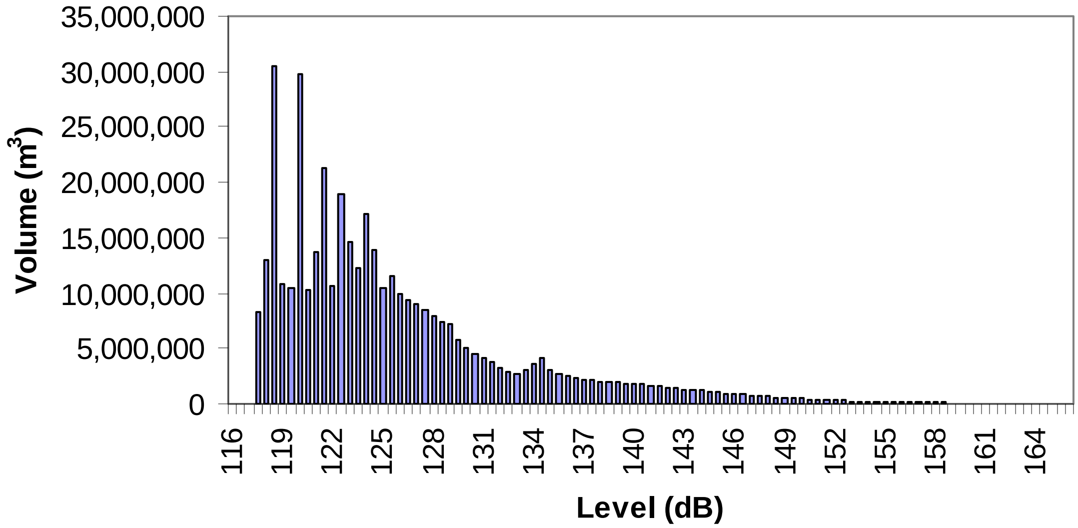
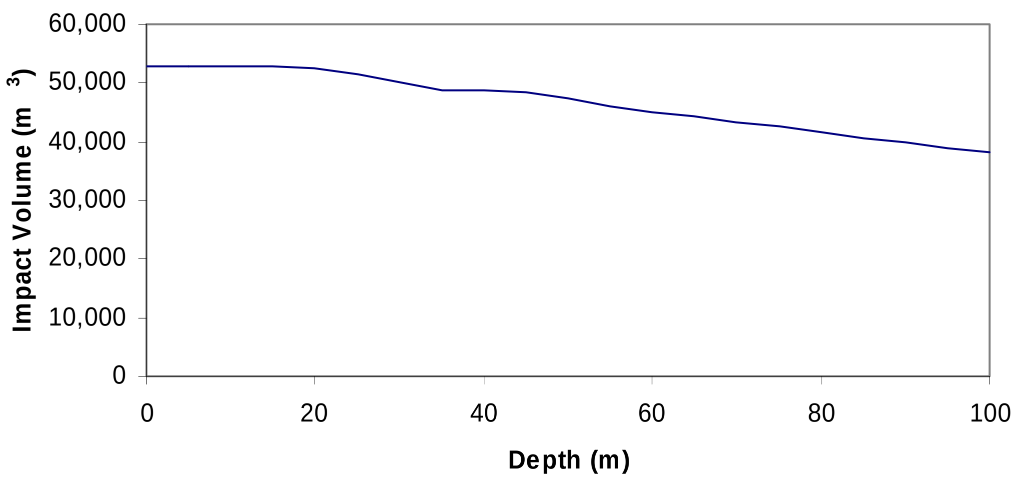


Figure C-13. Example of the Dependence of Impact Volume



The volumetric grid covers the waters in and around the area of acoustic source operation. The grid for this analysis has a uniform spacing of 5 meters in the x-coordinate and a slowly expanding spacing in the y-coordinate that starts with 5 meters spacing at the origin. The growth of the grid size along the y-axis is a geometric series. Each successive grid size is obtained from the previous by multiplying it by 1+Ry, where Ry is the y-axis growth factor. This forms a geometric series. The n^{th} grid size is related to the first grid size by multiplying by $(1+Ry)^{(n-1)}$. For an initial grid size of 5 meters and a growth factor of 0.005, the 100^{th} grid increment is 8.19 meters. The constant spacing in the x-coordinate allows greater accuracy as the source moves along the x-axis. The slowly increasing spacing in y reduces computation time, while maintaining accuracy, by taking advantage of the fact that TL changes more slowly at longer distances from the source. The x-and y-coordinates extend from –Rmax to +Rmax, where Rmax is the maximum range used in the TL calculations. The z direction uses a uniform spacing of 5 meters down to

1000 meters and 10 meters from 1000 to 2000 meters. This is the same depth mesh used for the effective energy metric as described above. The depth mesh does not extend below 2000 meters, on the assumption that animals of interest are not found below this depth.

The next three figures indicate how the accuracy of the calculation of impact volume depends on the parameters used to generate the mesh in the horizontal plane. Figure C-14 shows the relative change of impact volume for one ping as a function of the grid size used for the x-axis. The y-axis grid size is fixed at 5m and the y-axis growth factor is 0, i.e., uniform spacing. The impact volume for a 5 meters grid size is the reference. For grid sizes between 2.5 and 7.5 meters, the change is less than 0.1%. A grid size of 5 meters for the x-axis is used in the calculations. Figure C-15 shows the relative change of impact volume for one ping as a function of the grid size used for the y-axis. The x-axis grid size is fixed at 5 meters and the y-axis growth factor is 0. The impact volume for a 5 meters grid size is the reference. This figure is very similar to that for the x-axis grid size. For grid sizes between 2.5 and 7.5 meters, the change is less than 0.1%. A grid size of 5 meters is used for the y-axis in our calculations. Figure C-16 shows the relative change of impact volume for one ping as a function of the y-axis growth factor. The x-axis grid size is fixed at 5 meters and the initial y-axis grid size is 5 meters. The impact volume for a growth factor of 0 is the reference. For growth factors from 0 to 0.01, the change is less than 0.1%. A growth factor of 0.005 is used in the calculations.

Figure C-14. Change of Impact Volume as a Function of X-Axis Grid Size

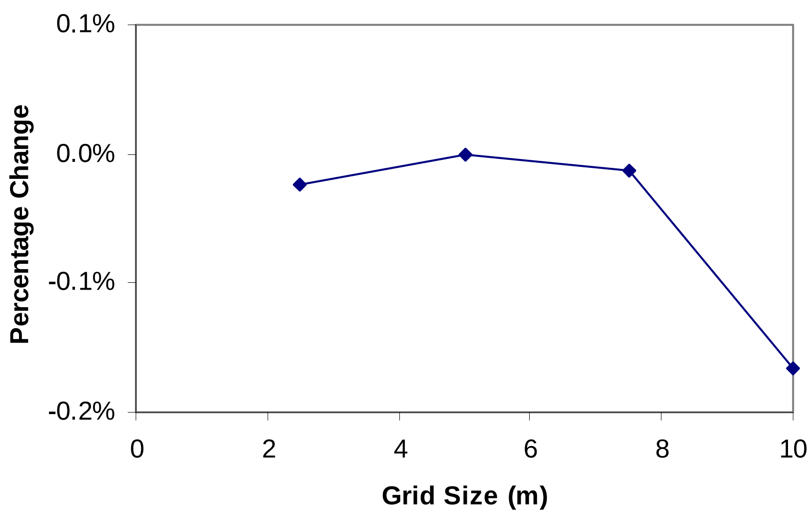


Figure C-15. Change of Impact Volume as a Function of Y-Axis Grid Size

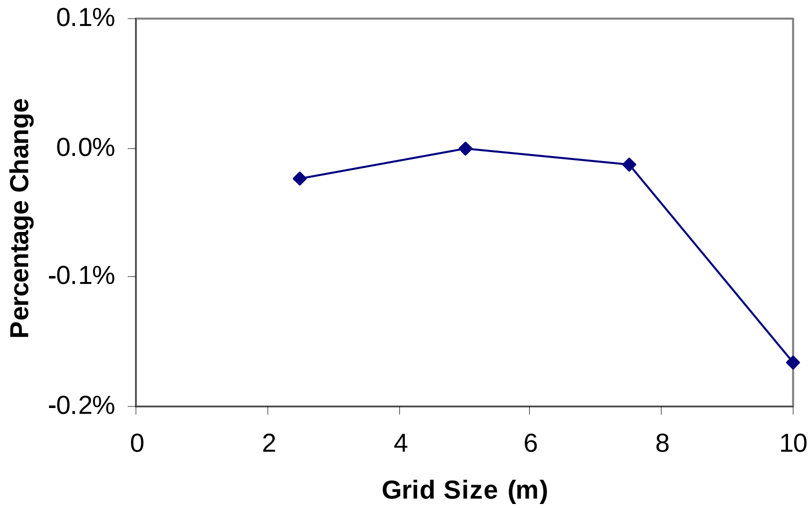
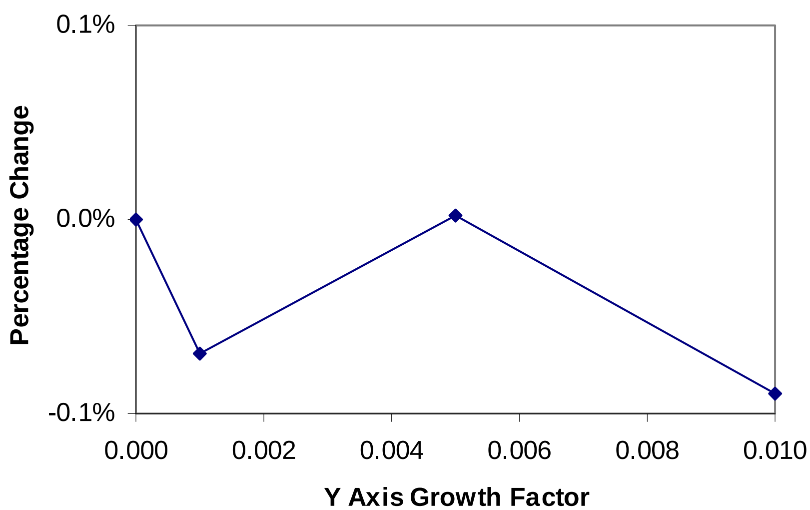
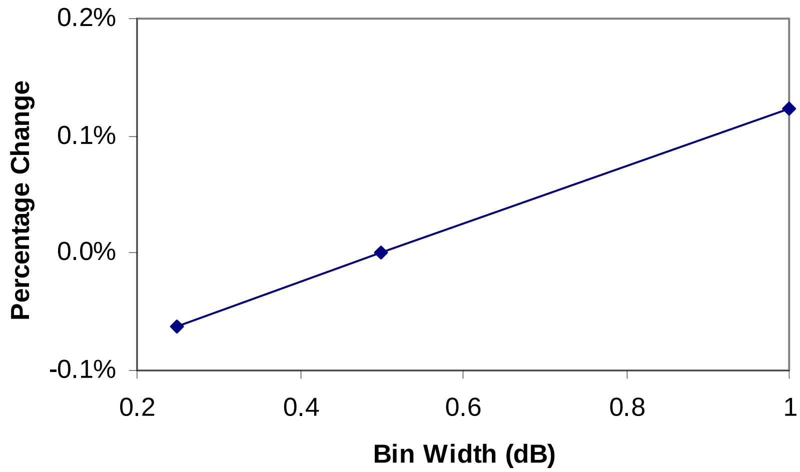


Figure C-16. Change of Impact Volume as a Function of Y-Axis Growth Factor



Another factor influencing the accuracy of the calculation of impact volumes is the size of the bins used for sound pressure level. The sound pressure level bins extend from 100 dB (far lower than required) up to 300 dB (much higher than that expected for any sonar system). Figure C-17 shows the relative change of impact volume for one ping as a function of the bin width. The x-axis grid size is fixed at 5 meters the initial y-axis grid size is 5 meters, and the y-axis growth factor is 0.005. The impact volume for a bin size of 0.5 dB is the reference. For bin widths from 0.25 dB to 1.00 dB, the change is about 0.1%. A bin width of 0.5 is used in our calculations.

Figure C-17. Change of Impact Volume as a Function of Bin Width



Two other issues for discussion are the maximum range (Rmax) and the spacing in range and depth used for calculating TL. The TL generated for the energy accumulation metric is used for risk function analysis. The same sampling in range and depth is adequate for this metric because it requires a less demanding computation (i.e., maximum value instead of accumulated energy). Using the same value of Rmax needs some discussion since it is not clear that the same value can be used for both metrics. Rmax, for a given source, was set so that the TL at Rmax is more than what is needed for the source level to reach the basement value of 120 dB SPL.

The process of obtaining the maximum sound pressure level at each grid point in the volumetric grid is straightforward. The active acoustic source starts at the origin and moves at constant speed along the positive x-axis emitting a burst of energy, a ping, at regularly spaced intervals. For each ping, the distance and horizontal angle connecting the acoustic source to each grid point is computed. Calculating the TL from the source to a grid point has several steps. The TL is made up of the sum of many eigenrays connecting the source to the grid point. The beam pattern of the source is applied to the eigenrays based on the angle at which they leave the source. After summing the vertically beamformed eigenrays on the range mesh used for the TL calculation, the vertically beamformed TL for the distance from the acoustic source to the grid point is derived by interpolation. Next, the horizontal beam pattern of the source is applied using the horizontal angle connecting the acoustic source to the grid point. To avoid problems in extrapolating TL, only use grid points with distances less than R_{max} are used. To obtain the sound pressure level at a grid point, the sound pressure level of the source is reduced by that TL. For the first ping, the volumetric grid is populated by the calculated sound pressure level at each grid point. For the second ping and subsequent pings, the source location increments along the x-axis by the spacing between pings and the sound pressure level for each grid point is again calculated for the new source location. Since the risk function metric uses the maximum of the sound pressure levels at each grid point, the newly calculated sound pressure level at each grid point is compared to the sound pressure level stored in the grid. If the new level is larger than the stored level, the value at that grid point is replaced by the new sound pressure level.

For each bin, a volume is determined by summing the ensonified volumes with a maximum SPL in the bin's interval. This forms the volume histogram shown in Figure C-12. Multiplying by the risk function for the level at the center of a bin gives the impact volume for that bin. The result can be seen in Figure C-13, which is an example of the impact volume as a function of depth.

The impact volume for a acoustic source moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases for the risk function metric is essentially linear with the number of pings. Figure C-18 shows the dependence of impact volume on the number of pings. The function is linear; the slope of the line at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector which contains the hourly impact volumes by depth for a province. Figure C-19 provides an example of an impact volume vector for a particular environment. Given the speed of the acoustic source, the impact volume vector could be displayed as the impact volume vector per kilometer of track. For the NAVSEA NUWC Keyport Range Complex, per-run impact volume vectors are used to calculate effects per run, instead of hourly impact vectors, but the below figures demonstrate the influence of ping number on impact volumes.

Figure C-18. Dependence of Impact Volume on the Number of Pings

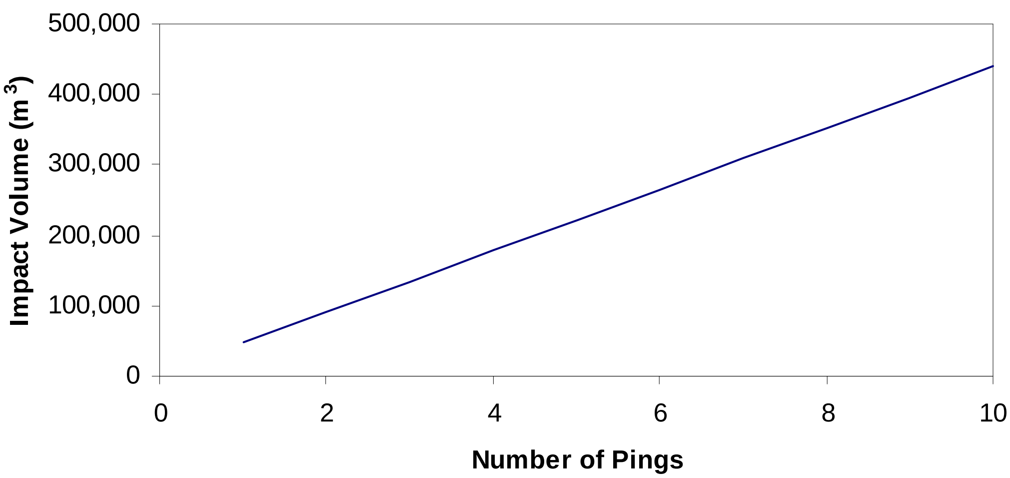
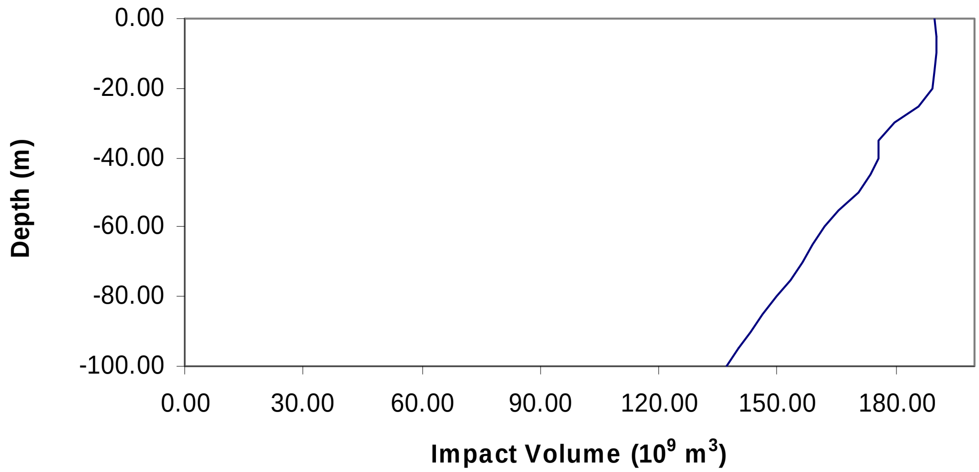


Figure C-19. Example of an Impact Volume Vector



C.6 EXPOSURES/TAKES

This section demonstrates how three-dimensional animal densities (animal density vectors) and the per-run impact volumes can be used together to calculate expected harassments. Also, it defines the animal densities and their depth distributions for the NAVSEA NUWC Keyport Range Complex, and shows how they are used to create animal density vectors. Refer to Appendix D for additional information on marine mammal densities and depth distributions.

C.6.1 Take Estimates

The following sperm whale example demonstrates the methodology used to create a three-dimensional density by merging the area densities with the depth distributions. In the QUTR Site, the sperm whale surface density is 0.0011 whales per square kilometer. From the depth distribution report, "depth distribution for sperm whales based on information in the Amano, Yoshiaka (2003) paper is: 31% in <10 m, 8% in 10-200 m, 9% in 201-400 m, 9% in 401-600 m, 9% in 601-800 m and 34% in >800 m." So the sperm whale density at 0-10 m is 0.0011*0.31/0.01 = 0.0341 per cubic km, at 10-200 m is 0.0011*0.08/0.190 = 0.0004632 per cubic km, and so forth.

In general, the impact volume vector samples depth in finer detail than given by the depth distribution data. When this is the case, the densities are apportioned uniformly over the appropriate intervals. For example, suppose the impact volume vector provides volumes for the intervals 0-2 meters, 2-10 meters, and 10-50 meters. Then for the depth-distributed densities discussed in the preceding paragraph,

- 0.0341 whales per cubic km is used for 0-2 meters,
- 0.0341 whales per cubic km is used for the 2-10 meters, and
- 0.0004632 whales per km^2 is used for the 10-50 meters.

Once depth-varying, three-dimensional densities are specified for each species type, with the same depth intervals and the ensonified volume vector, the density calculations are finished. The expected number of ensonified animals within each depth interval is the ensonified volume at that interval multiplied by the volume density at that interval and this can be obtained as the dot product of the ensonified volume and animal density vectors.

C.6.2 Additional Modeling Considerations in a General Modeling Scenario

When modeling the effect of sound projectors in the water, the ideal task presents modelers with complete *a priori* knowledge of the location of the source(s) and transmission patterns during the times of interest. In these cases, calculation inputs include the details of source path, proximity of shoreline, high-resolution density estimates, and other details of the scenario. However, in the NAVSEA NUWC Keyport Range Complex, there are sound-producing events for which the source locations and transmission patterns are unknown, but still require analysis to predict effects. For these cases, a more general modeling approach is required: "We will be operating somewhere in this large area for X minutes. What are the potential effects on average?"

Modeling these general scenarios requires a statistical approach to incorporate the scenario nuances into harassment calculations. For example, one may ask: "If an animal receives 130 dB SPL when the source passes at closest point of approach (CPA) on Tuesday morning, how do we know it doesn't receive a higher level on Tuesday afternoon?" This question cannot be answered without knowing the path of the source (and several other facts). Because the path of the source is unknown, the number of an individual's re-exposures cannot be calculated directly. But it can, on average, be accounted for by making appropriate assumptions.

Table C-18 lists unknowns created by uncertainty about the specifics of a future proposed action, the portion of the calculation to which they are relevant, and the assumption that allows the effect to be computed without the detailed information:

Table C-18. Unknowns and Assumptions

Unknowns	Relevance	Assumption
Path of acoustic source (esp. with respect to animals)	Ambiguity of multiple exposures, Local population: upper bound of harassments	Most conservative case: sources can be anywhere within range
Source locations	Ambiguity of multiple exposures, land shadow	Equal distribution of action in each range
Direction of source transmission	Land shadow	Equal probability of pointing any direction

The following sections discuss two topics that require action details, and describe how the modeling calculations used the general knowledge and assumptions to overcome the future-action uncertainty with respect to re-exposure of animals, and land shadow.

C.6.2.1 Multiple Exposures in General Modeling Scenario

Consider the following hypothetical scenario. A box is painted on the surface of a well-studied ocean environment with well-known propagation. A sonar-source and 100 whales are inserted into that box and a curtain is drawn. What will happen? This is the general scenario. The details of what will happen behind the curtain are unknown, but the existing knowledge, and general assumptions, can allow for a general calculation of average affects.

For the first period of time, the source is traveling in a straight line and pinging at a given rate. In this time, it is known how many animals, on average, receive their max SPLs from each ping. As long as the source travels in a straight line, this calculation is valid. However, after an undetermined amount of time, the source will change course to a new and unknown heading.

If the source changes direction 180 degrees and travels back through the same swath of water, all the animals the source passes at closest point of approach (CPA) before the next course change have already been exposed to what will be their maximum SPL, so the population is not "fresh." If the direction does not change, only new animals will receive what will be their maximum SPL from that source (though most have received sound from it), so the population is completely "fresh." Most source headings lead to a population of a mixed "freshness," varying by course direction. Since the route and position of the source over time are unknown, the freshness of the population at CPA with the source is unknown. This ambiguity continues through the remainder of the exercise.

What is known? The source and, in general, the animals remain in the vicinity of the range. Thus, if the farthest range to a possible effect from the source is X km, no animals farther than X km outside of the range site can be harassed. The intersection of this area with a given animal's habitat multiplied by the density of that animal in its habitat represents the maximum number of animals that can be harassed by activity in that RANGE SITE, which shall be defined as "the local population." Two details: first, this maximum should be adjusted down if a risk function is being used, because not 100% of animals within X km of the RANGE SITE border will be harassed. Second, it should be adjusted up to account for animal motion in and out of the area. In the Keyport and Dabob ranges, land masses interfere with propagating sound before it can travel a long distance. In those areas, the initial area of effect is small, because land constrains sound propagation, so the number of animals that could swim into the area drive the upper bound of harassments. In the QUTR site, however, the range alternatives are large, and not impeded by land, so in the QUTR site the animal motion does not have as great an effect on the upper bound of harassments.

The ambiguity of population freshness throughout the exercise means that multiple exposures cannot be calculated for any individual animal. It must be dealt with generally at the population level.

Solution to the Ambiguity of Multiple Exposures in the General Modeling Scenario

At any given time, each member of the population has received a maximum SPL (possibly zero) that indicates the probability of harassment in the exercise. This probability indicates the contribution of that individual to the expected value of the number of harassments. For example, if an animal receives a level that indicates 50% probability of harassment, it contributes 0.5 to the sum of the expected number of harassments. If it is passed later with a higher level that indicates a 70% chance of harassment, its contribution increases to 0.7. If two animals receive a level that indicates 50% probability of harassment, they together contribute 1 to the sum of the expected number of harassments. That is, we statistically expect exactly one of them to be harassed. Let the expected value of harassments at a given time be defined as "the harassed population" and the difference between the local population (as defined above) and the harassed population be defined as "the unharassed population." As the exercise progresses, the harassed population will never decrease and the unharassed population will never increase.

The unharassed population represents the number of animals statistically "available" for harassment. Since we do not know where the source is, or where these animals are, we assume an average (uniform) distribution of the unharassed population over the area of interest. The densities of unharassed animals are lower than the total population density because some animals in the local population are in the harassed population.

Density relates linearly to expected harassments. If action A in an area with a density of 2 animals per square kilometer produces 100 expected harassments, then action A in an area with 1 animal per square kilometer produces 50 expected harassments. The modeling produces the number of expected harassments per ping starting with 100% of the population unharassed. The next ping will produce slightly fewer harassments because the pool of unharassed animals is slightly less.

For example, consider the case where 1 animal is harassed per ping when the local population is 100, 100% of which are initially unharassed. After the first ping, 99 animals are unharassed, so the number of animals harassed during the second ping are

$$10\left(\frac{99}{100}\right) = 1(.99) = 0.99 \text{ animals}$$

and so on for the subsequent pings.

Mathematics

A closed form function for this process can be derived as follows.

Define $P_n =$ unharassed population after ping n

Define $H =$ number of animals harassed in a ping with 100% unharassed population

$P_0 =$ local population

$$P_1 = P_0 - H$$

$$P_2 = P_1 - H\left(\frac{P_1}{P_0}\right)$$

...

$$P_n = P_{n-1} - H\left(\frac{P_{n-1}}{P_0}\right)$$

Therefore,

$$P_n = P_{n-1}\left(1-\left(\frac{H}{P_0}\right)\right) = P_{n-2}\left(1-\left(\frac{H}{P_0}\right)\right)^2 = \ldots = P_0\left(1-\left(\frac{H}{P_0}\right)\right)^n$$

Thus, the total number of harassments depends on the per-ping harassment rate in an unharassed population, the local population size, and the number of operation hours.

Local Population: Upper Bound on Harassments

As discussed above, Navy planners have confined period of acoustic source use to operation areas. The size of the harassed population of animals for an action depends on animal re-exposure, so uncertainty about the precise source path creates variability in the "harassable" population. Confinement of active acoustics use to an operating area allows modelers to compute an upper bound, or worst case, for the number of harassments with respect to location uncertainty. This is done by assuming that there is an active acoustic source transmitting from each point in the confined area throughout the action length.

NMFS has defined a twenty-four hour "refresh rate," or amount of time in which an individual can be harassed no more than once. As shown in Table C-19, Navy has determined that, in a twenty-four hour period, all acoustic source operations in the NAVSEA NUWC Keyport Range Complex transmit for a subset of that time.

Table C-19. Duration of Acoustic Source Use During 24-hour Period

System	Longest continuous interval
S1	4 hours
S2	2 hours
S3	2 hours
S4	2 hours
S5	20 minutes
S6	10 minutes
S7	10 minutes
S8	10 minutes

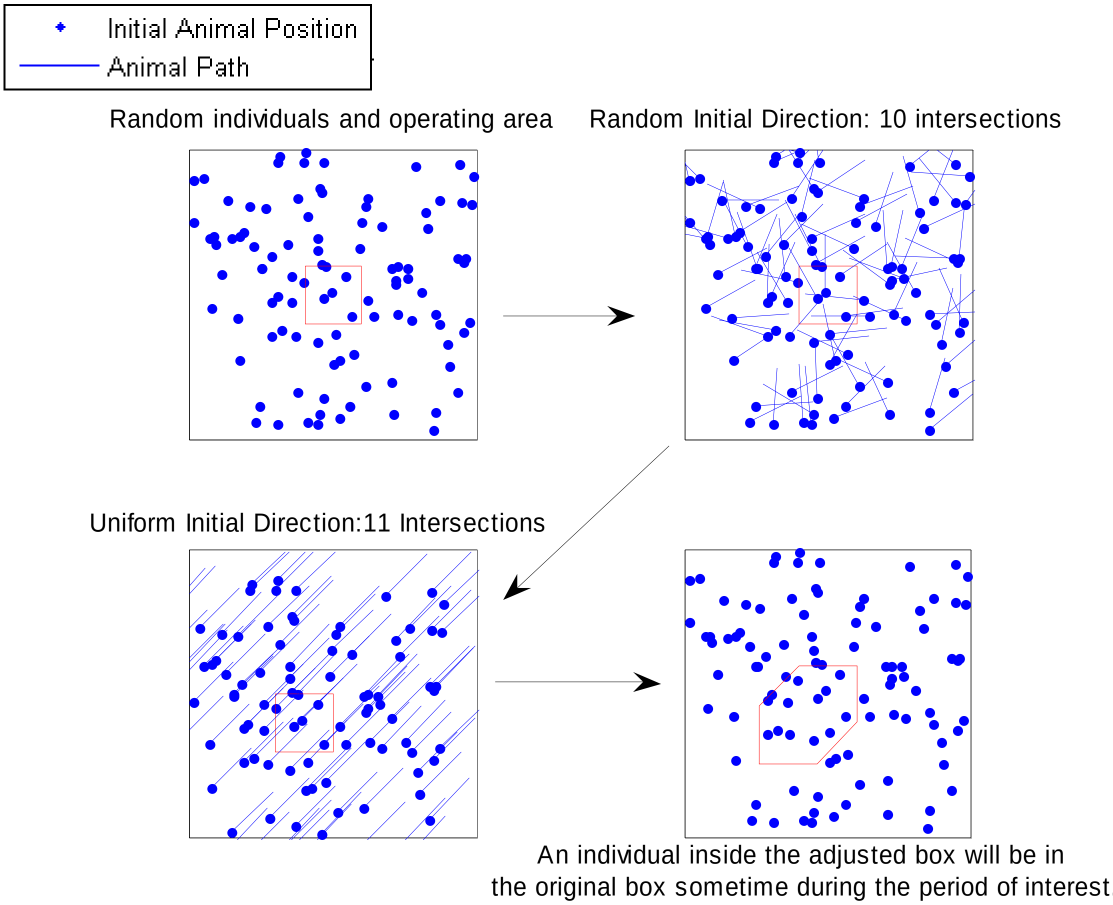
Creating the most conservative source position by assuming that an acoustic source transmits from each point on the range simultaneously can produce an upper bound on harassments for a single ping, but animal motion over the periods in Table C-19 can bring animals into range that otherwise would be out of the harassable population.

Animal Motion Expansion

Though animals often change course to swim in different directions, straight-line animal motion would bring the more animals into the harassment area than a "random walk" motion model. Since precise and accurate animal motion models exist more as speculation than documented fact and because the modeling requires an undisputable upper bound, calculation of the upper bound for NAVSEA NUWC Keyport Range Complex modeling areas uses a straight-line animal motion assumption. This is a conservative assumption.

For a circular area, the straight-line motion with initial random direction assumption produces an identical result to the initial fixed direction. Since the ranges are non-circular polygons, choosing the initial fixed direction as perpendicular to the longest diagonal produces greater results than the initial random direction. Thus, the product of the longest diagonal and the distance the animals move in the period of interest gives an overestimate of the expansion in range modeling areas due to animal motion. The NAVSEA NUWC Keyport Range Complex extensions use this overestimate for the animal-motion expansion. Figure C-20 illustrates an example of the overestimation, which occurs during the second arrow.

Figure C-20. Process of Overestimating Individuals Present in Area at Any Time.



Risk Function Expansion

The expanded area contains the number of animals that will enter the range over the period of interest. However, an upper bound on harassments must also include animals outside the area that would be affected by a source transmitting from the area's edge. A gross overestimation could simply include all area with levels greater than the risk function basement. In the case of the QUTR Site, this would include all area within approximately 65 km from the edge of the adjusted box. This basic method would give a crude and inaccurately high upper bound, since only a fraction of the population is affected in much of that area. A more refined upper bound on harassments can be found by maintaining the assumption that a acoustic source is transmitting from each point in the adjusted box and calculating the expected ensonified area.

The expected lateral range from the edge of a polygon to the cutoff range can be expressed as,

$$\int_{0}^{L^{-1}(120dB)} D(L(r))dr ,$$

where D is the risk function with domain in level and range in probability, L is the SPL function with domain in range and range in level, and r is the range from the acoustic source operating area.

At the corners of the polygon, additional area can be expressed as

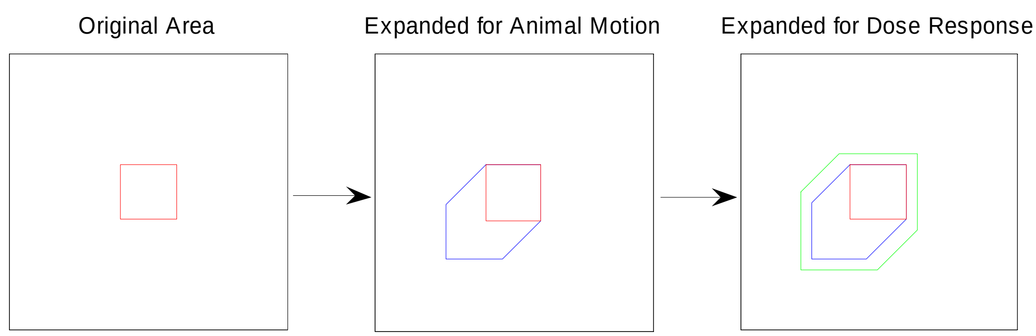
$$\frac{[\pi-\theta]\int_{0}^{L^{-1}(120dB)} D(L(r))rdr}{2\pi}$$

with D, L, and r as above, and θ the inner angle of the polygon corner, in radians.

For the risk function and transmission loss of the NAVSEA NUWC Keyport Range Complex, this method adds an area equivalent by expanding the boundaries of the adjusted box by four kilometers. The resulting shape, the adjusted box with a boundary expansion of 4 km, does not possess special meaning for the problem. But the number of individuals contained by that shape, as demonstrated above, is an overestimate of the number of harassments that would occur if acoustic sources transmitted continuously from each point in the range over the exercise length, an upper bound on harassments for that operation.

The plots in Figure C-21 illustrate the growth of area for the sample case above. The shapes of the boxes are unimportant. The area after the final expansion, though, gives an upper bound on the "harassable," or unharassed population.

Figure C-21. Process of Expanding Area to Create Upper Bound of Harassments



Example Case

Consider a sample case from the QUTR Site with Kalaloch extension: for the most powerful source, S6, the expected summer rate of harassment for Pacific whitesided dolphins is approximately 0.58743378 harassments per ping. The exercise will transmit acoustic source pings for ten minutes in a 24 hour period, as given in Table C-19 above, with 2 pings per minute, a total of 2*10=20 pings in a 24 hour period.

The QUTR Site with Kalaloch extension has an area of approximately 9033 square kilometers and a largest side of 300 km. Adjusting this with straight-line (upper bound) animal motion of 5.5 kilometers per hour for 10 minutes, or 0.167 hours, animal motion adds 300*5.5*0.167= 255 square kilometers to the area. Using the risk function to calculate the expected range outside the SOA adds another 2475 square kilometers, bringing the total upper-bound of the affected area to 11,733 km^2.

For this analysis, whitesided dolphins have an average density of 0.1929 animals per square kilometer in the QUTR Site with Kalaloch extension, so the upper bound number of whitesided dolphins that can be affected by S5 activity in the QUTR Site with Kalaloch Extension during a 24 hour period is 11,733 *0.1929 = 2263.3 dolphins.

In the first ping, 0.58743378 whitesided dolphins will be harassed. With the second ping,

$0.58743378 \left(\frac{2263.3-0.58743378}{2263.3}\right)=0.5873$ whitesided dolphins will be harassed. Using the formula derived above, after 10 minutes of continuous operation, the remaining **unharassed** population is

$$P_{240}=P_0\left(1-\left(\frac{h}{P_0}\right)\right)^{20}=2263.3\left(1-\left(\frac{.587433781}{2263.3}\right)\right)^{20}\approx 2251.6$$

So the harassed population will be 2263.3-2251.6=11.7 animals.

Contrast this with linear accumulation of harassments without consideration of the local population and the dilution of the unharassed population:

Harassments = 0.58743378 *20=11.748

C.6.2.2 Land Shadow

The risk function considers harassment possible if an animal receives 120 dB sound pressure level, or above. In the open ocean of the QUTR Site, this can occur as far away as 65 km, so over a large "effect" area, acoustic source sound could, but does not necessarily, harass an animal. The harassment calculations for a general modeling case must assume that this effect area covers only water fully populated with animals, but in some portions of the NAVSEA NUWC Keyport Range Complex, particularly the inshore ranges, land partially encroaches on the area, obstructing sound propagation.

As discussed in the introduction of "Additional Modeling Considerations..." Navy planners do not know the exact location and transmission direction of the acoustic sources at future times. These factors however, completely determine the interference of the land with the sound, or "land shadow," so a general modeling approach does not have enough information to compute the land shadow effects directly. However, modelers can predict the reduction in harassments at any point due to land shadow for different pointing directions and use expected probability distribution of activity to calculate the average land shadow for operations in each range.

For the ranges, in each alternative, the land shadow is computed over a dense grid in each operations area. The grid for the QUTR Site is shown in Figure C-22.

For each grid point, the land shadow is computed by combining the distance to land and the azimuth coverage. The process finds all of the points within 65 km of the gridpoint, as shown in Figure C-23, in an example from the extended QUTR Site Ocean City alternative.

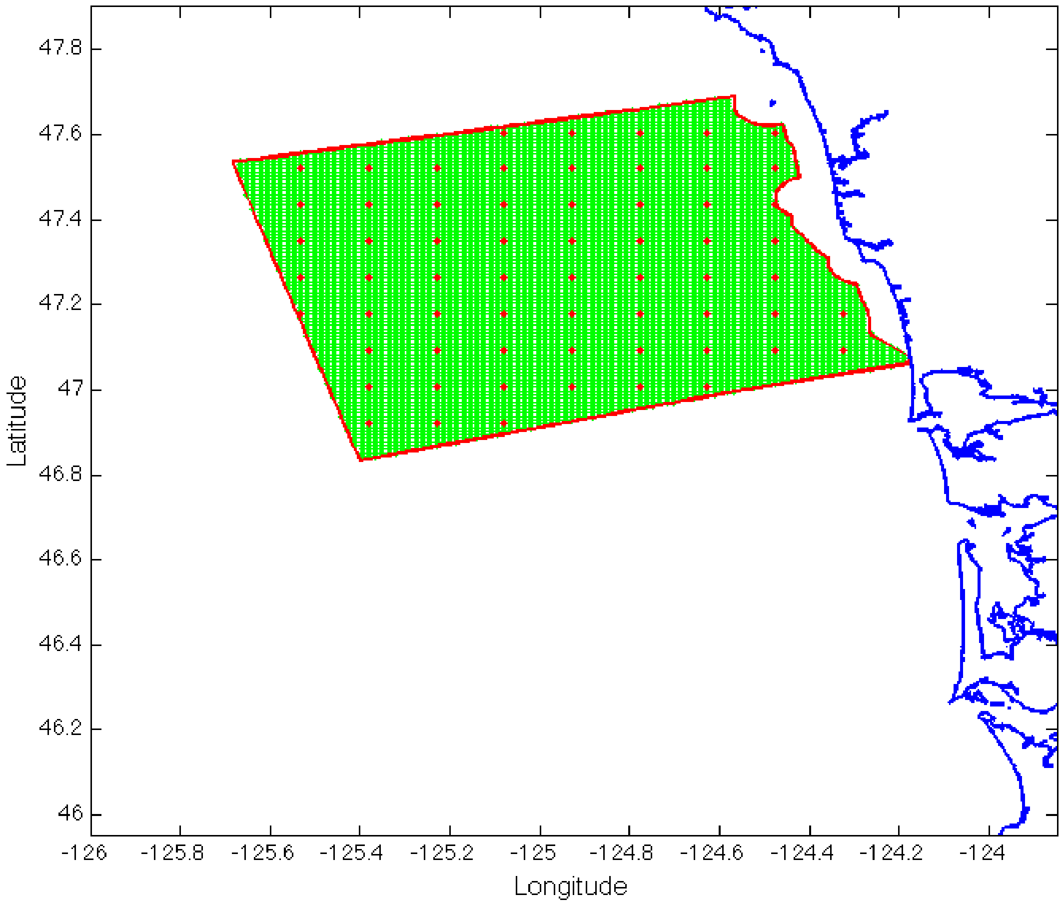


Figure C-22. Grid for an extended QUTR Site with Ocean City Alternative. The dense grid is shown by the near-continuous green dots.
For illustrative purposes, every 25th point is shown as a red cross.

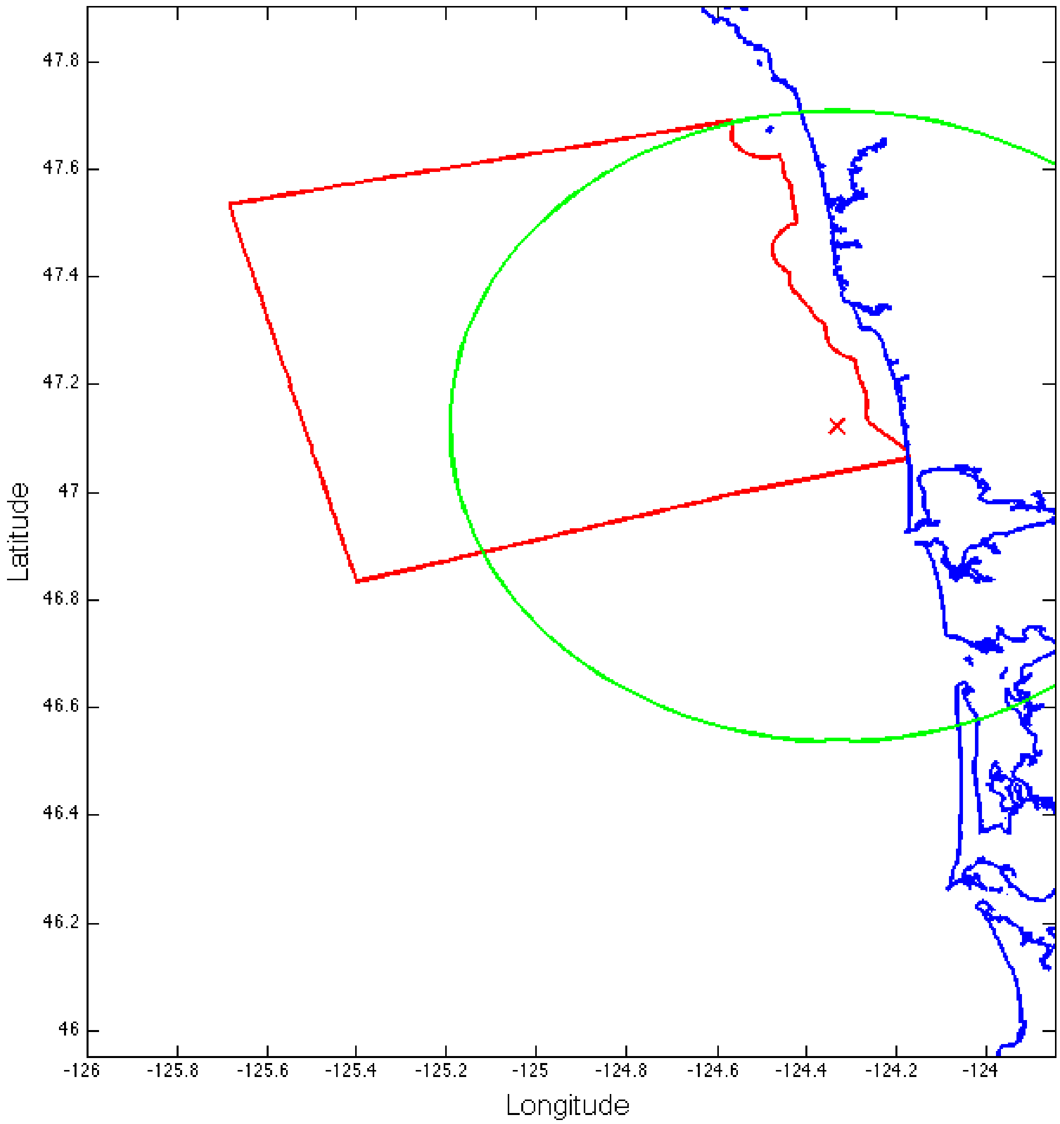


Figure C-23. Illustration of the Land Shadow Calculation. The red box is the operations area. The red X is one grid point, with the green circle corresponding to a radius of 65 km from the grid point.

For each of the coastal points that are within 65 km of the grid, the azimuth and distance is computed. In the computation, only the minimum range at each azimuth is computed. The minimum range compared with azimuth for the sample point is shown in Figure C-24.

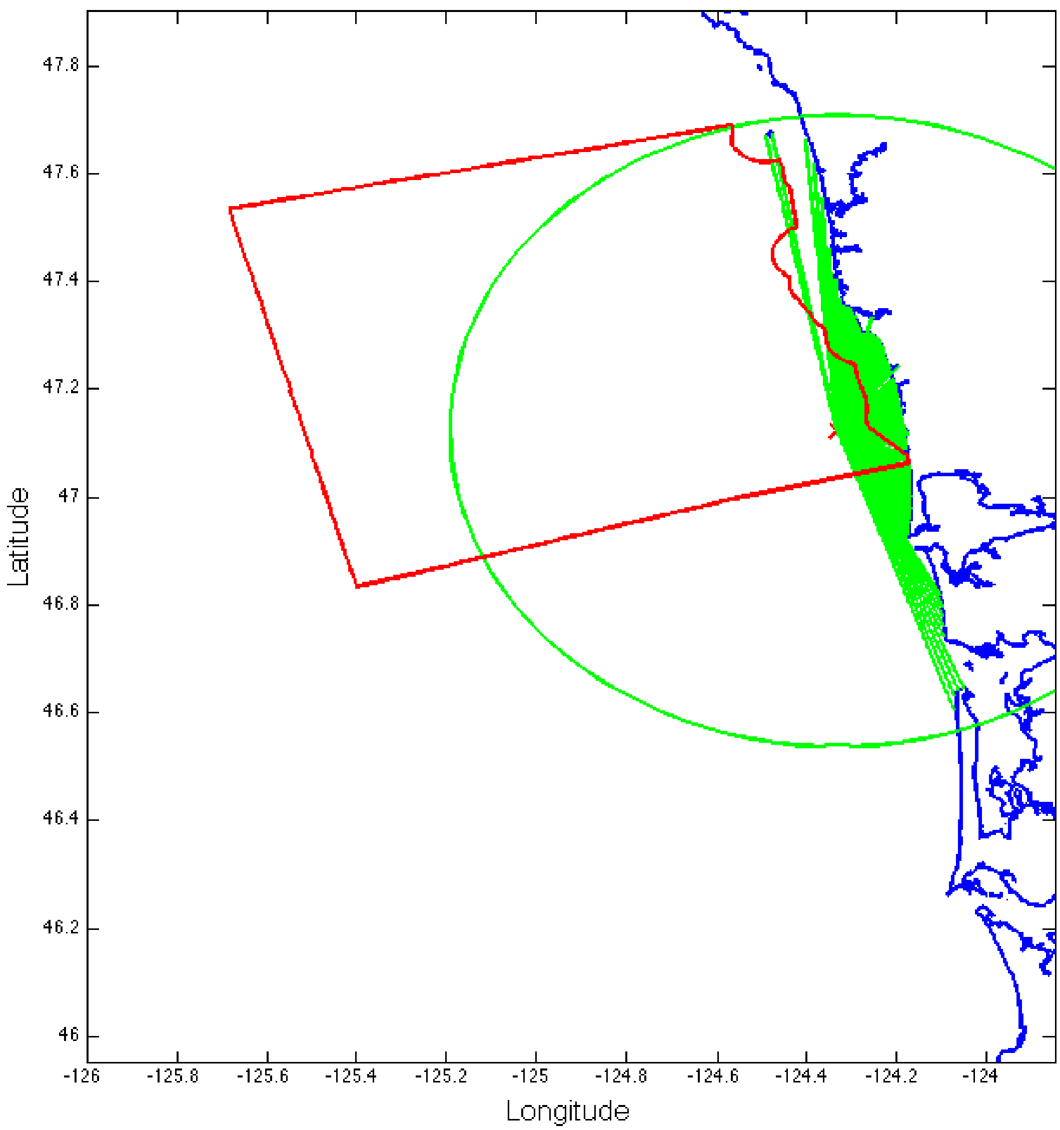


Figure C-24. The Nearest Point at Each Azimuth (with 1° spacing) to a Sample Grid Point (red X) is shown by the green lines.

Now, the average of the distances to shore, along with the angular profile of land is computed (by summing the unique azimuths that intersect the coast) for each grid point. The values are then used to compute the land shadow for the grid points.

Computing the Land Shadow Effect at Each Grid Point

The effect of land shadow is computed by determining the levels, and thus the distances from the sources, that the harassments occur. Table C-20 and Figure C-25 portray a mathematical extrapolation of the distances and levels at which harassments occur, with average propagation in the NAVSEA NUWC Keyport Range Complex.

Table C-20. Behavioral Harassments at each Received Level Band from S6

Received Level (dB SPL)	Distance at which Levels Occur in Range Site	Percent of Harassments Occurring at Given Levels
Below 150	4 km - 12 km	< 1 %
150>Level>160	2.3 km – 4 km	10 %
160>Level>170	1.0 km – 2.3 km	35 %
170>Level>180	400 m – 1000 m	33 %
180>Level>190	140 m – 400 m	15 %
190>Level>200	45 m – 140 m	6 %
Above 200	0 m – 45 m	<1 %

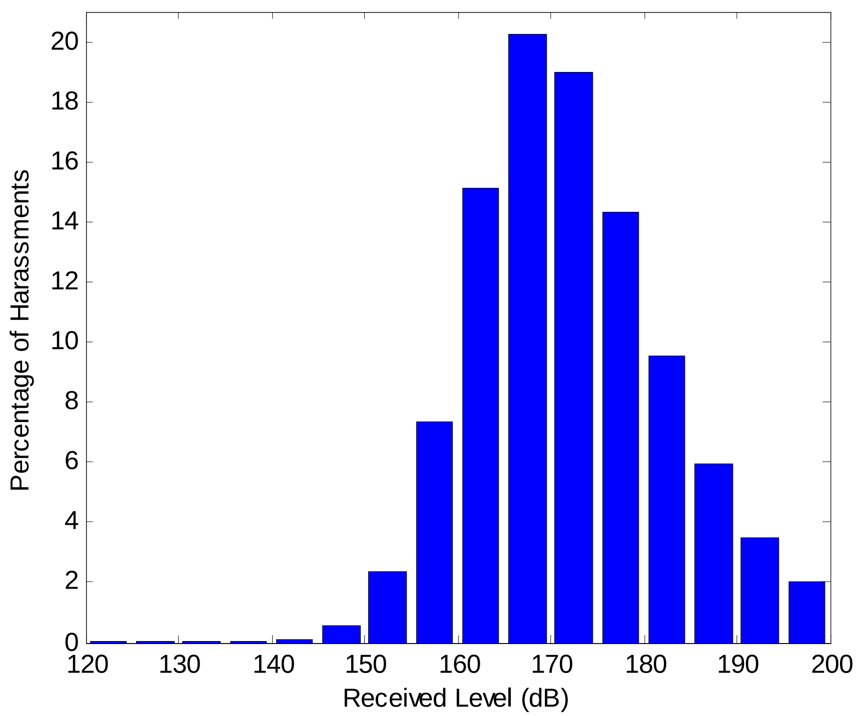


Figure C-25. The Percentage of Behavioral Harassments for Every 5 degree Band of Received Level from Acoustic Source S6

With the data used to produce the previous figure, the average effect reduction across season for a sound path blocked by land can be calculated. As shown in Figure C-26 for the example of acoustic source S6, approximately 86% of harassments occur within 2 kilometers of the source; therefore, a sound path blocked by land at 2 kilometers will, on average, cause approximately 86% the effect of an unblocked path.

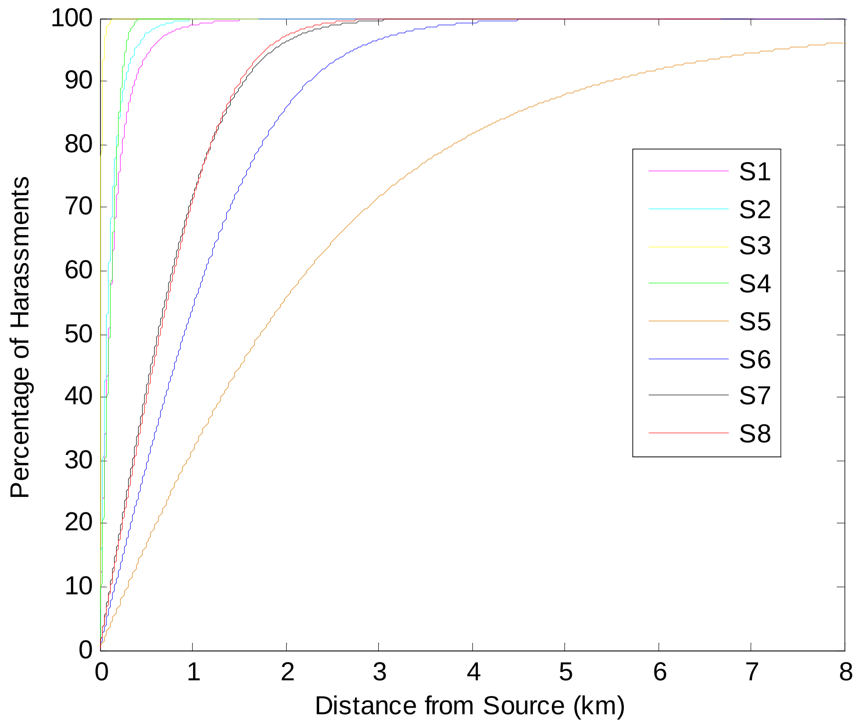


Figure C-26. Average Percentage of Harassments Occurring Within a Given Distance

As described above, the mapping process determines the angular profile of and distance to the coastline(s) from each grid point. The distance determines the reduction due to land shadow when the acoustic source is pointed in that direction. The angular profile determines the probability that the acoustic source is pointed at the coast.

Define θ_n = angular profile of coastline at point n in radians

Define r_n = mean distance to shoreline

Define A(r) = average effect adjustment factor for sound blocked at distance r

The land shadow at point n can be approximated by $A(r_n)\theta_n/(2\pi)$. For illustration, the following 9 plots (Figures C-27 to C-35) display the land shadow reduction factor at each point with the use of source S5 in each existing range site and for each proposed extension alternative. The white portions of the plot indicate the areas outside the range and the blue lines indicate the coastline. The color plots inside the ranges give the land shadow factor at each point. The average land shadow factor for the range will modify the per-ping harassment.

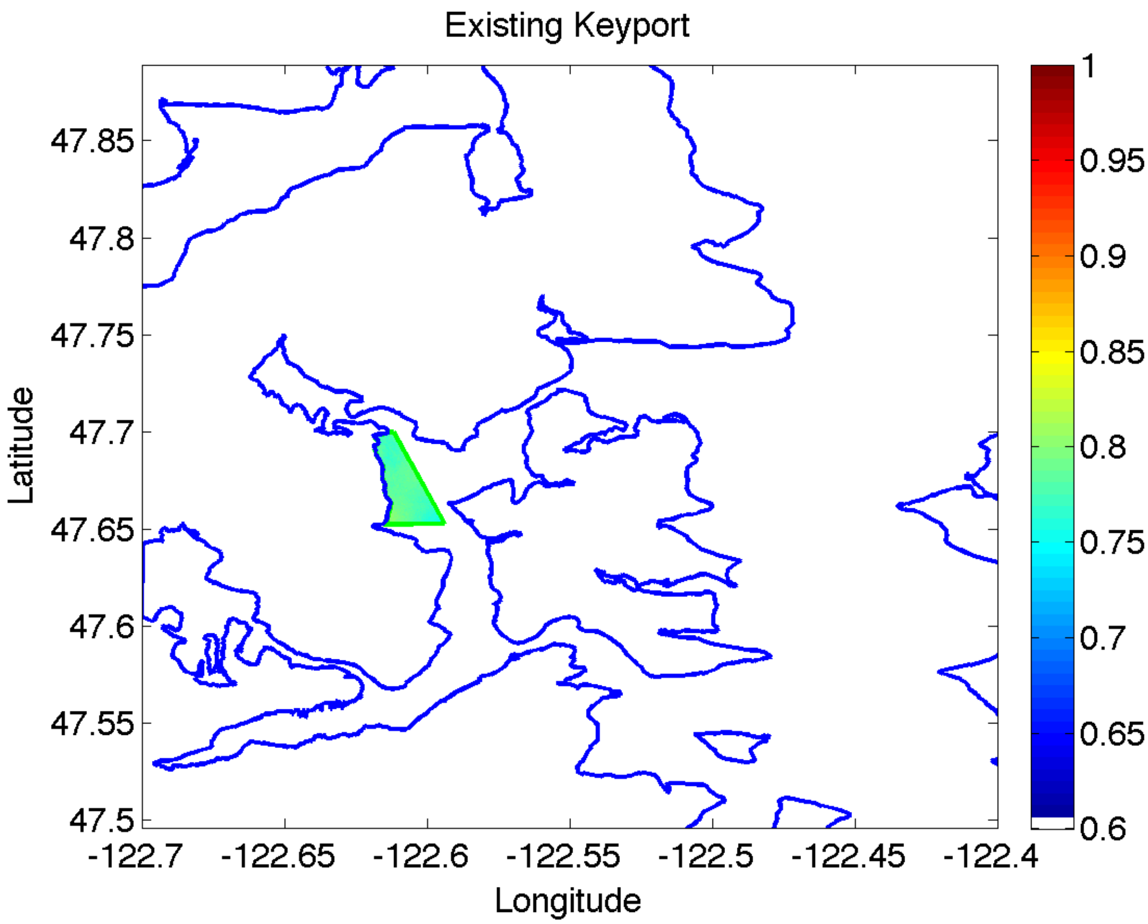


Figure C-27. Land Shadow Factor for Source S5 for grid in Keyport Existing

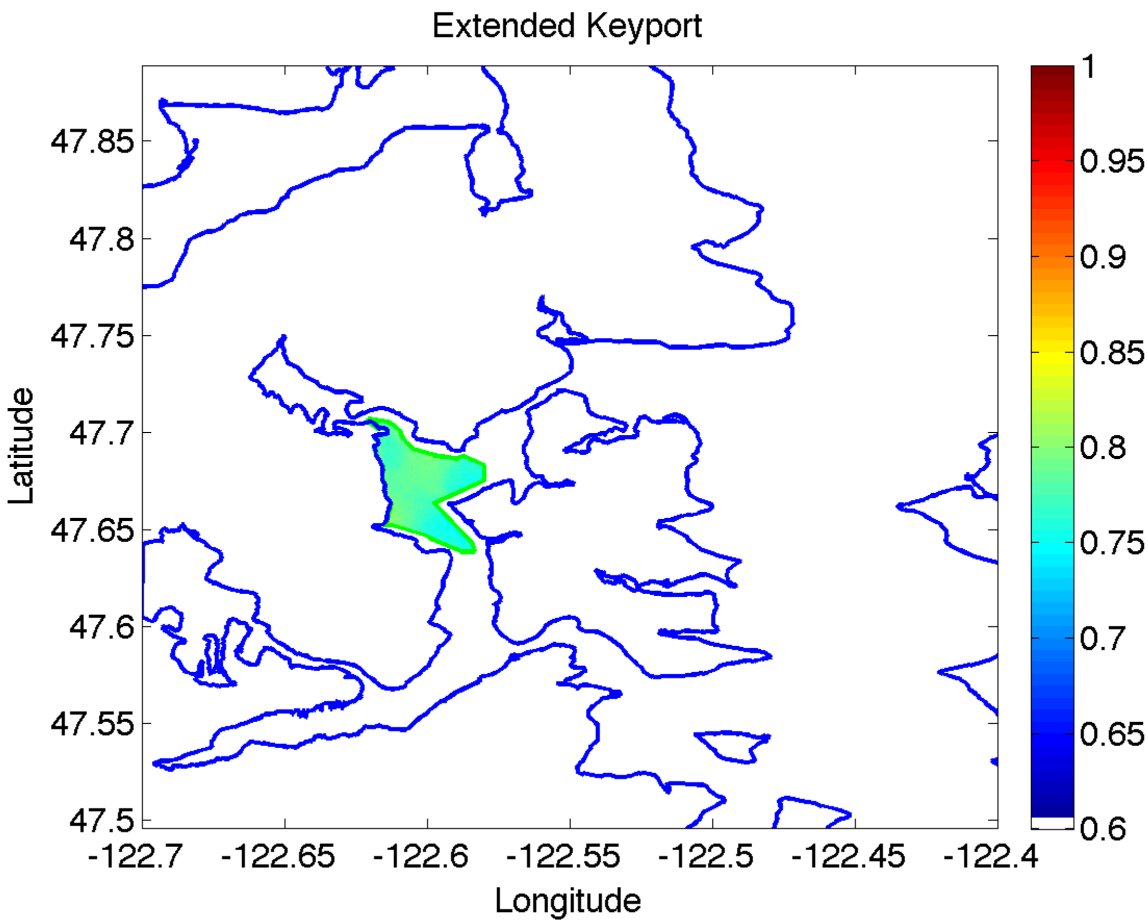


Figure C-28. Land Shadow Factor for Source S5 for grid in Keyport Extended

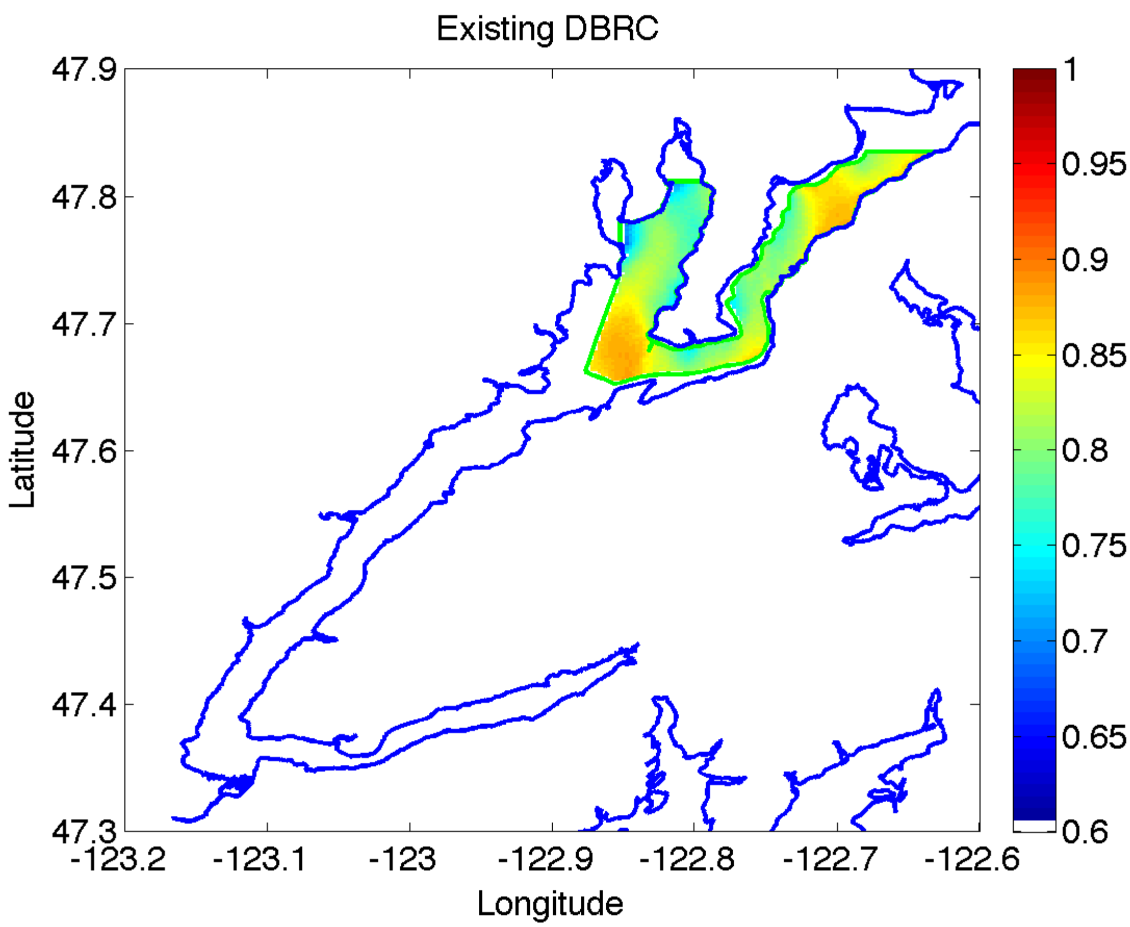


Figure C-29. Land Shadow Factor for Source S5 for grid in DBRC Existing

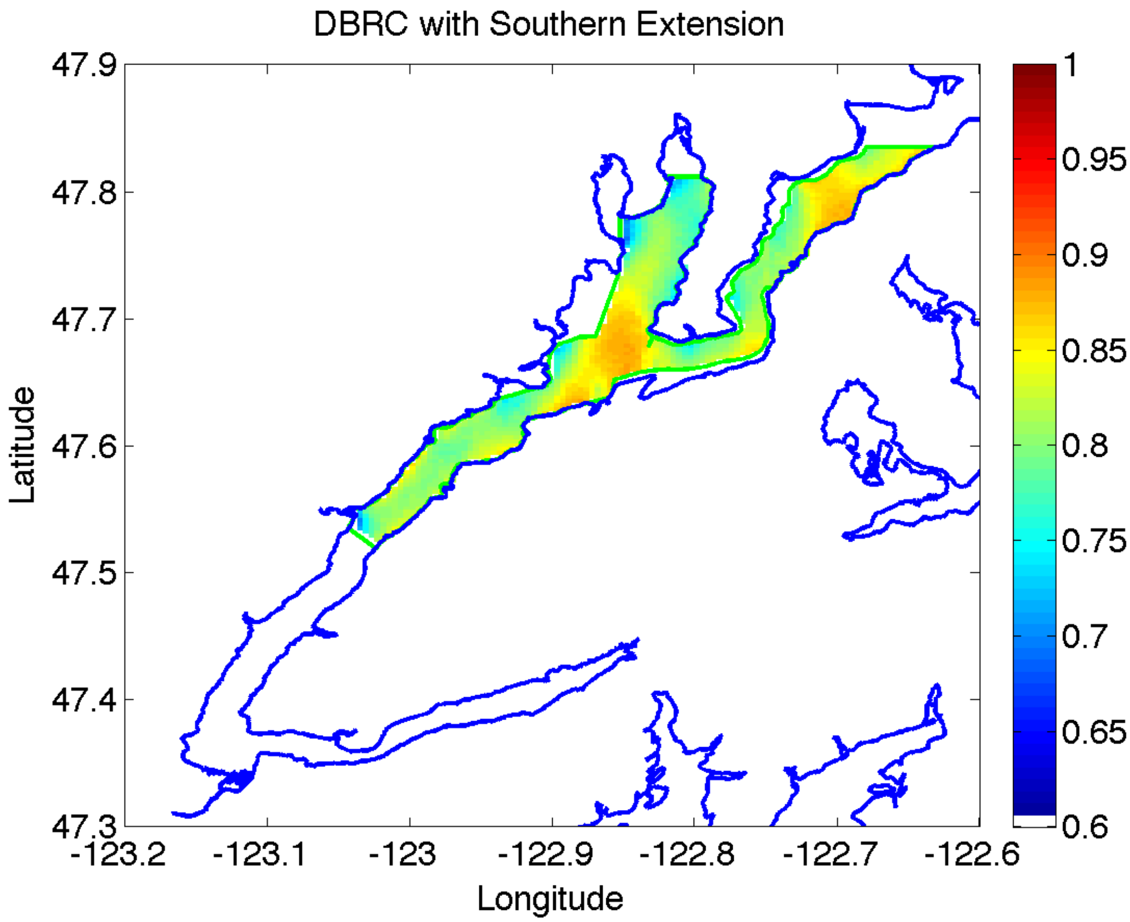


Figure C-30. Land Shadow Factor for Source S5 for grid in DBRC Southern Extension

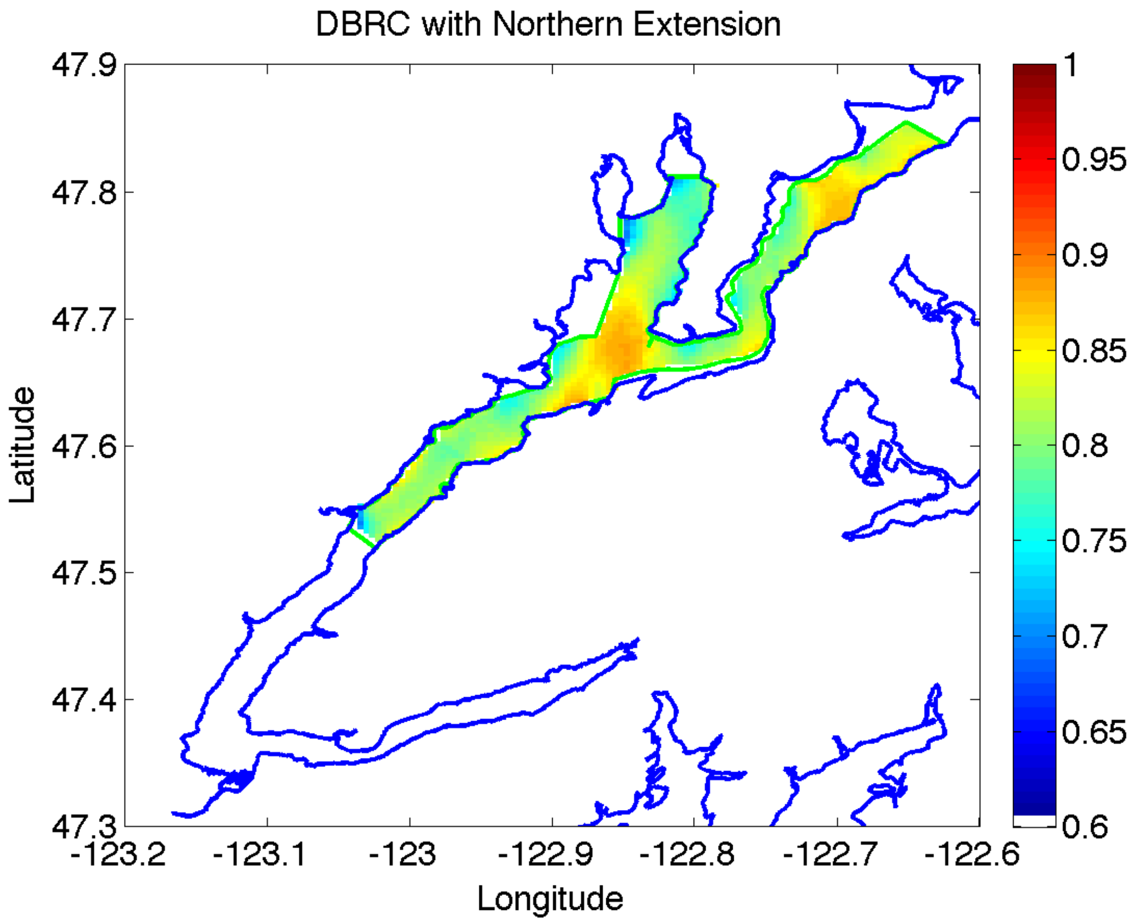


Figure C-31. Land Shadow Factor for Source S5 for grid in DBRC Southern and Northern Extensions

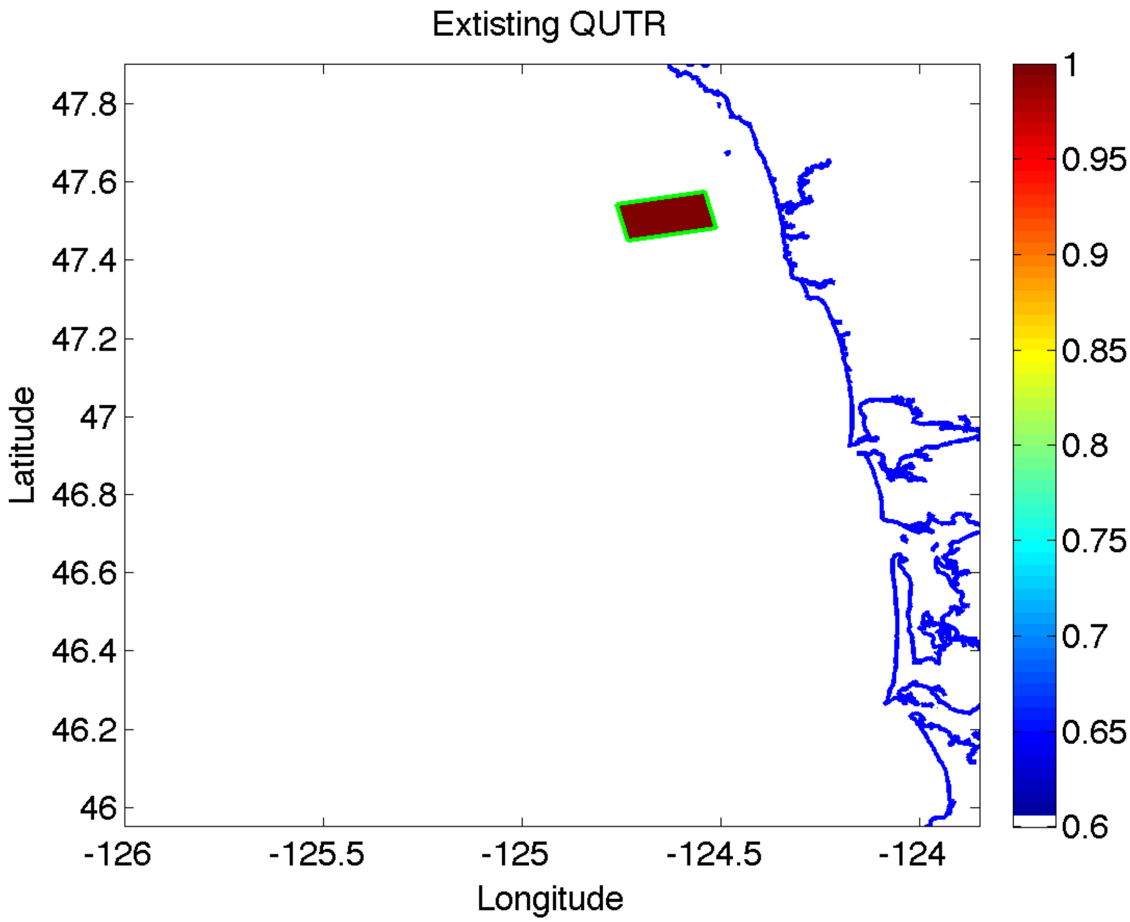


Figure C-32. Land Shadow Factor for Source S5 for grid in QUTR Site Existing

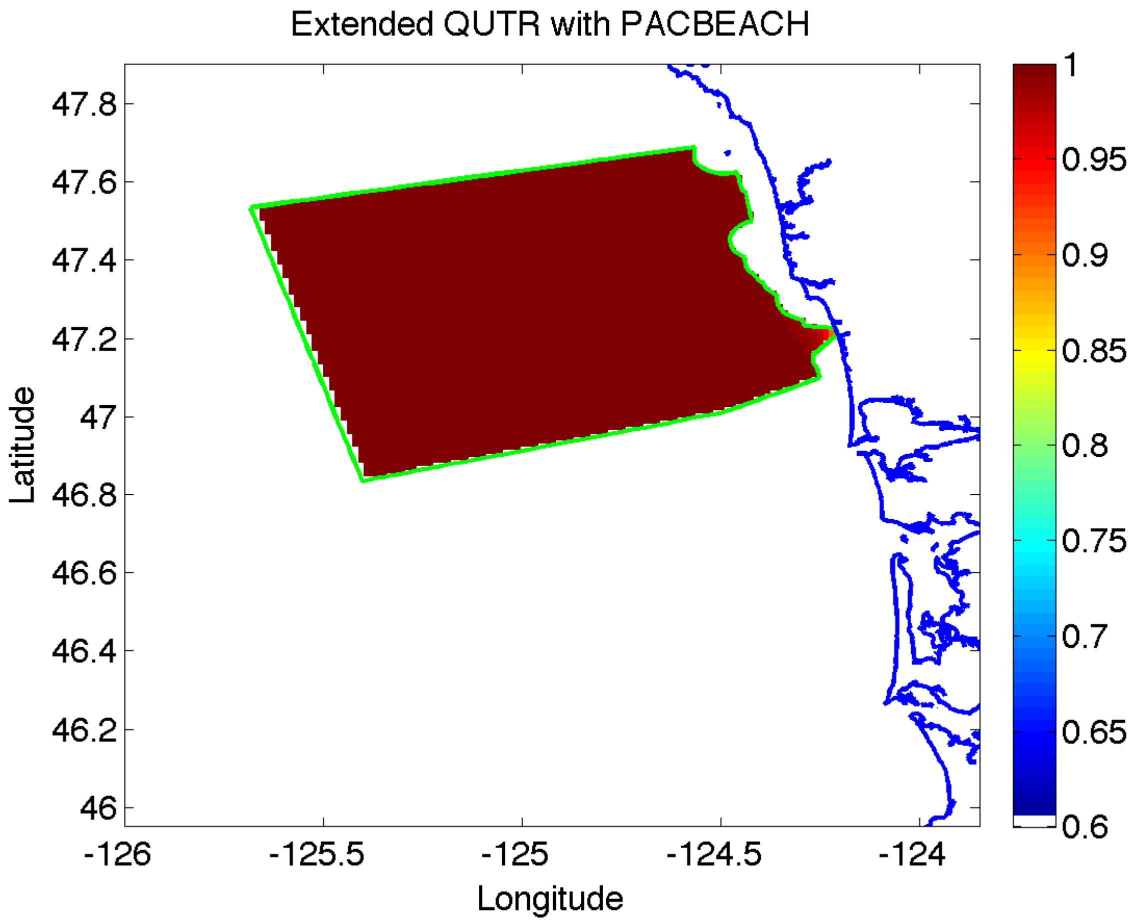


Figure C-33. Land Shadow Factor for Source S5 for grid in QUTR site Pacific Beach Extension

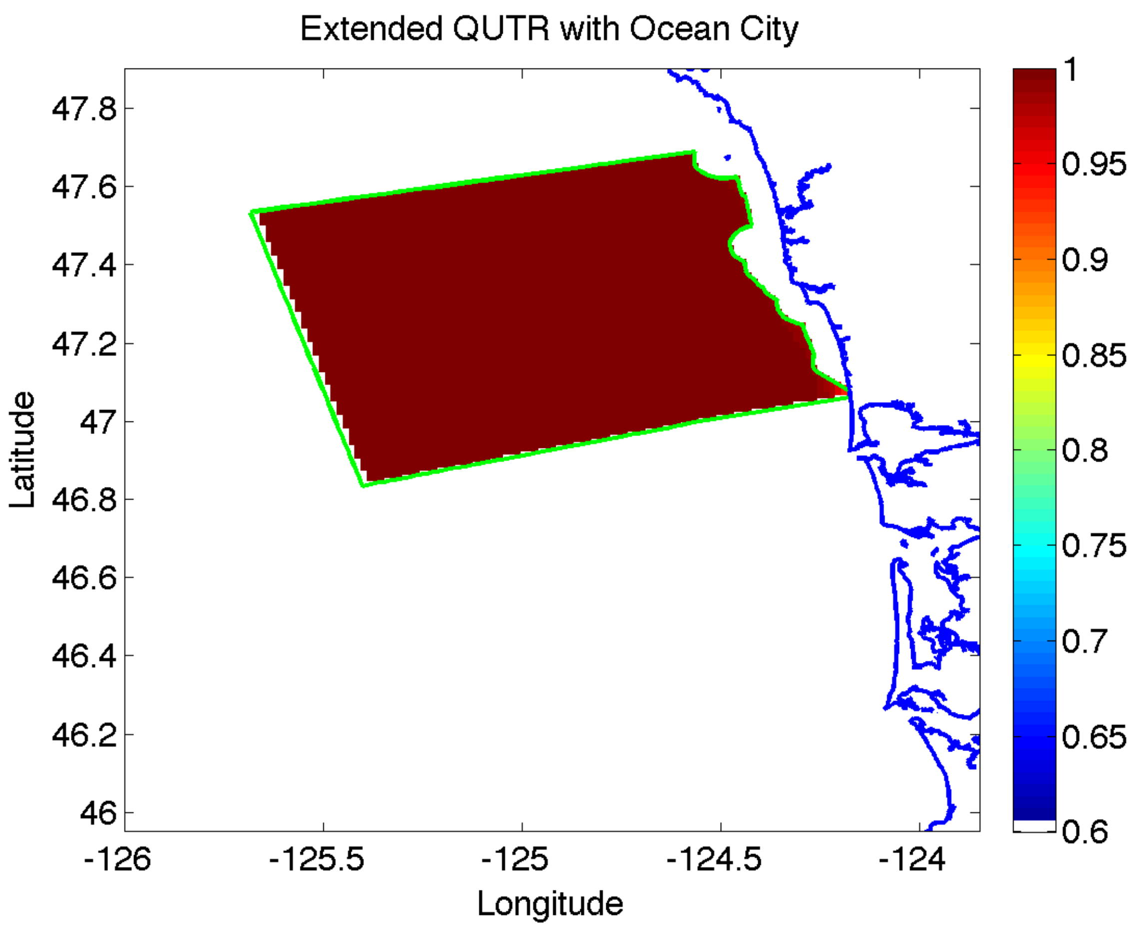


Figure C-34. Land Shadow Factor for Source S5 for grid in QUTR site Ocean City Extension

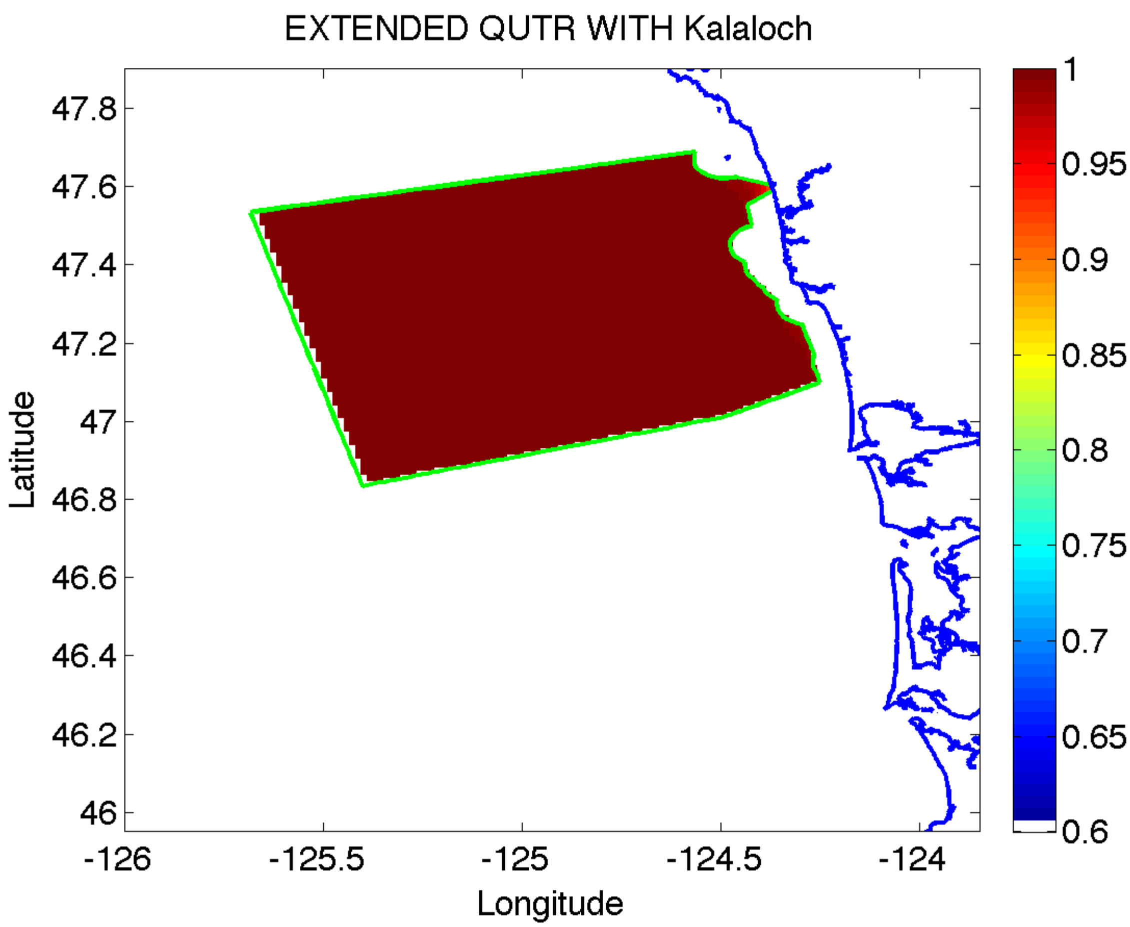


Figure C-35. Land Shadow Factor for Source S5 for grid in QUTR site Kalaloch Extension

The average land shadow for each existing and proposed range is calculated by averaging the average land shadow at each point. Table C-21 gives the average factor for each area.

Table C-21. TL Depth and Range Sampling Parameters by Acoustic Source Type

	S1	S2	S3	S4	S5	S6	S7	S8
DBRC with Northern Extension	0.9978	0.9991	1.0000	0.9995	0.8171	0.9392	0.9698	0.9709
DBRC with Southern Extension	0.9978	0.9991	1.0000	0.9995	0.8166	0.9388	0.9695	0.9706
EXTENDED QUTR WITH Kalaloch	1.0000	1.0000	1.0000	1.0000	0.9997	1.0000	1.0000	1.0000
Existing DBRC	0.9980	0.9992	1.0000	0.9996	0.8187	0.9442	0.9729	0.9739
Existing Keyport	0.9965	0.9984	1.0000	0.9991	0.7799	0.9173	0.9559	0.9569
Extended Keyport	0.9972	0.9988	1.0000	0.9995	0.7754	0.9195	0.9588	0.9599
Extended QUTR with Ocean City	1.0000	1.0000	1.0000	1.0000	0.9997	1.0000	1.0000	1.0000
Extended QUTR with PACBEACH	1.0000	1.0000	1.0000	1.0000	0.9997	1.0000	1.0000	1.0000
Extisting QUTR	1.0000	1.0000	1.0000	1.0000	0.9999	1.0000	1.0000	1.0000

C.6.3 Estimating Accumulated Effects on Marine Mammals

Until now, the acoustic energy flux density and risk function models have been focused on determining the volume of ensonified water above certain threshold levels for a single representative source for a single run for each species of animal. After considering effects like marine-mammal movement, multiple exposures within a small period of time and land-shadowing, this volume of water is multiplied by the density of each appropriate marine mammal species using information gathered from literature (see Appendix D). These calculations result in the number of animals harassed on a per-run basis for each range alternative and for each representative source. Then the results are accumulated over a year based on the number of runs expected for each representative source. Once the year-long amounts have been calculated, then they are rounded to the nearest whole animal using Navy guidelines based on the MMPA and the ESA. After this accumulation these results are initially developed for each range alternative with respect to Level A PTS (physiological effects), Level B TTS (physiological effects), and Level B sub-TTS (behavioral) effects for all marine mammal species which could be found in the boundaries of each range alternative.

After the calculation of the initial acoustic exposure modeling results careful consideration must be taken in light of the assumptions made while developing the model and in light of the limitations of the ecological data used in the model. Often the per-run model results are a small fraction of an animal either because the ensonified volume is small, or because the animal density is small (or even non-existent depending on the time of year). Based on this fact and on the conservative assumptions described in the model, the initial results of the model are considered to be conservative estimates of marine mammal acoustic harassment. Furthermore, the model results must be interpreted within the context of a given species' ecology.

NAVSEA NUWC Keyport Range Complex has had Range Operating Procedures (ROP) in place prior to the development of this Draft EIS. These procedures contain a section that describes the reaction of range operations when a marine mammal is detected along with the boundaries within which observers look for marine mammals (refer to Section 1.3.4 of the EIS). Because of the ROP, the initial results are modified for Cetaceans to reflect that no harassments will occur. Consequently, the initial results are modified accordingly before they are presented within the document. At this point, the annual estimated numbers of exposures from acoustic sources are considered for each species.

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APPENDIX D:
MARINE MAMMAL DENSITIES AND DEPTH DISTRIBUTION

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APPENDIX D: MARINE MAMMAL DENSITIES AND DEPTH DISTRIBUTION

D.1 INTRODUCTION

Marine mammal species occurring in the offshore and inland waters of Washington State include baleen whales (mysticetes), toothed whales (odontocetes) and seals and sea lions (commonly referred to as pinnipeds); sea otters are found near the QUTR Site only. Baleen and toothed whales, collectively known as cetaceans, spend their entire lives in the water and spend most of the time (>90% for most species) entirely submerged below the surface. When at the surface, cetacean bodies are almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This makes cetaceans more difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100% of the time because their ears are nearly always below the water's surface. Seals and sea lions (pinnipeds) spend significant amounts of time out of the water during breeding, molting and hauling out periods. In the water, pinnipeds spend varying amounts of time underwater, as some species regularly undertake long, deep dives (e.g., elephant seals) and others are known to rest at the surface in large groups for long amounts of time (e.g., California sea lions). When not actively diving, pinnipeds at the surface often orient their bodies vertically in the water column and often hold their heads above the water surface. Consequently, pinnipeds may not be exposed to underwater sounds to the same extent as cetaceans. Sea otters generally do not spend significant amounts of time on land, but they also often hold their heads above the water's surface, reducing the amount of exposure to underwater noise.

For the purposes of this analysis, a conservative approach has been adopted with reference to underwater noise and marine mammals:

Cetaceans – assume 100% of time is spent underwater and therefore exposed to noise.

Pinnipeds – adjust densities to account for time periods spent at breeding areas, haulouts, etc.; but for those animals in the water, assume 100% of time is spent underwater and therefore exposed to noise.

Sea otters – assume 100% of time is spent underwater and therefore exposed to underwater noise.

The QUTR Site, located west of Washington State and overlapping somewhat with Olympic Coast National Marine Sanctuary (OCNMS), is the largest in geographic size and has the greatest diversity of marine mammal species (see Table D-1). There are three proposed surf zone extension alternatives, Kalaloch, Ocean City and Pacific Beach (Figure D-1). For most marine mammal species, the surf zone alternative has no impact on density because species distribution is expected to overlap the entire area. For a few cetaceans (gray whale, harbor porpoises) and pinnipeds (California sea lion and harbor seal), the surf zone could potentially influence density or percentage of habitat within QUTR, so independent calculations were completed for each zone.

The DBRC Site, located in Hood Canal, has approximately six marine mammal species (two mysticetes, three odontocetes and one pinniped) with some regularity although most of these species do not occur often enough for abundance or density to be known. Note that lack of estimates for some species does not indicate that they are not present; rather it indicates that they have not been sufficiently or systematically studied to yield data suitable for generating abundance or density estimates. There are two proposed extensions to DBRC: a southward extension only and both a north and south extension (Figure D-1).

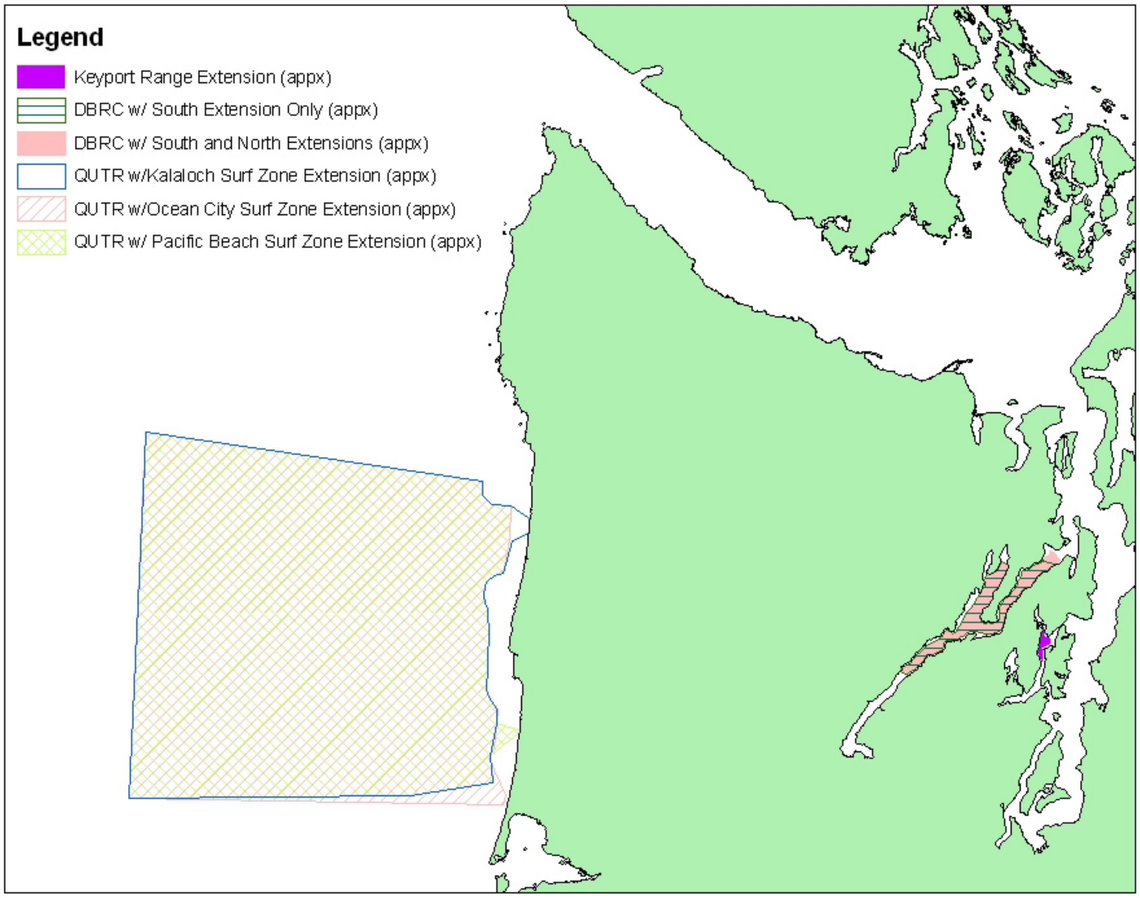

Figure D-1. The NAVSEA NUWC Keyport Range Complex and Proposed Extensions

The Keyport Range Site, located between the Kitsap Peninsula and Bainbridge Island, is the smallest of the three ranges. Only two species of cetaceans (gray and killer whales) have been sighted in the vicinity of the Keyport range site, and their occurrence is rare and transitory. The transient nature of cetaceans within the Keyport Range Site means that abundance or density values are not available. It should be noted that the absence of cetacean density values for the Keyport Range Site does not indicate that they are completely absent. It is possible that killer whales and gray whales, as well as minke whales, Dall's porpoise and harbor porpoise, could occasionally be found within the range. Harbor seals are regularly seen in the Keyport area (Table D-1). Due to the extremely small size of the range (~5.2 km^2), simple mitigation procedures, such as visual observations to detect dorsal fins or water vapor from blow exhalations, prior to the start of activities would eliminate any potential impacts to cetaceans on the Keyport Range Site. Harbor seals are regularly seen in the Keyport area (Table D-1). There is one proposed expansion to Keyport (Figure D-1).

Table D-1. Summary of Marine Mammal Densities for QUTR, DBRC, and Keyport Range Sites

Common Name	*Scientific Name*	*Status*	*Range*	*Density/km²*	*Season*	*Source*	*Notes*
MYSTICETES							
Blue whale	*Balaenoptera musculus*	Endangered	QUTR	0.0003	May-Oct	Barlow (2003: 2001 estimate)	
Fin whale	*B. physalus*	Endangered	QUTR	0.0012	Year round	Barlow (2003); Forney (2007)	
Sei whale	*B. borealis*	Endangered	QUTR	0.0002	Year round	Forney (2007)	
Minke whale	*B. acutorostrata*		QUTR	0.0004	Year round	Barlow (2003)	
			DBRC	0	Year round		
Humpback whale	*Megaptera novaeangliae*	Endangered	QUTR	0.0237	Jun-Oct	Forney (2007)	
				0	Nov-May		
Gray whale	*Eschrichtius robustus*		QUTR	0.003	Year round	Calambokidis et al. (2004)	Applies to 41% of QUTR
			DBRC	0	Year round		
			Keyport	0	Year round		
ODONTOCETES							
Sperm whale	*Physeter catodon*	Endangered	QUTR	0.0011	Year round	Forney (2007)	
Dwarf and pygmy sperm whales	*Kogia* sp.		QUTR	0.0015	May-Oct	Barlow (2003: 1996 estimate)	
Baird's beaked whale	*Berardius bairdii*		QUTR	0.0027	Year round	Forney (2007)	
Mesoplodonts, including Hubb's and Stejneger's beaked whales	*Mesoplodon* sp.		QUTR	0.0027	Year round	Forney (2007)	
Killer whale	*Orcinus orca*	Endangered	QUTR	0.0028	Year round	Forney (2007)	
			DBRC	0.038	Jan-Jun	London (2006)	
			DBRC	0	Jul - Dec		
			Keyport	0	Year round		
Risso's dolphin	*Grampus griseus*		QUTR	0.002	Year round	Forney (2007)	
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*		QUTR	0.1929	May-Oct	Forney (2007)	
Short-beaked common dolphin	*Delphinus delphinus*		QUTR	0.0012	May-Oct	Barlow (2003: 2001 estimate)	
Striped dolphin	*Stenella coeruleoalba*		QUTR	0.0002	May-Oct	Barlow (2003: 1996 estimate)	
Northern right whale dolphin	*Lissodelphis borealis*		QUTR	0.0419	Year round	Forney (2007)	
Dall's porpoise	*Phocoenoides dalli*		QUTR	0.1718	Year round	Forney (2007)	
			DBRC	0	Year round		
Harbor porpoise	*Phocoena phocoena*		QUTR	2.86	Year round	Laake (2007)	Applies to 24% of QUTR
			DBRC	0	Year round		

Common Name	*Scientific Name*	*Status*	*Range*	*Density/km^2*	*Season*	*Source*	*Notes*
CARNIVORES - Pinnipeds (seals and sea lions)							
Northern fur seal	*Callorhinus ursinus*		QUTR	0.117	Nov-May	National Marine Fisheries Service (NMFS) (2006a); Carretta et al. (2007)	
				0.091	Jun-Oct		
Steller sea lion	*Eumetopias jubatus*	Threatened	QUTR	0.0096	Year round	Angliss and Outlaw (2007); Bonnell et al. (1992)	
California sea lion	*Zalophus californianus*		QUTR	0.283	Aug-Apr	Jeffries et al. (2000)	Applies to 6% of QUTR
				0	May-Jul		
			DBRC	0.052	Aug-Apr	Jeffries et al. (2000)	
				0	May-Jul		
Northern elephant seal	*Mirounga angustirostris*		QUTR	0.019	Dec-Feb	Caretta et al. (2007); Lowry (2002)	
				0.026	Mar-Apr		
				0.038	May-Jul		
				0.047	Aug-Nov		
Harbor seal	*Phoca vitulina*		QUTR	0.44	Year round	Jeffries et al. (2003); Huber et al. (2001)	Applies to 52% of QUTR
			DBRC	1.31	Year round		
			Keyport	0.55	Year round	Jeffries et al. (2003)	
CARNIVORES - Sea otters							
Sea otter	*Enhydra lutris*		QUTR	0	Year round	Lance et al. (2004)	only within 2 km of shore; distribution does not overlap with QUTR

D.2 DENSITY

Survey data for the inland waters of Puget Sound are sparse. There have been few comprehensive studies of marine mammals in inland waters, and those that have occurred have focused on inland waters farther north (e.g., Strait of Juan de Fuca, San Juan/Gulf Islands, Strait of Georgia) (Osmek et al. 1998). Most published information focuses on single species (e.g., harbor seals, Jeffries et al. 2003) or are stock assessment reports published annually by the National Marine Fisheries Service (NMFS) (e.g., Carretta et al. 2007).

Survey data for the offshore waters of Washington State, including the area of the QUTR Site, are somewhat better, particularly for cetaceans. The NMFS conducted vessel surveys in the region in 1996 and 2001, which are summarized in Barlow (2003) and Appler et al. (2004). Vessel surveys were again conducted by NMFS in summer 2005, and included finer-scale survey lines within the OCNMS (Forney 2007). Cetacean densities from this most recent effort were used wherever possible (Table D-1); older density values (2001 or 1996) were used when more recent values were not available. Species with rare or extralimital occurrence off Washington State are included in the species summaries; however, there are no densities available and they are not included in Table D-1. Some cetacean densities (gray and killer whale, harbor porpoise) were obtained from sources other than the broad scale surveys indicated above and the methodologies of deriving the densities are included here in some detail.

Pinniped at-sea density is not often available because pinniped abundance is most often obtained via shore counts of animals at known rookeries and haulouts. Therefore, densities of pinnipeds were derived differently from those of cetaceans. Several parameters were identified from the literature, including area of stock occurrence, number of animals (which may vary seasonally) and season, and those parameters were then used to calculate density. Determining density in this manner is risky as the parameters used usually contain error (e.g., geographic range is not exactly known and needs to be estimated, abundance estimates usually have large variances) and, as is true of all density estimates, it assumes that animals are always distributed evenly within an area which is likely never true. However, this remains one of the few means available to determine at-sea density for pinnipeds.

Sea otters occur along the northern Washington coast. Density of sea otters was published as animals/km, which was modified to provide density per area.

Some cetacean and pinniped geographic distributions do not overlap the entire area of each proposed QUTR surf zone alternative and, in those cases, density was further refined as the percentage of the QUTR that is actually overlapped by the species distribution. Species distributions were taken from published literature accounts.

Brief species summaries are included for all marine mammals whose distribution extends to the Pacific Northwest coast, even if rarely seen. Additional information on all species is available in the Pacific Northwest Operating Area Marine Resource Assessment (Department of the Navy, 2006), a recent publication that includes most of the pertinent literature published to date. That publication listed seven mysticetes, 19 odontocetes, six pinnipeds, and one fissiped as occurring or possibly occurring in the NAVSEA NUWC ranges (Department of the Navy 2006; Tables 3-1 and 3-3). However, several of the species listed are rare or extralimital and do not regularly occur. Only species with regular occurrence and for which densities are available are included in Table D-1.

D.3 DEPTH DISTRIBUTION

There are limited depth distribution data for most marine mammals. This is especially true for cetaceans, as they must be tagged at-sea and by using a tag that either must be implanted in the skin/blubber in some manner or adhere to the skin. There is slightly more data for some pinnipeds, as they can be tagged while on shore during breeding or molting seasons and the tags can be glued to the pelage rather than implanted. There are a few different methodologies/techniques that can be used to determine depth distribution percentages, but by far the most widely used technique currently is the time-depth recorder. These instruments are attached to the animal for a fairly short period of time (several hours to a few days) via a suction cup or glue, and then retrieved immediately after detachment or when the animal returns to the beach. Depth information can also be collected via satellite tags, sonic tags, digital tags, and, for sperm and some beaked whales, via acoustic tracking of sounds produced by the animal itself.

There are somewhat suitable depth distribution data for a few marine mammal species. Sample sizes are usually extremely small, nearly always fewer than 10 animals total and often only one or two animals. Depth distribution information often must be interpreted from other dive and/or preferred prey characteristics. Depth distributions for species for which no data are available are extrapolated from similar species.

Summary depth distribution information for marine mammal species occurring regularly in the NAVSEA NUWC Keyport Range Complex, and for which densities are available, is provided in Table D-2. More detailed depth information for species for which densities are available is included in Table D-3. located at the end of this Appendix.

D.4 DENSITY AND DISTRIBUTION COMBINED

Density is nearly always reported for an area, e.g., animals/km^2. Analyses of survey results using Distance Sampling techniques include correction factors for animals at the surface but not seen as well as animals below the surface and not seen. Therefore, although the area (e.g., km^2) appears to represent only the surface of the water (two-dimensional), density actually implicitly includes animals anywhere within the water column under that surface area. Density assumes that animals are uniformly distributed within the prescribed area, even though this is likely rarely true. Marine mammals are usually clumped in areas of greater importance, for example, areas of high productivity, lower predation, safe calving, etc. Density can occasionally be calculated for smaller areas that are used regularly by marine mammals, but more often than not there are insufficient data to calculate density for small areas. Therefore, assuming an even distribution within the prescribed area remains the norm.

Assuming that marine mammals are distributed evenly within the water column is not correct. The ever-expanding database of marine mammal behavioral and physiological parameters obtained through tagging and other technologies has demonstrated that marine mammals use the water column in various ways, with some species capable of regular deep dives (>800 m) and others regularly diving to <200 m, regardless of the bottom depth. Assuming that all species are evenly distributed from surface to bottom is almost never appropriate and can present a distorted view of marine mammal distribution in any region.

By combining marine mammal density with depth distribution information, a more accurate three-dimensional density estimate is possible. These 3-D estimates allow more accurate modeling of potential marine mammal exposures from specific noise sources.

Table D-2. Summary of Marine Mammal Depth Distributions for NAVSEA NUWC Ranges.

Common Name	Scientific Name	Depth Distribution	Reference
MYSTICETES - Baleen whales			
Blue whale	*Balaenoptera musculus*	78% at 0-16m, 9% at 17-32 m, 13% at >32 m	Lagerquist et al. (2000)
Fin whale	*B. physalus*	40% at <50m, 20% at 50-225m, 40% at >225m	Goldbogen et al. (2006)
Sei whale	*B. borealis*	53% at <20m, 47% at 21-65m	extrapolated from minke whale (Blix and Folkow, 1995)
Minke whale	*B. acutorostrata*	53% at <20m, 47% at 21-65m	Blic and Folkow (1995)
Humpback whale	*Megaptera novaeangliae*	37% at <4m, 25% at 4-20m, 7% at 21-35m,4% at 36-50m, 6% at 51-100m, 7% at 101-150m, 8% at 151-200m, 6% at 201-300m, <1% at >300m	Dietz et al. (2002)
Gray whale	*Eschrichtius robustus*	40% at <3 m, 38% at 3-18 m, 22% at >18 m	Malcolm et al. (1995/96); Malcolm and Duffus (2000)
ODONTOCETES - Toothed whales			
Sperm whale	*Physeter catodon*	31% at <10 m, 8% at 10-200 m, 9% at 201-400 m, 9% at 401-600 m, 9% at 601-800 m and 34% at >800 m	Amano and Yoshioka (2003)
Dwarf and pygmy sperm whales	*Kogia sp.*	26% at <2 m, 41% at 2-71 m, 2% at 72-200 m, 4% at 201-400 m, 4% at 401-600 m, 4% at 601-835 m and 19% at >835 m	extrapolated from Blainville's beaked whale (Tyack et al., 2006)
Baird's beaked whale	*Berardius bairdii*	34% at 0-40 m, 39% at 41-800 m, 27% at >800 m	extrapolated from northern bottlenose whale (Hooker and Baird, 1999)
Mesoplodonts	*Mesoplodon sp.*	26% at <2 m, 41% at 2-71 m, 2% at 72-200 m, 4% at 201-400 m, 4% at 401-600 m, 4% at 601-835 m and 19% at >835 m	extrapolated from Blainville's beaked whale (Tyack et al., 2006)
Killer whale	*Orcinus orca*	96% at 0-30 m, 4% at >30 m	Baird et al. (2003)
Risso's dolphin	*Grampus griseus*	50% at <50 m, 15% at 51-200 m, 15% at 201-400 m, 10% at 401-600 m and 10% at >600 m	Blanco et al. (2006); Baumgartner (1997)
Striped dolphin	*Stenella coeruleoalba*	Daytime: 89% at 0-10 m, 11% at 11-50 m, and <1% at 51-122 m; Nighttime: 80% at 0-10 m, 8% at 11-20 m, 2% at 21-30 m, 2% at 31-40 m, 2% at 41-50 m, and 6% at 51-213 m	extrapolated from pantropical spotted dolphin (Baird et al. 2001)
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	Daytime: 100% at 0-65 m; Nighttime: 100% at 0-130 m	extrapolated from other *Lagenorhynchus* (Mate et al., 1994; Benoit-Bird et al., 2004)
Short-beaked common dolphin	*Delphinus delphinus*	100% at 0-200m	Ohizumi et al. (1998); Pusineri et al. (2007); Chou et al. (1995); Perrin (2002b)
Northern right whale dolphin	*Lissodelphis borealis*	Daytime: 100% at 0-50 m; Nighttime: 100% at 0-400 m	extrapolated from spinner dolphin (Benoit-Bird and Au, 2003)
Dall's porpoise	*Phocoenoides dalli*	39% at <1 m, 8% at 1-10 m, 45% at 11-40 m, and 8% at >40 m	Hanson and Baird (1998)
Harbor porpoise	*Phocoena phocoena*	75% at 0-20 m, 15% at 21-40 m, and 10% at >40 m	Otani et al. (1998)
CARNIVORES - Pinnipeds			
Northern fur seal	*Callorhinus ursinus*	Daytime: 100% at 0-210 m; Nighttime: 100% at 0-75 m	Ponganis et al. (1992); Kooyman and Goebel (1986); Sterling and Ream (2004); Gentry et al. (1986)
Steller sea lion	*Eumetopias jubatus*	60% at 0-10 m, 22% at 11-20 m, 12% at 21-50 m, 5% at 51-100 m and 1% at >100 m	Merrick and Loughlin (1997)
California sea lion	*Zalophus californianus*	26% at <2 m, 41% at 2-10 m, 3% at 11-19 m, 17% at 20-60 m and 13% at >60 m	Feldkamp et al. (1989)
Northern elephant seal	*Mirounga angustirostris*	9% at <2 m, 11% at 2-100 m, 11% at 101-200 m, 11% at 201-300 m, 11% at 301-400 m, 11% at 401-500 m and 36% at >500 m	Asaga et al. (1994)
Harbor seal	*Phoca vitulina*	50% at <3 m, 20% at 3-50 m, 25% at 51-100 m and 5% at >100 m	Eguchi and Harvey (2005)

This document is organized into taxonomic categories: Mysticetes, Odontocetes, and Carnivores, which includes pinnipeds and sea otters. Species for which distribution summaries were included are those listed in the Marine Resource Assessment (MRA) for the Pacific Northwest Operating Area (Department of the Navy 2006; Table 3-1). However, many of the species included in the MRA are rare or extralimital in Washington waters and do not regularly occur on the Keyport Range Site, DBRC Site, or QUTR Site. Only species with regular occurrence and for which density is available are included in Table D-1. Nomenclature was adopted from the Integrated Taxonomic Information System (www.itis.gov). Distribution and density summaries are followed by discussions of depth distribution for those species that have regular occurrence.

D.5 MYSTICETES

<u>Blue Whale – QUTR Site</u>

Up to five stocks of blue whale may currently exist in the north Pacific, including an Eastern North Pacific population, which winters as far south as the eastern tropical Pacific and feeds near California in summer/fall. This is the only stock for which abundance is available (2005 population estimate = 1,774; Carretta et al. 2007). Blue whales have been seen during vessel surveys as far north as Oregon, although none were seen off Washington during surveys conducted in 1996, 2001 and 2005 (Appler et al. 2004; Barlow 2003; Forney 2007). Density of blue whales was estimated at $0.0003/km^2$, based on surveys conducted in 2001 off Oregon and Washington (Barlow 2003); this estimate is applicable to the QUTR Site from May-October. Density is zero for the DBRC and Keyport Range sites; blue whales are not known to occur in inland Washington waters.

Blue whales feed on euphausiid crustaceans, including *Euphausia* sp and *Thysanoessa* sp (Sears 2002). They have been documented feeding near the surface as well as at depths exceeding 140 m (Croll et al. 2001). Data from southern California and Mexico showed that whales dived to >100 m for foraging; once at depth, vertical lunge-feeding often occurred (lunging after prey). Lunge-feeding at depth is energetically expensive and likely limits the deeper diving capability of blue whales. Foraging dives were deeper than traveling dives; traveling dives were generally to ~ 30m. Typical dive shape was somewhat V-shaped, although the bottom of the V was wide to account for the vertical lunges at bottom of the dive. Blue whales also have shallower foraging dives. The best information available for % of time at depth is from Lagerquist et al (2000; Figure 2): 78% in 0-16 m, 9% in 17-32 m, 13% in >32 m; most dives were to <16 m and 96-152 m ranges, but only 1.2% of total time was spent in the deeper range.

<u>Fin Whale – QUTR Site</u>

Fin whales occur in all oceans in temperate to polar latitudes, and many populations undergo seasonal migrations, from low latitude breeding areas to higher latitude feeding areas (Aguilar 2002). This seasonal cycle is less defined in the northern hemisphere. The most current population estimate for the California/Oregon/Washington stock of fin whales is 3,279, based on vessel surveys conducted in the summer of 1996 and 2001. Fin whales were sighted offshore Washington and Oregon in 1996, 2001, and 2005 (Appler et al. 2004; Barlow 2003; Forney 2007). Fin whales were detected acoustically on SOSUS hydrophone arrays nearly year round from September 1991-August 1992 (Moore et al. 1998). Densities of fin whales from surveys conducted offshore Washington and Oregon in 2001 and 2005 were both $0.0012/\ km^2$ (Table D-1), which is applicable to the Quinault region year round. Fin whales are not known to occur in the inland waters of Washington State; the density of fin whales on the DBRC and Keyport Range sites is zero.

Fin whales feed on planktonic crustaceans, including *Thysanoessa* sp and *Calanus* sp, as well as schooling fish including herring, capelin and mackerel (Aguilar 2002). Depth distribution data from the Ligurian Sea in the Mediterranean are the most complete (Panigada et al. 2003), and showed differences between day and night diving; daytime dives were shallower (<100m) and night dives were deeper (>400m). This data may be atypical of fin whales elsewhere in areas where they do not feed on vertically-migrating prey. Goldbogen et al. (2006) studied fin whales in southern California and found that 60% of total time was spent diving, with the other 40% near surface (<50m); dives were to >225 m and were characterized by rapid gliding ascent, foraging lunges near the bottom of the dive, and rapid ascent with flukes. Dives were somewhat V-shaped although the bottom of the V was wide. Based on this information, percentage of time at depth levels is estimated as 40% at <50m, 20% at 50-225 m (covering the ascent and descent times) and 40% at >225 m.

<u>Sei whale – QUTR Site</u>

Sei whales occur in all oceans from subtropical to sub-arctic waters, and can be found on the shelf as well as in oceanic waters (Reeves et al. 2002). They are known to occur in the Gulf of Alaska and as far north as the Bering Sea in the north Pacific. However, their distribution is poorly understood. The only stock estimate for US waters is for the eastern north Pacific stock offshore of California, Oregon and Washington (Carretta et al. 2007). Sei whales were not seen during vessel surveys conducted off Washington in 1996, 2001, or 2005 (Appler et al. 2004; Barlow 2003; Forney 2007); there were two sightings of sei whales offshore south-central Oregon in 2005 (Forney 2007). Density of sei whales for the Oregon/Washington stratum in 2005 was $0.0002/km^2$ (Table D-1), which is applicable to the QUTR Site year round. Sei whales are not known to occur in inland Washington waters; there are no density estimates available for QUTR, DBRC, or Keyport Range sites.

Sei whales feed on copepods, amphipods, euphausiids, schooling fish and squid (Horwood 2002). They appear to be skim feeders that feed on swarms of prey at fairly low densities (Nemoto and Kawamura 1977). There are no depth distribution data and very little information on preferred habitat. In lieu of other information, the depth distribution for minke whales will be extrapolated to sei whales: 53% at <20 m and 47% at 21-65 m.

<u>Minke Whale – QUTR Site</u>

Minke whales are the smallest of all mysticete whales. They are widely distributed in the north Atlantic and Pacific. Minkes can be found in nearshore shallow waters and have been detected acoustically in offshore deep waters. Most minke whale populations inhabit colder waters in summer and migrate to warmer regions in winter. However, in the inland waters of Puget Sound, particularly around the San Juan Islands and in Johnstone Strait between Vancouver Island and mainland British Columbia, they appear to show some site fidelity and may not undergo extensive migrations (Dorsey et al. 1990). The most current population estimate for the California/Oregon/Washington stock of minke whales is 1,015, based on vessel surveys conducted in the summer of 1996 and 2001. Minke whales were sighted offshore Washington and Oregon in both 1996 and 2001 (Appler et al. 2004; Barlow 2003), but were not sighted during CSCAPE 2005 surveys conducted in June (Forney 2007). Density of minke whales from surveys conducted offshore Washington and Oregon in 2001 was $0.0004/km^2$ (Table D-1), which is applicable to the QUTR Range Site year round. Density for minke whales on the DBRC Site and Keyport Range Site is zero; minke whales have been sighted in Hood Canal (Angell and Balcomb 1982) and a few strandings have been recorded (Norman et al. 2004), but they are infrequent visitors.

Minke whales feed on small schooling fish and krill, and are the smallest of all balaenopterid species, which may affect their ability to dive. The only depth distribution data for this species were reported from a study on daily energy expenditure conducted off northern Norway and Svalbard (Blix and Folkow 1995). The limited depth information available (from Figure 2 in Blix and Folkow 1995) was representative of a 75-minute diving sequence where the whale was apparently searching for capelin, then foraging, then searching for another school of capelin. Search dives were mostly to ~20 m, while foraging dives were to 65 m. Based on this very limited depth information, rough estimates for % of time at depth are as follows: 53% at <20 m and 47% at 21-65 m.

Humpback Whale – QUTR Site

Humpback whales are found in all oceans, in both coastal and continental waters as well as near seamounts and in deep water during migration (Reeves et al. 2002). Some populations have been extensively studied (e.g., Hawaii, Alaska, Caribbean), and details about migratory timing, feeding and breeding areas are fairly well known. Humpbacks are highly migratory, feeding in summer at mid and high latitudes and calving and breeding in winter in tropical or subtropical waters. Humpbacks of the Eastern North Pacific stock appear to spend winter and spring near Central America and Mexico and migrate north to California, Oregon, Washington and British Columbia in summer and fall (Carretta et al. 2007). The most recent stock estimate, based on photo identification mark-recapture surveys conducted from 1991-2003, is 1,391 whales (Calambokidis et al. 2004a). Humpback whales were sighted offshore Washington and Oregon in both 1996 and 2001 (Appler et al. 2004; Barlow 2003), and there were several sightings during CSCAPE 2005 surveys conducted in 2005 (Forney 2007). Density of humpbacks from surveys conducted in the OCNMS stratum in 2005 (Forney 2007) was 0.0237/km^2 (Table D-1), which is applicable for the QUTR Site for June-October. Humpback whales were once plentiful enough in the inland waters of Washington State that whaling stations were present at Victoria, British Columbia, and in the Strait of Georgia. However, their occurrence in inland waters is now rare; density for humpback whales on the DBRC and Keyport Range sites is zero.

Humpback whales feed on pelagic schooling euphausiids and small fish including capelin, herring and mackerel (Clapham 2002). Like other large mysticetes, they are a "lunge feeder," taking advantage of dense prey patches and engulfing as much food as possible in a single gulp. They also blow nets, or curtains, of bubbles around or below prey patches to concentrate the prey in one area, then lunge with mouths open through the middle. Dives appear to be closely correlated with the depths of prey patches, which vary from location to location. In the north Pacific, most dives were of fairly short duration (<4 minutes) with the deepest dive to 148 m (southeast Alaska; Dolphin 1987), while whales observed feeding on Stellwagen Bank in the north Atlantic dove to <40 m (Hain et al. 1995). Depth distribution data collected at a feeding area in Greenland resulted in the following estimation of depth distribution: 37% of time at <4 m, 25% of time at 4-20 m, 7% of time at 21-35m, 4% of time at 36-50 m, 6% of time at 51-100 m, 7% of time at 101-150 m, 8% of time at 151-200 m, 6% of time at 201-300 m, and <1% at >300 m (Dietz et al. 2002).

Gray whale – QUTR Site

Gray whales inhabit shallow coastal waters of the northeastern Pacific, from Baja California north to Arctic Alaska (a separate small remnant stock of gray whales also ranges in the northwestern Pacific). The current estimate for the Eastern North Pacific stock of gray whales is 18,813 (Angliss and Outlaw 2007), which is based on a census conducted during the southbound migration in 2001-02. Gray whales from the Eastern North Pacific stock undertake a well-documented migration from winter calving lagoons in Baja California to summer feeding areas in the Bering and Chukchi seas (Swartz et al. 2006). The migration route is primarily near shore in shallow water, although gray whales have been documented swimming offshore near the Channel Islands in the Southern California Bight. Green et al. (1995) noted that the migration corridor along Oregon and Washington expanded to approximately 43 km in some locations. In addition to the Bering and Chukchi sea feeding areas, gray whales are known to feed opportunistically at several locations along the migratory route (e.g., Oregon; Newell and Cowles 2006), and several whales remain on these opportunistic feeding grounds throughout the year. Calambokidis et al. (2004b) estimated annual abundance of "resident" gray whales in the Pacific Northwest from 1998-2003 using photo identification methods. The Pacific Coast Feeding Aggregation, covering an area stretching from northern California to southeast Alaska, was estimated at 261-298 whales. The estimate for Oregon to British Columbia (excluding Alaska and California) was 197-256 whales. Gray whales would, therefore, likely be present in the nearshore regions of the QUTR Site on a year round basis. To determine density, the maximum number of gray whales estimated for Oregon to British Columbia (256) was divided by the area offshore Oregon, Washington and British Columbia out to 43 km offshore (estimated at 79,650 km^2 via ArcMap; see Figure D-2 for depiction of this area) for a value of 0.003/km^2 (256 gray whales/79,650 km^2; Table D-1). This density is applicable only to the nearshore waters of Washington State, which represents 41% of the QUTR Site (see Figure D-2 for depiction of this area).

Gray whales are seen annually in northern Puget Sound, particularly the waters around Whidbey Island. They are occasionally seen in Hood Canal, and there were several recorded gray whale strandings in that area (Norman et al. 2004). A gray whale stranded at the Kitsap Navy Base in Bremerton in May 2005 (Cascadia Research 2005). These occasional sightings and strandings indicate that while gray whales occur in the inland waters of Washington State, they do not occur in high enough numbers to permit density to be calculated; density for gray whales on the DBRC and Keyport Range sites is zero.

Gray whales migrate from breeding and calving grounds in Baja California to primary feeding grounds in the Bering and Chukchi seas. Behavior, including diving depth and frequency, can vary greatly between geographic regions. Gray whales feed on the bottom, mainly on benthic amphipods that are filtered from the sediment (Reeves et al. 2002), so foraging dive depth is dependent on depth at the foraging location. There have been several studies of gray whale movement within the Baja lagoons (Harvey and Mate 1984; Mate and Harvey 1984), but these are likely not applicable to gray whales elsewhere. Mate and Urban Ramirez (2003) noted that 30 of 36 locations for a migratory gray whale with a satellite tag were in water <100m deep, with the deeper water locations all in the southern California Bight within the Channel Islands. There has been only one study yielding a gray whale dive profile, and all information was collected from a single animal that was foraging off the west coast of Vancouver Island (Malcolm and Duffus 2000; Malcolm et al. 1995/96). They noted that the majority of time was spent near the surface on interventilation dives (<3 m depth) and near the bottom (extremely nearshore in a protected bay with mean dive depth of 18 m, range 14-22 m depth). There was very little time spent in the water column between surface and bottom. Foraging depth on summer feeding grounds is generally between 50-60 m (Jones and Swartz 2002). Based on this very limited information, the following is a rough estimate of depth distribution for gray whales: 40% of time at <3 m (surface and interventilation dives), 38% of time at 3-18 m (active migration), 22% of time at >18 m (foraging).

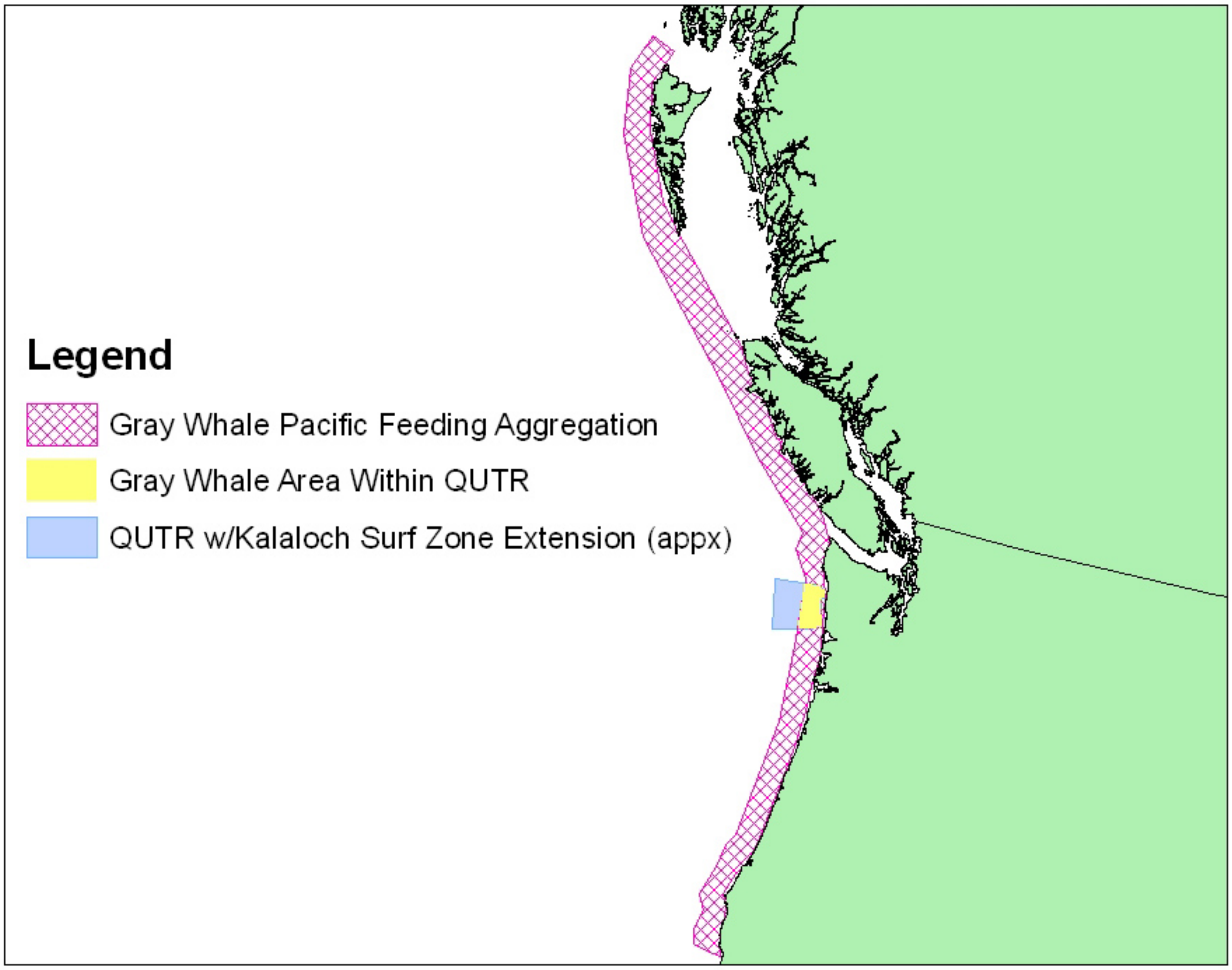

Figure D-2. Area of Pacific Coast Feeding Aggregation of Gray Whales off Oregon, Washington, and British Columbia and area of QUTR Site for Which Density is Applicable. Only the Kalaloch Surf Zone extension is shown.

North Pacific Right Whale – QUTR Site

North Pacific right whales range across the northern Pacific, from the Bering Sea south to Japan in the west and California in the east. They occur mostly in coastal and shelf waters but have been sighted well offshore (Reeves et al. 2002). Although right whales were heavily hunted throughout their range from the mid-1800s through the early 1900s, they were rarely caught in coastal fisheries along the North American west coast (Clapham et al. 2004). Despite international protection, the species has not recovered and remains one of the rarest of all cetaceans. They likely undertake northward migrations in the spring returning to more southern latitudes in fall, but the only regular recent sightings of right whales in the north Pacific have been since 1996 on the eastern Bering Sea shelf (e.g., Goddard and Rugh 1998). One right whale was positively identified offshore of Washington in May 1992 (Rowlett et al. 1994). Right whales may be present in winter in extremely low numbers in the QUTR Site but are not known to inhabit inland Washington waters; there are no density estimates available for QUTR, DBRC, or Keyport Range sites.

D.6 ODONTOCETES

Sperm Whale – QUTR Site

Sperm whales are most often found in deep water, near submarine canyons, and along the edges of banks and over continental slopes (Reeves et al. 2002). Adult males range farther north than females and juvenile males which tend to inhabit waters >1000 m deep and north to 50°N in the north Pacific. Vessel surveys conducted in 1996 and 2001 offshore Oregon and Washington yielded several sightings, and abundance for the California/Oregon/Washington stock was estimated at 1,233 (Angliss and Outlaw 2007). Density for sperm whales from the Olympic Coast –Slope stratum (Forney 2007) was estimated at 0.0011/km^2 (Table D-1), and is applicable on the QUTR Site year round. Sperm whales are not known to inhabit inland Washington waters; density for sperm whales on the DBRC and Keyport Range sites is zero.

Unlike other cetaceans, there is a large body of dive information for this species, most likely because it is the deepest diver of all cetacean species and therefore generates a lot of interest. Sperm whales feed on large and medium-sized squid, octopus, rays and sharks, on or near the ocean floor. Some evidence suggests that they do not always dive to the bottom of the sea floor (likely if food is elsewhere in the water column), but that they generally feed at the bottom of the dive. Davis et al. (2007) report that dive-depths (100-500 m) of sperm whales in the Gulf of California overlapped with depth distributions (200-400 m) of jumbo squid, based on data from satellite-linked dive recorders placed on both species, particularly during daytime hours. Their research also showed that sperm whales foraged throughout a 24-hour period, and that they rarely dove to the sea-floor bottom (>1000 m). The most consistent sperm whale dive type is U-shaped, during which the whale makes a rapid descent to the bottom of the dive, forages at various velocities while at depth (likely while chasing prey) and then ascends rapidly to the surface. Perhaps the best source for depth distribution data comes from Amano and Yoshioka (2003), who attached a tag to a female sperm whale near Japan in an area where water depth was 1000-1500m. Based on values in Amano and Yoskioka 2003 for dives with active bottom periods, the total dive sequence was 45.9 minutes (mean surface time plus dive duration). Mean post-dive surface time divided by total time (8.5/45.9) plus time at surface between deep dive sequences yields a percentage of time at the surface (<10 m) of 31%. Mean bottom time divided by total time (17.5/45.9) and adjusted to include the percentage of time at the surface between dives, yields a percentage of time at the bottom of the dive (in this case >800 m as the mean maximum depth was 840 m) of 34%. Total time in the water column descending or ascending results from the duration of dive minus bottom time (37.4-17.5) or ~20 minutes. Assuming a fairly equal descent and ascent rate (as shown in Table 1 in Amano and Yoshioka 2003) and a fairly consistent descent/ascent rate over depth, we assume 10 minutes each for descent and ascent and equal amounts of time in each depth gradient in either direction. Therefore, 0-200 m = 2.5 minutes one direction (which correlates well with the descent/ascent rates provided) and therefore 5 minutes for both directions. Same for 201-400 m, 401-600 m and 601-800 m. Therefore, the depth distribution for sperm whales based on information in the Amano paper is: 31% in <10 m, 8% in 10-200 m, 9% in 201-400 m, 9% in 401-600 m, 9% in 601-800 m and 34% in >800 m. The percentages derived above from data in Amano and Yoshioka (2003) are in fairly close agreement with those derived from Table 1 in Watwood et al. (2006) for sperm whales in the Ligurian Sea, Atlantic Ocean and Gulf of Mexico.

Dwarf and Pygmy Sperm Whales – QUTR Site

Dwarf (*Kogia simus*) and pygmy (*Kogia breviceps*) sperm whales are difficult to differentiate at-sea, and are therefore often recorded as *Kogia* sp. during survey efforts. The distribution of both species is generally temperate to tropical and probably seaward of the continental shelf (Reeves et al. 2002). There is a single record of a dwarf sperm whale stranding from British Columbia (Willis and Baird 1998) and four pygmy sperm whales are known to have stranded in Washington (Norman et al. 2004). The most recent stock estimate for the California/Oregon/Washington stock of *Kogia* sp. was 247 (Carretta et al. 2007). There was one sighting of *Kogia* offshore Oregon/Washington in 1996, no sightings in 2001 (Barlow 2003) and no sightings in 2005 (Forney 2007). Density of *Kogia* was estimated as 0.0015 based on surveys conducted in 1996 (Barlow 2003); this estimate is applicable to the QUTR Site from May-October. There are no density estimates available for the Dabob Bay or Keyport ranges.

There are no depth distribution data for *Kogia*. An attempt to record dive information on a rehabbed pygmy sperm whale failed when the time depth recorder (TDR) package was never recovered (Scott et al. 2001). Prey preference appears to be cephalopods, crustaceans and fish, and there is some evidence that they feed at the bottom. Beatson (2007) found that stomach contents of pygmy sperm whales stranded in New Zealand consisted primarily of immature cephalopods (*Histioteuthis*), which are known to undergo vertical migrations, as well as mysids that are usually found at 650 m during day and between 274 and 650 m at night. A pygmy sperm whale that stranded in Atlantic Canada contained squid beaks, a fish otolith and crustaceans, and the squid species were representative of mesopelagic slope-water community (McAlpine et al. 1997). In lieu of any other information, Blainville's beaked whale depth distribution data will be extrapolated to pygmy sperm whales as the two species appear to have similar prey preferences and are closer in size than either is to sperm or Cuvier's beaked whales. Blainville's beaked whale undertakes shallower non-foraging dives in-between deep foraging dives. Blainville's beaked whale depth distribution data, taken from Tyack et al. (2006) and summarized in greater depth later in this document is: 26% at <2 m, 41% at 2-71 m, 2% at 72-200 m, 4% at 201-400 m, 4% at 401-600 m, 4% at 601-835 m and 19% at >835 m.

<u>Cuvier's Beaked Whale – QUTR Site</u>

Cuvier's beaked whale has the widest distribution of all beaked whales, and occurs in all oceans. It is most often found in deep offshore waters, and appears to prefer slope waters with steep depth gradients. As with most beaked whales, Cuvier's are fairly cryptic at-sea and therefore difficult to sight and identify. The best abundance estimate for Cuvier's beaked whales for the California/Oregon/Washington stock, based on vessel surveys conducted in 1996 and 2001, is 1,884 (Barlow 2003). No density is provided in Barlow (2003) for either *Ziphius cavirostris* or Ziphiid whales. This species was also not seen during surveys conducted in 2005 in the OCNMS (Forney 2007). Numerous strandings have been recorded along the outer coast (Figure 10 in Norman et al. 2004). Cuvier's beaked whales may be present in very low numbers in the QUTR Site and are not known to inhabit inland Washington waters; there are no density estimates available for QUTR, DBRC, or Keyport Range Sites.

<u>Baird's Beaked Whale – QUTR Site</u>

Baird's beaked whales, like most beaked whales, are a deep water species that inhabits the north Pacific. They generally occur close to shore only in areas with a narrow continental shelf. The most current population estimate for the California/Oregon/Washington stock of Baird's beaked whales is 228, based on vessel surveys conducted in summer 1996 and 2001 (Angliss and Outlaw 2007). Density for the Oregon and Washington stratum, calculated from vessel surveys in 2005 (Forney 2007), is 0.0027/km^2 (Table D-1), which is applicable to the QUTR Site year round. Baird's beaked whales have not been sighted nor have strandings been recorded in Puget Sound; density for the DBRC and Keyport Range sites is zero.

There are no depth distribution data for this species. Studies conducted on the diet of Baird's beaked whales from stomach content analysis reveal some insight into feeding patterns. Samples collected off the Pacific coast of Honshu, Japan, revealed a preference primarily for benthopelagic fish (87%) and cephalopods (13%), while samples collected in the southern Sea of Okhotsk were primarily cephalopods (Walker et al. 2002). Other stomach samples collected from same geographic regions indicated demersal fish were the most commonly identified prey, and that Baird's beaked whales were feeding at the bottommost depths of at least 1,000 m (Ohizumi et al. 2003). The overall dive behavior of this beaked whale is not known (e.g., shape of dive, interventilation dives, etc). In lieu of other information, the depth distribution for northern bottlenose whales, *Hyperoodon ampullatus,* will be extrapolated to Baird's. beaked whales. There has been one study on northern bottlenose whales, which provides some guidance as to depth distribution (Hooker and Baird 1999). Most (62-70%, average = 66%) of the time was spent diving (deeper than 40 m), and most dives were somewhat V-shaped. Both shallow dives (<400 m) and deep dives (>800 m) were recorded, and whales spent 24-30% (therefore, average of 27%) of dives at 85% maximum depth indicating they feed near the bottom. Using these data points, we estimate 34% of time at 0-40 m, 39% at 41-800 m, 27% at >800 m for *H. ampullatus* and extrapolate this to *B. berardius*.

Hubb's Beaked Whale and Stejneger's Beaked Whale – QUTR Site

Hubb's beaked whales are known only from temperate waters of the north Pacific, mainly along the west coast of North America (Reeves et al. 2002). Stejneger's beaked whale ranges across arctic and cool temperate waters from Baja California to Japan. Both *Mesoplodon* species have stranded along the Washington coastline (Norman et al. 2004). Very little is known about the behavior of either species, as they are cryptic and difficult to sight at-sea; only one of the Mesoplodonts sighted during vessel surveys off California, Oregon and Washington in 1996, 2001 and 2005 was identified to species (Angliss and Outlaw 2007; Forney 2007), and that sighting was identified as *Mesoplodon densirostris*. One unidentified Mesoplodont was sighted in the Oregon/Washington stratum during vessel surveys in 2005 (Forney 2007). The habits of these species, combined with recent (1996) recorded sightings offshore Washington, indicate that they may be likely to occur in the QUTR Site. Density for the Oregon/Washington stratum (Forney 2007) for Mesoplodont beaked whales was calculated as 0.0027/km^2 (Table D-1), which is applicable for *Mesoplodon* sp. in the QUTR Site year round. Beaked whales have not been sighted nor have strandings been recorded in Puget Sound; density for the DBRC and Keyport Range sites is zero.

Mesoplodonts feed primarily on mesopelagic squid and some fish. They are likely suction feeders, based on the relative lack of teeth and enlarged hyoid bone and tongue muscles (Pitman 2002). There are no depth distribution data for *Mesoplodon* species as a group. In lieu of any other information, Blainville's beaked whale depth distribution data, taken from Tyack et al. (2006), will be extrapolated to *Mesoplodon* species beaked whales: 26% in <2 m (surface); 41% in 2-71 m; 2% in 72-200 m; 4% in 201-400 m; 4% in 401-600 m; 4% in 601-835; 19% in >835 m.

Killer Whale – QUTR and DBRC Sites

There are four stocks of killer whales in the north Pacific that can be found at least seasonally in inland and offshore waters of Washington State, but who differ in feeding preferences, acoustics and genetics; each of these stocks appears to be reproductively isolated from the others. The Eastern North Pacific Southern Resident stock feeds primarily on fish, and ranges from the inland waters of Washington and southern British Columbia to nearshore waters as far north as the Queen Charlotte Islands of British Columbia and south to at least central California (Wiles 2004). The latest published NMFS count of the three pods in the Southern Resident Stock is 91 (Carretta et al. 2007). Southern resident pods are present in the inland waters of Washington primarily in summer (May-November), with occurrence centered in Georgia Basin and Haro Strait. In fall, occurrence may shift to Puget Sound as residents take advantage of returning chum and Chinook salmon (Wiles 2004). The Eastern North Pacific Northern Resident stock also feeds on fish, but its range is primarily the inland waters of British Columbia. This stock, which numbers approximately 16 pods, will occasionally venture into the Strait of Juan de Fuca and offshore of the Olympic Peninsula of Washington (Wiles 2004). The Eastern North Pacific Offshore Stock is found year round ranging from offshore California north to offshore Washington and occasionally British Columbia, and also apparently feeds primarily on fish. The current stock estimate is 466 animals; 211 have been photo-identified (Carretta et al. 2007). The West Coast Transient stock ranges year round from Alaska to California, and feeds primarily on other marine mammals. The minimum estimate based on photo ID for that population is 314.

Density for killer whales in the OCNMS stratum (Forney 2007) was estimated at 0.0028/km^2 (Table D-1), which is applicable year round for the QUTR Site; this density does not differentiate between killer whale stocks (i.e., likely includes killer whales from more than one stock).

Density for killer whales in inland waters is more difficult to determine, due to the seasonality and inconsistency of occurrence by both transient and resident pods in those regions. There are no published densities for killer whales in inland waters. Resident killer whales have not been observed in Dabob Bay, but transient pods were observed in Hood Canal for lengthy periods of time in 2003 (January-March) and 2005 (February-June), feeding on harbor seals (London 2006). To determine density, the maximum number of transient killer whales (11) observed at any one time was divided by the area of Hood Canal (estimated at 291 km^2 via ArcMap; see Figure D-3 for depiction of this area) for a value of 0.038/km^2 (11 killer whales/291 km^2; Table D-1), and is applicable for the DBRC Site for January-June. Killer whales have occasionally been seen in the Keyport area, but incidence is low and transitory; density is zero for the Keyport Range Site.

Diving studies on killer whales have been undertaken mainly on “resident” (fish-eating) killer whales in Puget Sound and may not be applicable across all populations of killer whales. Diving is usually related to foraging, and mammal-eating killer whales may display different dive patterns. Killer whales in one study (Baird et al. 2005b) dove as deep as 264 m, and males dove more frequently and more often to depths >100 m than females, with fewer deep dives at night. Dives to deeper depths were often characterized by velocity bursts that may be associated with foraging or social activities. Using best available data from Baird et al. (2003), it would appear that killer whales spend ~4% of time at depths >30 m and 96% of time at depths 0-30 m.

<u>False killer whale – QUTR Site</u>

False killer whales are found in tropical to warm temperate waters, with well known populations near Japan and in the eastern tropical Pacific. They were not seen along the Pacific US coast during surveys conducted from 1986-2001 (Ferguson and Barlow 2003; Barlow 2003) nor in 2005 (Forney 2007). They have occasionally been sighted as far north as British Columbia (Reeves et al. 2002) and two were reported stranded along the Washington coast from 1930-2002, both in El Nino years (Norman et al. 2004). False killer whales may occur in extremely low numbers in the QUTR Site but are not known at all from Puget Sound; there are no density estimates available for the QUTR, DBRC, or Keyport Range sites.

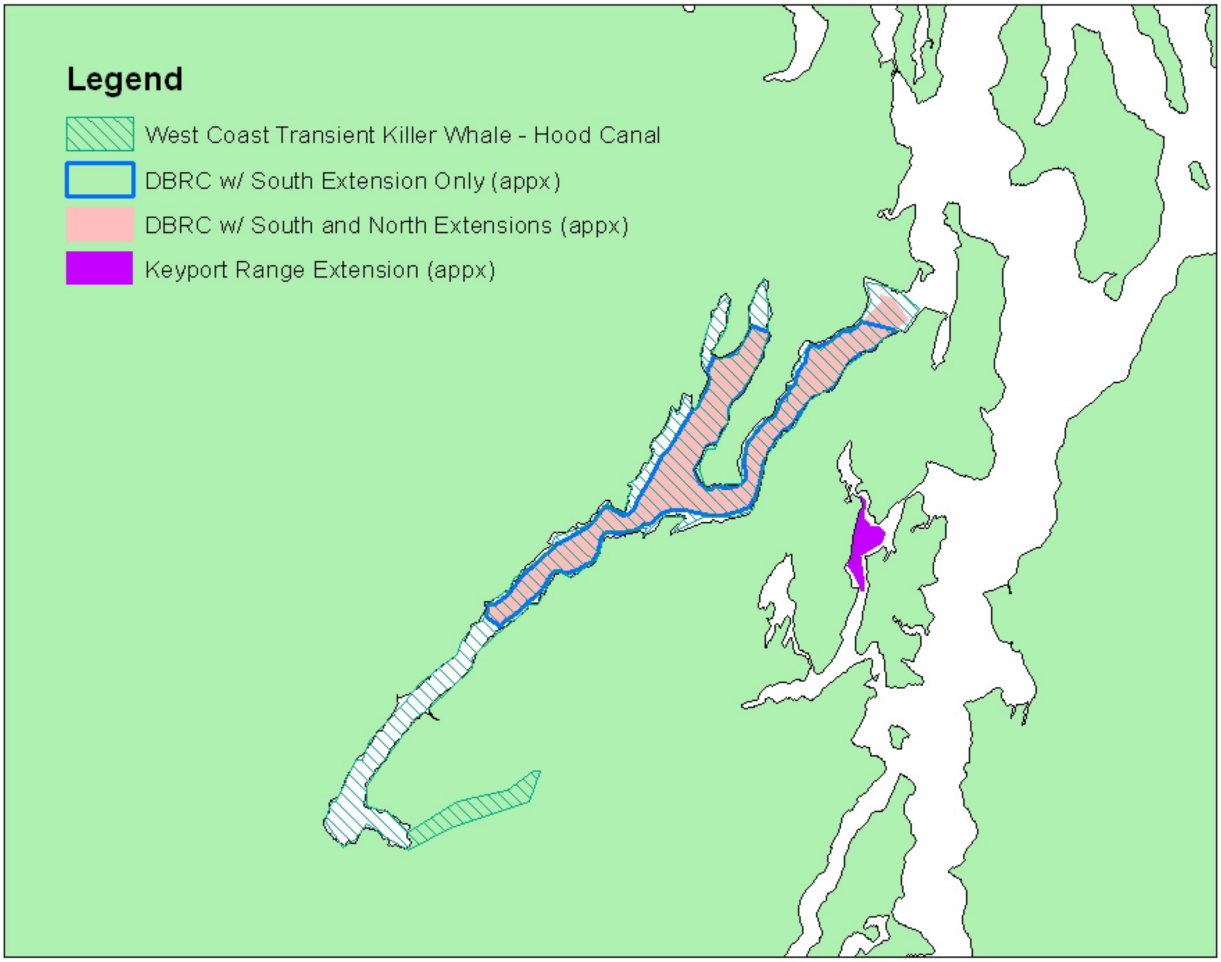

Figure D-3. Area of West Coast Transient Killer Whales Used to Calculate Density for DBRC Site

<u>Short-finned Pilot Whale – QUTR Site</u>

This species is known from tropical and warm temperate waters and, in the northeast Pacific, its distribution may extend as far north as Vancouver Island (Reeves et al. 2002). Pilot whales were not seen during vessel surveys conducted offshore Washington and Oregon in 1996 or 2001 (Barlow 2003) or 2005 (Forney 2007). All six pilot whale strandings recorded in Washington state from 1930-2002 occurred during El Nino years when warmer ocean currents are carried farther north than usual. Short-finned pilot whales may occur in low numbers in the QUTR Site but is not known from Puget Sound; there are no density estimates available for the QUTR, DBRC, or Keyport Range sites.

<u>Risso's Dolphin – QUTR Site</u>

This species is known from tropical and warm temperate oceans, primarily in waters with surface temperatures between 50 and 82˚F (Reeves et al. 2002). They are usually found in water depths exceeding 300 m but are also found on the continental shelf. There were several *Grampus* sighted offshore Washington during vessel surveys conducted in 2001 (Appler et al. 2004), although none were sighted during surveys in 2005 (Forney 2007); the closest sighting was off north-central Oregon. Density for Risso's dolphins in the Oregon/Washington stratum (Forney 2007) was estimated at 0.002/km^2 (Table

D-1), which is applicable year round for the QUTR Site. Risso's dolphins are not known from inland Washington waters; density for the DBRC and Keyport Range sites is zero.

There are no depth distribution data for this species. They are primarily squid eaters and feeding is presumed to take place at night. A study undertaken in the Gulf of Mexico demonstrated that Risso's are distributed non-uniformly with respect to depth and depth gradient (Baumgartner 1997), utilizing mainly the steep sections of upper continental slope bounded by the 350 m and 975 m isobaths. That data agreed closely with Blanco et al. (2006), who collected stomach samples from stranded Risso's dolphins in the western Mediterranean. Their results indicate that, based on prey items, Risso's dolphins feed on the middle slope at depths ranging from 600-800 m. In lieu of any true depth distribution information or information on the shape of dives, the following are very rough estimates of time at depth: 50% at <50 m, 15% at 51-200 m, 15% at 201-400 m, 10% at 401-600 m and 10% at >600 m.

<u>Bottlenose Dolphin – QUTR Site</u>

Bottlenose dolphins are distributed in all oceans from temperate to tropical latitudes. In the eastern north Pacific, the distribution extends to about central California, although distribution of Atlantic bottlenose dolphins extends much farther north (to 60˚N; Reeves et al. 2002). There has been only one occurrence of a bottlenose dolphin in Washington State (Ferrero and Tsunoda 1989). Bottlenose dolphins are likely extremely rare and extralimital in Washington waters; there are no density estimates available for the QUTR, DBRC, or Keyport Range sites.

<u>Rough-toothed Dolphin – QUTR Site</u>

Rough-toothed dolphins are distributed in warm temperate to tropical waters of all oceans. In the eastern north Pacific, the distribution extends north to Baja California (Reeves et al. 2002). There are two records of stranded rough-toothed dolphins in Washington State, both of which occurred during El Nino years when warmer water occurred farther north (Norman et al. 2004). Rough-toothed dolphins are likely extremely rare and extralimital in Washington waters; there are no density estimates available for the QUTR, DBRC, or Keyport Range sites.

<u>Striped Dolphin – QUTR Site</u>

Striped dolphins are distributed in tropical and warm temperate waters of all oceans. In the Eastern North Pacific, their distribution extends as far north as Washington, although there have been few sightings (Appler et al. 2004). Strandings of this species from 1930-2002 occurred far more frequently in Oregon (10) than in Washington (2) (Norman et al. 2004), which also might be indicative of a more southerly distribution. There was a single sighting of striped dolphins in the Oregon/Washington stratum in 1996, and no sightings in either 2001 or 2005 (Barlow 2003; Forney 2007). Density was estimated as $0.0002/km^2$ based on surveys conducted in 1996 (Barlow 2003); this estimate is applicable to the QUTR Site from May-October. There are no density estimates available for the Dabob Bay or Keyport ranges.

Striped dolphins feed on pelagic fish and squid and may dive during feeding to depths exceeding 200 m (Archer 2002). However, studies are rare on this species. Stomach content remains from three dolphins in the Mediterranean included several species of cephalopod as well as some fish, and suggested that striped dolphins may not feed quite as deep as Risso's dolphins (Ozturk et al. 2007). There is some evidence that striped dolphins feed at night to take advantage of vertical migrations of the deep scattering layer. In lieu of other information, pantropical spotted dolphin depth distribution data will be extrapolated to striped dolphins. One study on pantropical spotted dolphins in Hawaii contains dive information (Baird et al. 2001). The biggest differences recorded were in the increase in dive activity at night. During the day, 89% of time was spent within 0-10 m, most of the rest of the time was 10-50 m, and the deepest dive was to

122 m. At night, only 59% of time was spent from 0-10 m and the deepest dive was to 213 m; dives were especially pronounced at dusk. For activities conducted during daytime-only, the depth distribution would be 89% at 0-10 m and 11% at 11-50 m, with <1% at 51-122 m. For activities conducted over a 24-hour period, the depth distribution needs to be modified to reflect less time at surface and deeper depth dives; 80% at 0-10 m, 8% at 11-20 m, 2% at 21-30 m, 2% at 31-40 m, 2% at 41-50 m, and 6% at 51-213 m.

Pacific White-sided Dolphin – QUTR Site

Pacific white-sided dolphins range throughout the north Pacific in cold temperate waters. Movements between inshore/offshore and north/south are not well understood, but most sightings are in shelf and slope waters and distribution appears to shift northward off Oregon and Washington in late spring and summer (Carretta et al. 2007). The California/Oregon/Washington stock of this species is currently estimated at 59,274, based on data collected during vessel surveys conducted in 1996 and 2001 (Barlow 2003). There were several sightings of this species during vessel surveys conducted in 2005 (Forney 2007); density calculated for the OCNMS stratum from 2005 surveys was 0.1929/km^2 (Table D-1), which is applicable to the QUTR Site from May-October. This species is not known to occur in Puget Sound; density for the DBRC and Keyport Range sites is zero.

Pacific white-sided dolphins are generalist feeders (von Waerebeek and Wursig 2002). Studies on diving by this species have not been undertaken. Satellite tag studies of a rehabilitated related species (*Lagenorhynchus acutus*) in the Gulf of Maine indicated that nearly all time was spent in waters <100 m total depth with largely directed movement (Mate et al. 1994). Another related species, *Lagenorhynchus obscurus*, was observed feeding in two circumstances; at night to 130 m depth to take advantage of the deep scattering layer closer to the surface and during the day in shallower depths (<65 m) where they fed on schooling fish (Benoit-Bird et al. 2004). In lieu of the lack of other data available for this species, the following are very rough estimates of time at depth: daytime - 100% at 0-65 m; night time – 100% at 0-130 m.

Short-beaked Common Dolphin – QUTR Site

Short-beaked common dolphins are found in continental shelf waters of the Atlantic and Pacific, as well as pelagic waters of the eastern tropical Pacific and Hawaii (Reeves et al. 2002). Distribution in the eastern north Pacific extends as far north as the California/Oregon border, based on sightings in 2001; there have been few sightings or strandings farther north (Appler et al. 2004; Forney 2007; Norman et al. 2004). There were single sightings in 2001 and 2005 of common dolphins in the Oregon/Washington stratum, but both sightings occurred off southern Oregon. Density was estimated as 0.0012 based on surveys conducted in 2001 (Barlow 2003), which is applicable to the QUTR Site for May-October. This species is not known to occur in Puget Sound; density is zero for the DBRC and Keyport Range sites.

Common dolphins feed on small schooling fish as well as squid and crustaceans, and prey preference varies with habitat and location. They appear to take advantage of the deep scattering layer at dusk and during early night-time hours, when the layer migrates closer to the water surface, as several prey species identified from stomach contents are known to vertically migrate (e.g., Ohizumi et al. 1998; Pusineri et al. 2007). Perrin (2002b) reports foraging dives to 200 m, but there have been no detailed studies of diving behavior. Based on this limited information, depth distribution is estimated as 100% at 0-200m.

Northern Right Whale Dolphin – QUTR Site

The northern right whale dolphin occurs in a band across the north Pacific, generally between 34˚ and 47˚N (Reeves et al. 2002). They are primarily an open ocean species, and rarely come near shore.

Northern right whale dolphin abundance, based on surveys conducted in 1996 and 2001, is estimated at 20,362 (Carretta et al. 2007). Density calculated from surveys in the Olympic Coast-Slope stratum in 2005 (Forney 2007) was 0.0419/km^2 (Table D-1), which is applicable to the QUTR Site year round. This species is not known to occur in Puget Sound; density for the DBRC and Keyport Range sites is zero.

There are no depth distribution data for this species. They feed on small fish, especially lanternfish and squid (Lipsky 2002), and are believed to take advantage of the deep scattering layer around 200 m. Based on the lack of specific information, spinner dolphin depth distribution data will be extrapolated to northern right whale dolphins. Studies on spinner dolphins in Hawaii have been carried out using active acoustics (fish-finders) (Benoit-Bird and Au 2003). These studies show an extremely close association between spinner dolphins and their prey (small, mesopelagic fishes). Mean depth of spinner dolphins was always within 10 m of the depth of the highest prey density. These studies have been carried out exclusively at night, as stomach content analysis indicates that spinners feed almost exclusively at night when the deep scattering layer moves toward the surface bringing potential prey into relatively shallower (0-400 m) waters. Prey distribution during the day is estimated at 400-700 m. Based on these data, the following are very rough order estimates of time at depth: daytime: 100% at 0-50 m; nighttime: 100% at 0-400 m.

Dall's Porpoise – QUTR Site

Dall's porpoises are endemic to the north Pacific, ranging north of ~32˚N into the Bering Sea. They are generally found in deep, cool waters but are also common in coastal areas. The California/Oregon/Washington stock is currently estimated at 98,617 animals (Carretta et al. 2007). Density of Dall's porpoise in the Olympic Coast-Slope stratum in 2005 (Forney 2007) was estimated at 0.1718/km^2 (Table D-1), which is applicable to the QUTR Site year round. Dall's porpoise have stranded both along the Washington coast as well as in inland waters, and they are occasionally observed in Puget Sound. Their use of inland Washington waters, however, is mostly limited to the Strait of Juan de Fuca; the expected density for the DBRC and Keyport Range sites is zero.

Dall's porpoise feed on a wide variety of schooling fish, including herring and anchovies, mesopelagic fish including deep-sea smelts, and squids (Jefferson 2002). One study of this species includes dive information for a single animal (Hanson and Baird 1998). The authors concluded that the animal responded to the TDR tag for the initial eight minutes it was in place. Therefore, using data only from dives 7-17 (after the abnormally deep high velocity dive) in Table 2 of Hanson and Baird (1998), total time of the sequence was 26.5 minutes (from start of dive 7 to end of dive 17). Total time at the surface was 10.27 min (time between dives minus the dive durations). Dives within 10 m totaled 2.11 min, dives to >60 m totaled 0.4 min, and dives with bottom time between 41 and 60 m totaled 1.83 min. The remaining time can be assumed to be spent diving between 11 and 40 m. Based on this information, the depth distribution can be estimated as 39% at <1 m, 8% at 1-10 m, 45% at 11-40 m, and 8% at >40 m.

Harbor Porpoise – QUTR Site

Harbor porpoise are found in coastal regions of northern temperate and subarctic waters (Reeves et al. 2002). They are found year round in nearshore waters off the Washington coast (known as the Oregon-Washington Coast Stock) as well as in inland waters (known as the Washington Inland Waters Stock). Harbor porpoise are generally not found in water deeper than 100 m, and decline linearly as depth increases (Carretta et al. 2001; Barlow 1988; Angliss and Outlaw 2007). Abundance for each stock was determined based on aerial surveys conducted in 2002 and 2003. The Coastal Stock, from Cape Blanco, Oregon, north to Cape Flattery, Washington, was estimated at 37,735 animals (Carretta et al. 2007).

Abundance and density for subregions of the Coastal Stock were provided by Jeff Laake based on aerial surveys conducted in 2002 (Laake 2007). Density for region "F", which most closely approximates the Quinault area, was calculated by Laake (2007) as 2.86/km^2 (Table D-1). This density is applicable only to that portion of region "F" within the QUTR Site, which represents 24% (1,704 km^2/ 7,036 km^2) of the QUTR Site (see Figure D-4 for depiction of this area).

The 2002 surveys did not extend south into Puget Sound or Hood Canal. Harbor porpoise are occasionally seen in Hood Canal and elsewhere in southern Puget Sound, however, their occurrence there is rare; density for DBRC and Keyport Range sites is zero.

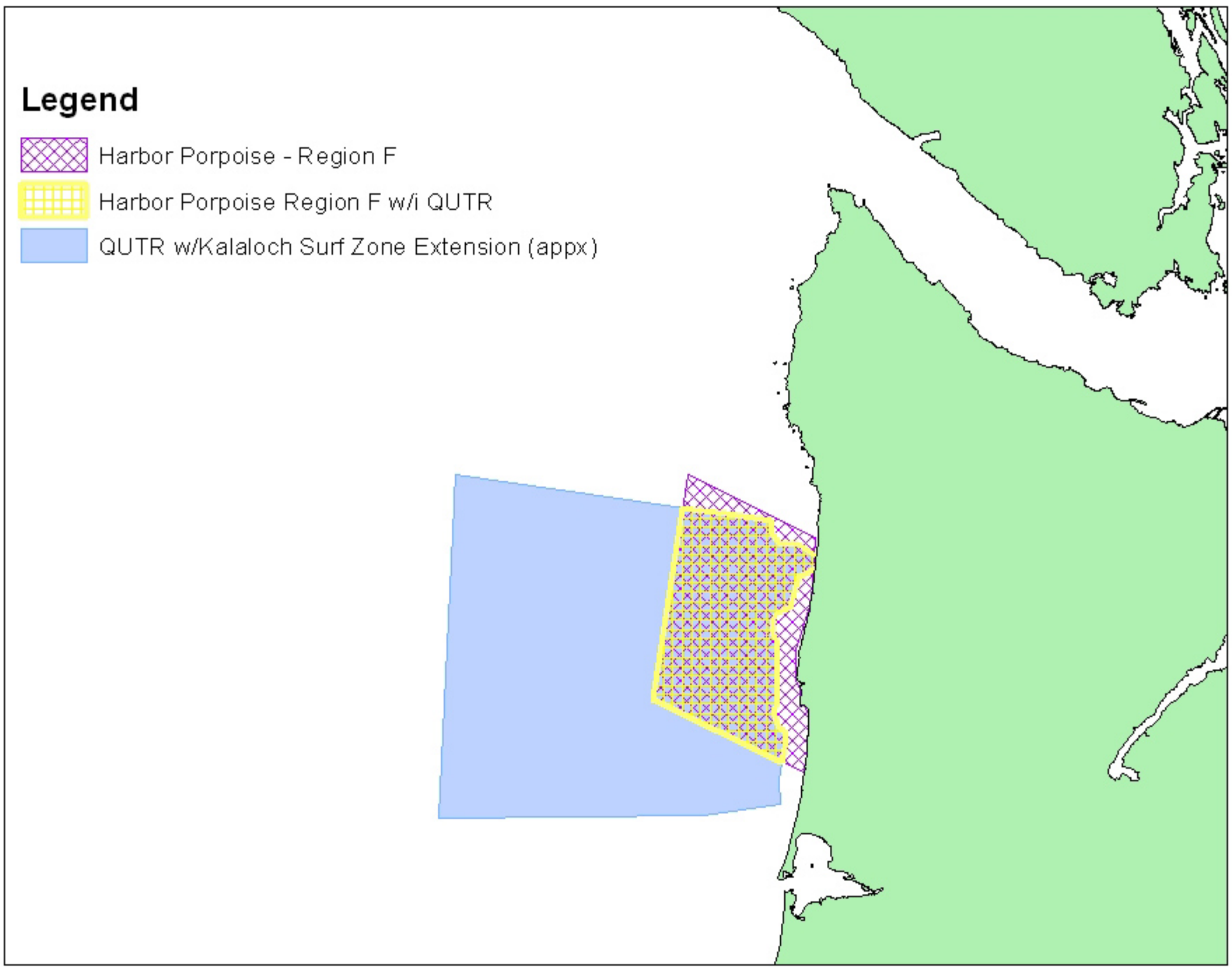

Figure D-4. Depiction of Region "F" from Laake (2007) for which Density was Adopted, and Area of Region "F" Within QUTR Site for which that Density is Applicable.

Harbor porpoise eat fish and squid, and may feed on or near the sea floor at depths <200m (Bjorge and Tolley 2002). Harbor porpoise depth distribution has been studied in the north Atlantic (Bay of Fundy; Westgate et al. 1995) and northwest Pacific (Hokkaido, Japan; Otani et al. 1998, 2000). In the northwest Pacific, two porpoises were initially caught in set nets and, after a short rehabilitation period, were released in Funka Bay, Hokkaido, Japan (Otani et al. 1998). More than 70% of their diving times were at

≤20 m, with most shallow dives V-shaped and very little bottom time (Otani et al. 1998). Deeper dives (>90 m) were U-shaped; daytime dives did not differ significantly from nighttime dives. Dive durations were short (mean maximums of 1.1 and 1.6 minutes), and number of dives per hour averaged 28-35 (Otani et al. 1998). A study of seven porpoises conducted in the Bay of Fundy, Maine, had similar results as in Japan (>50% of dive time at ≤20 m), but also demonstrated that porpoises are capable of diving to 226 m depth and to the deepest area of depth habitat (Westgate et al. 1995). Based on information primarily from the Otani et al. (1998) study, the depth distribution for harbor porpoises can be estimated as 75% at 0-20 m, 15% at 21-40 m, and 10% at >40 m.

D.7 CARNIVORES - PINNIPEDS

Northern Fur Seal – QUTR Site

The northern fur seal is endemic to the north Pacific. Breeding sites are located in the Pribilof Islands (up to 70% of the world population) and Bogoslof Island in the Bering Sea, Kuril and Commander Islands in the northwest Pacific, and San Miguel Island in the southern California Bight. Abundance of the Eastern Pacific Stock has been decreasing at the Pribilof Islands since the 1940s although increasing on Bogoslof Island. The stock is currently estimated to number 721,935 (NMFS 2006a). The San Miguel Island stock is much smaller, estimated at 7,784 (Carretta et al. 2007); this stock is believed to remain predominantly offshore California year round.

Males are present in the Pribilof Island rookeries from around mid-May until August; females are present in the rookeries from mid-June to late-October. Nearly all fur seals from the Pribilof Island rookeries are foraging at sea from fall through late spring. Females and young males migrate through the Gulf of Alaska and feed primarily off the coasts of British Columbia, Washington, Oregon and California before migrating north again to the rookeries (Ream et al. 2005); there were several northern fur seal sightings in the OCNMS region during June 2005 vessel surveys. Immature males and females may remain in southern foraging areas year round until they are old enough to mate (NMFS 2006a). Adult males migrate only as far south as the Gulf of Alaska or to the west off the Kuril Islands. Therefore, adult female (November-April) and all non-adult fur seals (year round) can potentially be found offshore Washington depending on the time of year.

To determine fur seal density for the area off Washington, geographic area and number of seals need to be determined. The geographic area was defined as the large region offshore California, Oregon, Washington and British Columbia as this is where fur seals forage. This area, based on Figure 4 in NMFS (2006a), was estimated via ArcMap as 6,165,000 km^2 (Figure D-5).

To determine the number of fur seals in this area from November-May, adult females plus non-breeding immature males and females from the Eastern North Pacific Stock (711,957; NMFS 2006a) needed to be added to the entire stock from San Miguel Island (7,784; Carretta et al. 2007) for a total of 719,741; adult males (9,978; NMFS 2006a) from the Pribilof Islands were excluded as they forage in the Gulf of Alaska. Density was then calculated as 719,741 fur seals/6,165,000 km^2, or 0.117/km^2 (Table D-1). This density is applicable for the QUTR Site for November-May.

To determine density for the rest of the year (June-October) when only immature non-breeding fur seals would be present (adult breeding seals would be returning to the rookeries), the same geographic area was used. The number of animals was adjusted to remove adult females. The 2005 census of pups in the Pribilof Islands yielded 160,430 pups (NMFS 2006a), therefore the same number of adult females are assumed. In the San Miguel Island stock, 2,356 pups were counted in 2005 (Carretta et al. 2007). Total number of adult females, therefore, was 162,786 which, when subtracted from the total determined above

(719,741) results in 556,955 fur seals. Density of immature fur seals from June-October was 556,955/6,165,000 km^2 or 0.090/ km^2 (Table D-1), which is applicable for the QUTR Site. Northern fur seals are rarely sighted in Puget Sound; density for the DBRC and Keyport Range sites is zero for all months.

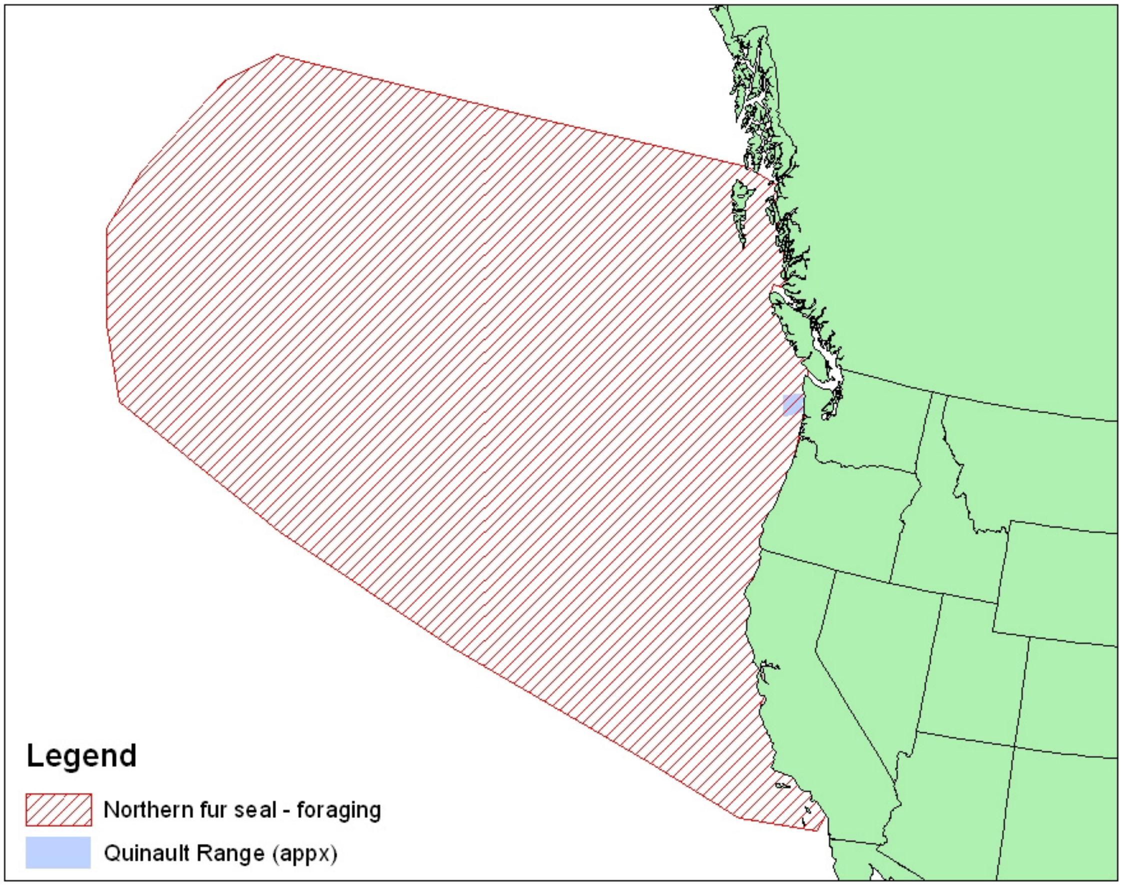

Figure D-5. Area of Northern Fur Seal Foraging Distribution Used to Calculate Density

Northern fur seals feed on small fish and squid in deep water and along the shelf break; deep dives occur on the shelf and feeding probably occurs near the bottom (Gentry 2002). There have been a few studies of this species' diving habits during feeding and migration, although there is no information on dive depth distribution. Ponganis et al. (1992) identified two types of northern fur seal dives, shallow (<75 m) and deep (>75 m). Kooyman and Goebel (1986) found that the mean dive depth for seven tagged females was 68 m (range 32-150 m) and the mean maximum depth was 168 m (range 86-207 m). Sterling and Ream (2004) reported that the mean dive depth for 19 juvenile males was 17.5 m, with a maximum depth attained of 175 m. Diving was deeper in the daytime than during nighttime, perhaps reflecting the different distribution of prey (especially juvenile pollock), and also differed between inner-shelf, mid-shelf, outer-shelf and off-shelf locations. Deeper diving in the Sterling and Ream study tended to occur on-shelf, with shallower diving off-shelf. Based on these very limited depth data, the following are very rough order estimates of time at depth: daytime: 100% at 0-210 m; nighttime: 100% at 0-75 m.

Steller Sea Lion – QUTR Site

The range of the Steller sea lion (SSL) crosses the north Pacific from Japan to northern California. This species does not undergo extensive migrations but will disperse widely during the non-breeding season. There are two US stocks, which are delineated based on the location of rookeries. The eastern US stock, listed as Threatened, includes SSL whose rookeries are east of 144˚W and extend down the west coast of North America. The current population estimate for the eastern US stock, based on pup counts conducted in 2005, is 47,885 (Angliss and Outlaw 2007). There are no SSL rookeries in Washington. The closest major rookery in Oregon is Three Arch Rock-Seal Rock and the closest major rookeries in British Columbia are on Triangle, Sartine and Beresford Islands at the north end of Vancouver Island (NMFS 2006b). SSL numbers in Washington vary seasonally, with peak counts at haulouts occurring during fall and winter. Jeffries et al. (2000) identified 21 haulout locations for SSL along the coast and inland waterways of Washington, including four in the Split Rock area (47.40N, 124.35W); animals at these haulout locations are assumed to be immatures and non-breeding adults associated with rookeries in Oregon and British Columbia (Pitcher et al. 2007). Steller sea lions are not known to haulout in Hood Canal. Most SSL remain fairly close to rookeries and haulouts throughout the year, with adult females with pups averaging 17 km trip length in summer and 130 km trip length in winter; however, foraging trips extended to >500 km offshore (Loughlin 2002; Merrick and Loughlin 1997). Foraging trips are interspersed with time spent at haulouts throughout the year, and different age and sex classes molt at different times from late summer through early winter. Consequently, at any particular time during the year, at least some portion of the population will be at-sea. Bonnell et al. (1992) estimated that 25% of the SSL population was feeding at sea at any given time. Call et al. (2007) found that the duration of at-sea and on-shore cycles of juvenile SSL differed between regions. In the Aleutian Islands and Gulf of Alaska, juvenile SSL departed at dusk and returned to haul out just prior to sunrise, while juvenile SSL in southeast Alaska departed throughout the day. Time of day departures and length of time at-sea are likely related to foraging opportunities and the distance/depth required for juveniles to travel finding food.

To determine densities of SSL off Washington State, two parameters needed to be identified – the specific area and the number of animals. The area for the Eastern US stock of SSL, taken from Figure I-1 in NMFS (2006b), was estimated as ~1,244,000 km^2 via ArcMap (Figure D-6). The population estimate for the eastern US population (47,885) was multiplied by 25% for a total of 11,971. Density, therefore, was estimated as 11,971 SSL/1,244,000 km^2, or 0.0096/km^2 (Table D-1), which is applicable to the QUTR Site year round. Steller sea lions are occasionally seen in Puget Sound, but their occurrence is generally rare; density is zero for the DBRC and Keyport Range sites for all months.

Steller sea lions feed on fishes and invertebrates, including walleye pollock, Pacific cod, mackerel, octopus, squid and herring (Loughlin 2002). Ongoing studies of SSL diving behavior have been conducted by NMFS in Alaska and Washington as part of an overall effort to determine why sea lion populations have been steadily declining (Merrick and Loughlin 1997; Loughlin et al. 2003). Tagging studies often focus on different age classes (weanling, young of year, adult female). Steller sea lion prey changes depending on the season, with some prey moving farther offshore in winter, which affects maximum depth. Females dived the longest and deepest, with young of the year and weanlings having lesser values for both categories. Because all age classes may be in the water at any given time, the depth distribution was estimated from the proportion of dives per depth range for all age classes (Merrick and Loughlin 1997; Figures 4 and 2, respectively). Based on this information, the depth distribution can be roughly estimated at 60% at 0-10 m, 22% at 11-20 m, 12% at 21-50 m, 5% at 51-100 m and 1% at >100 m.

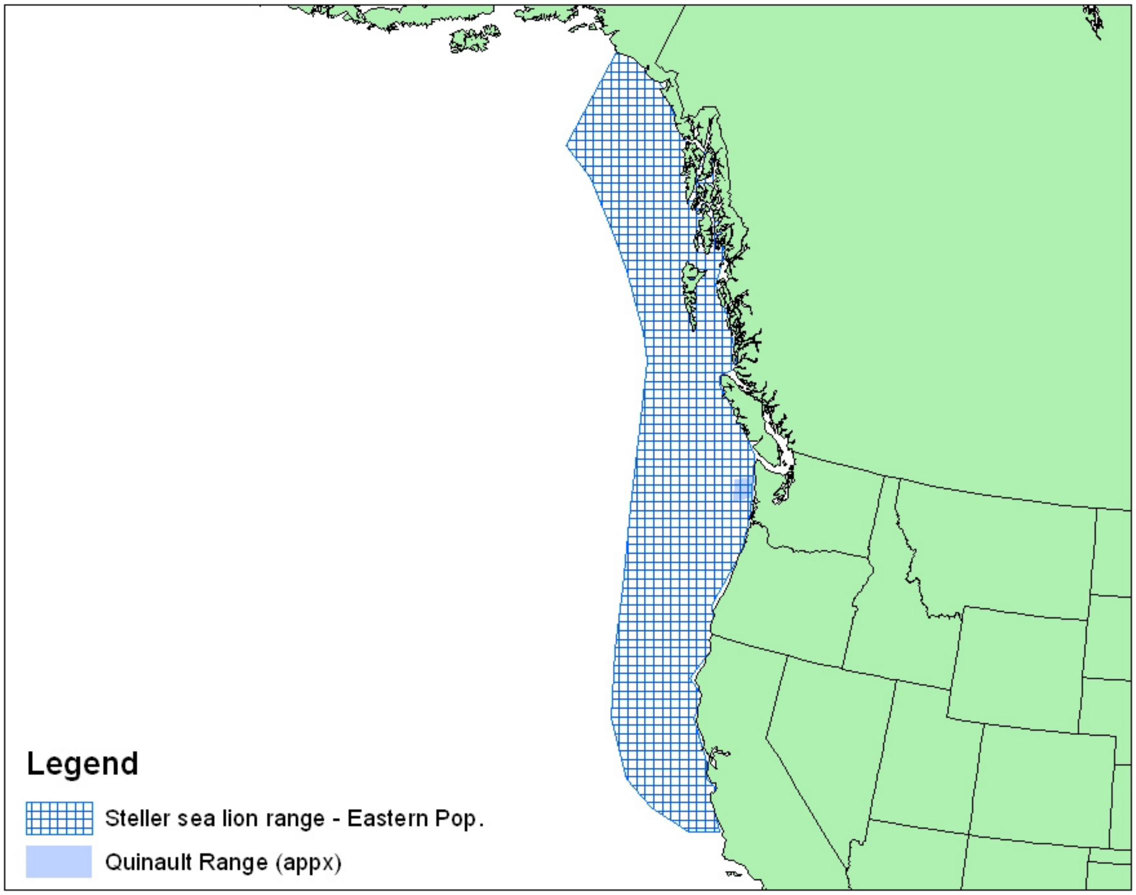

Figure D-6. Area of Steller Sea Lion Eastern US population Range Used to Calculate Density

<u>California Sea Lion – QUTR and DBRC Sites</u>

The US stock of California sea lions breeds in the Channel Islands in the southern California Bight. The population is currently estimated at 237,000 to 244,000, based on pup counts conducted in 2001 (Carretta et al. 2007). There are two additional stocks of California sea lions; one breeds on islands off the west coast of Baja California, while the other breeds on islands in the Gulf of California. There is some mixing between all three stocks during the non-breeding season, although the extent is unknown. Pupping and breeding occur from May-July. Females generally do not migrate as far north as males, remaining closer to the rookeries. Adult male California sea lions will migrate north after the breeding season (August-April) to nearshore waters of Washington, Oregon and British Columbia, and a few immature males will remain in northern feeding areas year round. Jeffries et al. (2000) identified 46 haulout locations used by California sea lions along the Washington/southern British Columbia coast and inland waterways. Most haulouts were in southern Puget Sound, with two large (100-500 animals each) haulouts located along the outer coast in the Split Rock area. California sea lions feed near the mainland coast and around seamounts; in Washington, males position themselves near river and stream mouths to take advantage of fish migrations.

As with other pinniped species, geographic area and number of animals need to be identified to determine density. Geographic area was approximated from the 14 haulout regions delineated by Jeffries et al. (2000) in the Atlas of Pinniped Haulout Sites (Figure D-7). This area was estimated as ~17,650 km^2 via

ArcMap. California sea lions do not use haulouts in all 14 of the regions, however, they would be traversing many of the areas during migration or foraging. Jeffries et al. (2000) estimated that peak numbers of 3,000 to 5,000 California sea lions migrate into northwest numbers from fall until late spring. Density, therefore, was estimated as 5,000/17,650 km^2, or 0.283/km^2 (Table D-1). This density is applicable only to the very nearshore waters of Washington State, which represents 6% (414 km^2/ 7,063 km^2) of the QUTR Site (see Figure A-34 for depiction of this area), from August to April.

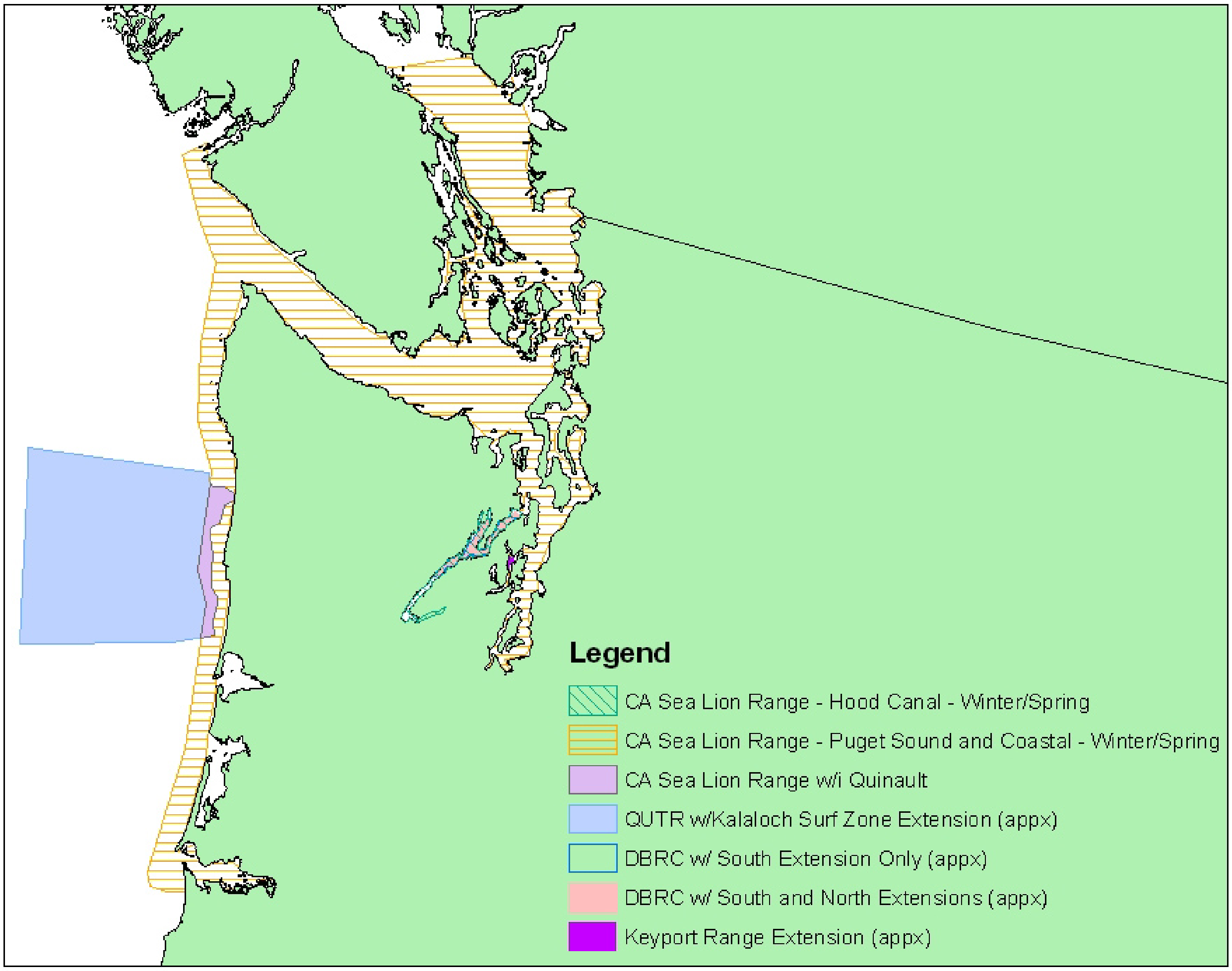

Figure D-7. Area of California sea lion range used to calculate densities, and area of Quinault range for which density is applicable. Only the Kalaloch Surf Zone extension is shown.

Jeffries et al. (2000) did not identify any California sea lion haulouts within Hood Canal, but five navigational buoys near the entrance to Hood Canal were documented as haulouts; navigational buoys are large enough to hold approximately three adult male California sea lions at any one time. California sea lions are also commonly seen in the vicinity of the Bangor Subase (Department of the Navy 2001). To determine density of California sea lions for the DBRC Site, the maximum number of sea lions per buoy (3) was multiplied by the number of buoys used by California sea lions near Hood Canal (5), then divided by the size of Hood Canal as determined via ArcMap (291 km^2) for a density of 0.052/ km^2. This density is likely conservative, as the likelihood that all 15 sea lions would be in the water at one time is remote. This density applies to the DBRC Site for from August-April.

California sea lions are rarely seen near Keyport; density is zero for the Keyport Range Site for all months.

California sea lions feed on a wide assortment of fish, including anchovy, whiting, rockfish and mackerel, as well as cephalopods; diet depends on season, location and oceanographic conditions (Heath 2002). There have been limited dive data collected on California sea lions. Feldkamp et al. (1989) tagged ten female sea lions on San Miguel Island during the breeding season. The deepest dive recorded was estimated at 274 m but most dives were <80 m (with the majority between 20 and 60 m; see Figure 4 in Feldkamp et al. 1989). Less than 5% of all dives were >200 m. Peak diving frequency occurred near sunrise and sunset, but diving was recorded during all hours. Activity patterns showed that ~33% of total time was spent diving, ~41% was spent swimming between dive bouts, ~23% of the time was at the surface during dive bouts, and 3% was spent resting. Seasonal and daily diving patterns suggested that prey presence strongly influences depth and duration of dives. Based on this information, California sea lion depth distribution can be roughly estimated at 26% at <2 m (surface), 41% at 2-10 m (swimming between dive bouts), 3% at 11-19 m, 17% at 20-60 m and 13% at >60 m.

<u>Northern Elephant Seal – QUTR Site</u>

The California stock of elephant seals breeds at rookeries located along the California coast; breeding season is December through February (Reeves et al. 2002). The most recent population estimate (2001) was 101,000 animals and was based primarily on pup counts (Carretta et al. 2007). Except during breeding season and annual molt, elephant seals remain largely at-sea and rarely haulout for long periods of time. Adult male elephant seals migrate north via the California current to the Gulf of Alaska during foraging trips, and could potentially be passing through the area offshore Washington in May and August (migrating to and from molting periods) and November and February (migrating to and from breeding periods), but likely their presence there is transient and short-lived. Elephant seals seen at Washington State haulouts have been mostly solitary adult males (Jeffries et al. 2000); known haulouts are along the outer coast and the Strait of Juan de Fuca. Adult females and juveniles forage in the California current offshore California to British Columbia (LeBoeuf et al. 1986, 1993, 2000). Pups remain onshore for up to 3 months after birth before they venture offshore. Females and juveniles return to rookeries and haulouts to molt from March through July. Molting takes about three weeks and is a long protracted population event as different age and sex classes tend to molt at the same time.

Estimating density for elephant seals requires an estimate of geographic area and an estimate of the population that would be in that area at any given time. Geographic area was estimated, via ArcMap, as 2,032,000 km^2 (Figure D-8), based on a figure of female foraging range provided in Reeves et al. (2002). During the breeding period (December-February), offshore occurrence would be limited to immature (non-breeding) seals. The number of immature seals was estimated by subtracting the estimated number of adult males, females and pups from the total estimated population. The most recent pup counts (Carretta et al. 2007) yielded 28,845 pups, which extrapolate to 28,845 adult females. Lowry (2002) estimated 2,300 males at rookeries in the Channel Islands in 2001, and 523 males were estimated at the Anõ Nuevo rookery the same year. There were several rookeries not included in this estimate, including a rapidly growing rookery at Piedras Blancas, which in 2007 had an estimated population of 16,000 animals of all age and sex classes (www.elephantseal.org). The California elephant seal population has also been steadily increasing over time (Carretta et al. 2007). To account for males at rookeries not counted and an increase in the population since 2001, the number of males reported in the 2007 stock assessment report (2,840) was doubled to 5,680. Assuming a total estimate of 101,000 seals, and subtracting the number of adult males (5,680), adult females (28,845) and pups (28,845), the density for December-February was calculated as 37,630 seals/2,032,000 km^2, or 0.019/km^2 (Table 1), which applies to the entire QUTR Site.

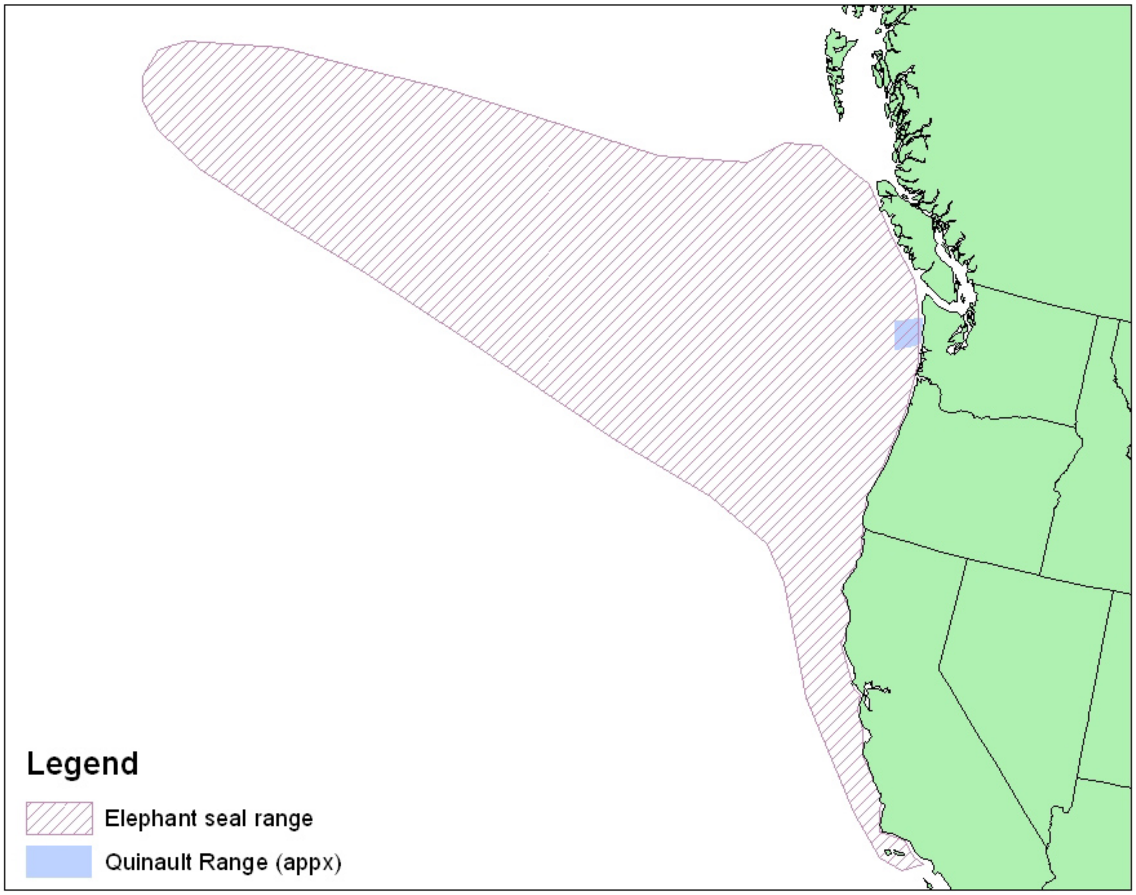

Figure D-8. Area of Elephant Seal Range Used to Calculate Density

Following the breeding season, most seals are at-sea foraging, but some juveniles are returning to rookeries to molt. Molting of all age and sex classes occurs over a roughly 15-week period from Mar-Jul, so we have assumed that approximately 80% of the adult females and juveniles are foraging at any one time. In March and April, offshore occurrence would include females (28,845) and juveniles (37,630) only (pups have not yet left the rookeries and adult males have migrated farther north to the Gulf of Alaska); 80% of that total is 53,180. Therefore, density in the QUTR Site in March-April would be 53,180/2,032,000km^2, or 0.026/km^2 (Table D-1). In May-July, offshore occurrence would include adult females, juveniles and pups of the year for a total of 95,320; 80% of that total would be 76,256. Therefore, density in the QUTR Site in May-July would be 76,256/2,032,000 km^2, or 0.038/km^2 (Table 20). In August-November, offshore occurrence would include all elephant seals except adult males, and there is no molting taking place so the estimated abundance offshore would be 95,320. Therefore, density in the QUTR Site in August-November would be 95,320/2,032,000 km^2, or 0.047/km^2 (Table 1).

Elephant seals are rarely seen in Puget Sound; the closest documented haulout is on Dungeness Spit in the Strait of Juan de Fuca (Jeffries et al. 2000). Density is zero for the DBRC and Keyport Range sites.

Elephant seals feed on deep-water squid and fish, and likely spend about 80% of their annual cycle at sea feeding (Hindell 2002). There has been a disproportionate amount of research done in the diving capabilities of northern elephant seals. Breeding and molting beaches are all located in California and Baja California. Elephant seals are relatively easy to tag (compared to cetaceans) when they are hauled out on the beach and the tag package can be retrieved when the animal returns to shore rather than relying on finding it in the ocean. They are deep divers, and have been tracked to depths >1000 m, although mean depths are usually around 400-600 m. Elephant seals have more than one dive type, termed Types A-E, including rounded and squared-off U-shape, V-shape and others. Particular dive types appear to be used mainly during transit (Types AB), "processing" of food (Type C), and foraging (Types DE) (Crocker et al. 1994). Asaga et al. (1994) collected dive information on three female seals and provided summary statistics for three dive types. Davis et al. (2001) recorded the diving behavior of a seal returning to the beach, and illustrated transit depth averaging 186 m with range of depth from 8 m to 430 m. LeBoeuf et al. (1986; 1988), Stewart and DeLong (1993) and LeBoeuf (1994) provided histograms of dives per depth range for tagged females. LeBoeuf et al. (2000, 1988) and LeBoeuf (1994) provided details on foraging trips for males and females offshore California, including information on percentage of time at surface. Hassrick et al. (2007) noted that larger animals (adult males) exhibited longer bottom times and that surface swimming was not noted in the sixteen elephant seals that they tagged. Hindell (2002) noted that traveling likely takes place at depths >200m.

Even with this abundance of information, the numerous types of dives and lack of clear-cut depth distribution data means that the percentage of time at depth needs to be estimated. The closest information provided is from Asaga et al. (1994), which was used here. Note that this information is representative of type D foraging dives of females only. This is the type of dive that would be likely of an elephant seal at-sea. Summary statistics from Table 17.3 (Asaga et al. 1994) were used; the data were collected from females only but will be applied to both sexes and all age classes due to lack of other data. Mean dive duration and mean surface intervals were added together to yield total dive cycle in minutes. Amount of time to traverse from surface to bottom and bottom to surface was calculated by subtracting bottom time (given) from dive duration. Values for total cycle, surface interval, bottom time and descent/ascent were then averaged for all three females. Roundtrip surface to bottom and back averaged 12.9 minutes. Assuming a mean rate of descent/ascent over 527 m (average mean dive depth for all three females combined), the average rate per 100 m was 2.4 min. Based on these averaged numbers, the following are estimates of time at depth: 9% at <2 m, 11% at 2-100 m, 11% at 101-200 m, 11% at 201-300 m, 11% at 301-400 m, 11% at 401-500 m and 36% at >500 m.

<u>Harbor Seal – QUTR, DBRC, and Keyport Range Sites</u>

Harbor seals are found largely in coastal areas of the north Pacific and north Atlantic (Reeves et al. 2002). Most are non-migratory, and breed and feed in the same area throughout the year. This is the only pinniped species that breeds in Washington State. Jeffries et al. (2000) documented several harbor seal rookeries and haulouts along the Washington coastline and inland waterways. Two different stocks of harbor seals are recognized for the waters of Washington State. The most recent estimate for the Oregon/Washington Coastal stock, based on counts of hauled out seals including pups and conducted in 1999, was 24,732 (Carretta et al. 2007). The 1999 count of harbor seals along the outer Olympic Peninsula region alone was 7,117 (Jeffries et al. 2003) which, when adjusted by a correction factor of 1.53 to account for seals in the water (and not counted), provides an estimate for that region of 10,889. The correction factor of 1.53 (from Huber et al. 2001) indicates that approximately 35% of harbor seals are in the water at any given time (7,117 counted on land/10,889 total = 65% on land). Therefore, the estimated number of harbor seals on the Olympic Coast in the water is 3,811. The geographic area for this stock, estimated via ArcMap (Figure D-9), is 8,630 km^2. Therefore, the density of harbor seals year round in the waters of the QUTR Site was estimated as 0.44/km^2 (Table D-1); this density is applicable to nearshore (<50 km) areas only, which represents 52% (3,656 km^2/ 7,063 km^2) of the QUTR Site (see Figure A-36 for depiction of this area).

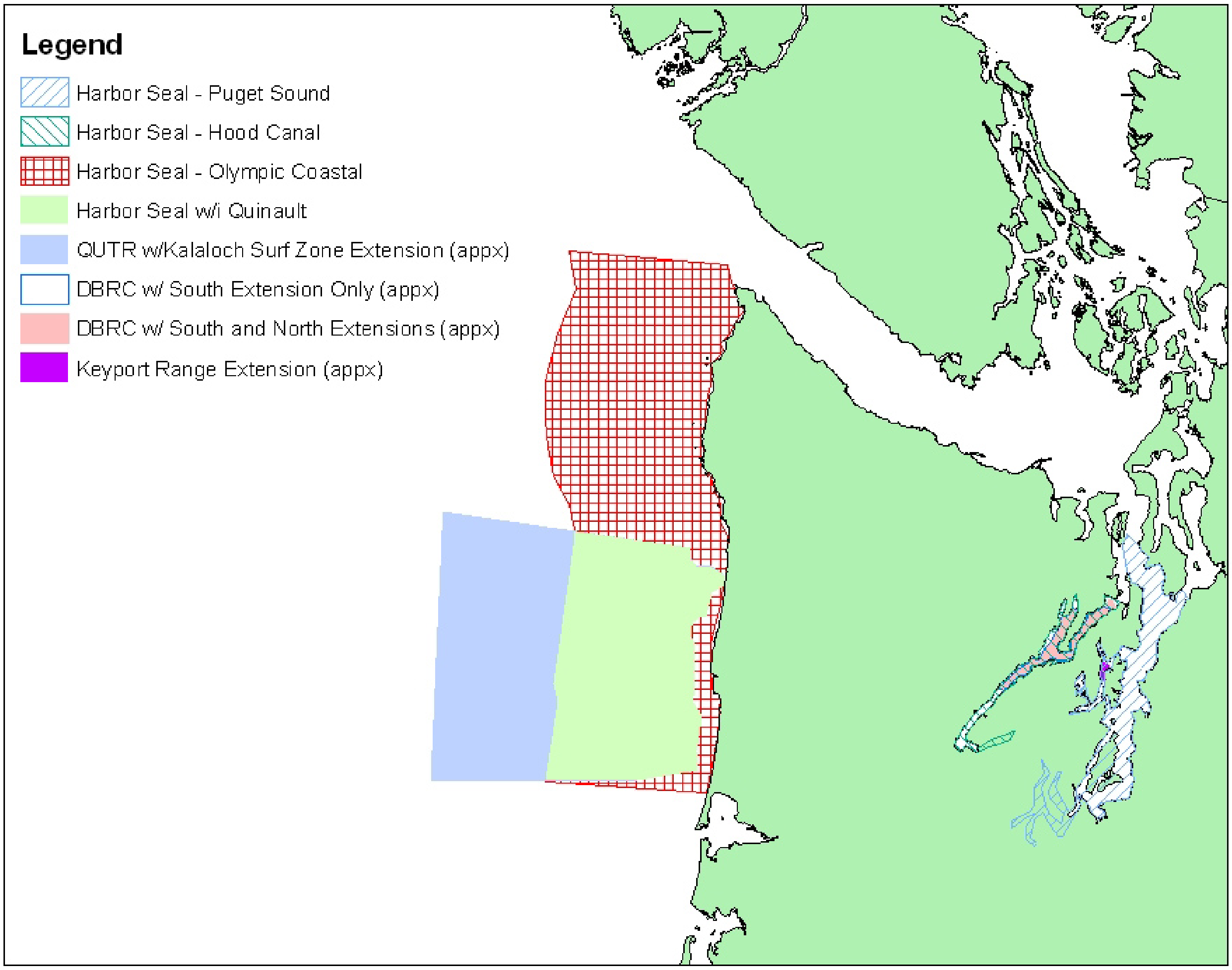

Figure D-9. Area of Harbor Seal Ranges Used to Calculate Density, and Area of QUTR Site for Which Density is Applicable (Note that the area for Puget Sound harbor seals did not include Vashon Island even though the hatching extends across the island)

The Washington Inland Waters stock inhabits waters of Puget Sound, Hood Canal and Strait of Juan de Fuca out to Cape Flattery, and the most recent (1999) abundance estimate for the entire area (1999) was 14,612 (Carretta et al. 2007). The 1999 count of harbor seals for the Hood Canal region (including the Dabob Bay area) was 711 (Jeffries et al. 2003) which, when adjusted by a correction factor of 1.53 to account for seals in the water and not counted, provides an estimate for Hood Canal of 1,088. Assuming that only 35% of the seals are in the water at any given time, based on the assumptions outlined above, the estimated number of harbor seals in Hood Canal in the water is 381. The geographic area for this stock, estimated via ArcMap (Figure D-9), is 291 km^2. Therefore, the density of harbor seals year round in the waters of the Dabob Bay range was estimated as 1.31/km^2 (Table D-1) which is applicable to the entire range. There are several harbor seal haulouts in Hood Canal (Jeffries et al. 2000). In 2003 and 2005, transient killer whales were observed in Hood Canal for extended periods of time (>59 days each year) feeding on harbor seals. London (2006) estimated via bio-energetic models and vessel-based observations that harbor seal consumption by killer whales was significant. "However, aerial surveys conducted following the two foraging events have not detected a significant decline in the harbor seal population." (London 2006).

Harbor seals are seen regularly in the Keyport area, despite no nearby documented haulouts (the closest haulout is north near Poulsbo; Jeffries et al. 2000). The 1999 count of harbor seals for the Puget Sound (including the Keyport area) was 1,025 (Jeffries et al. 2003) which, when adjusted by a correction factor of 1.53 provides an estimate for Puget Sound of 1,568. Assuming that only 35% of the seals are in the water at any given time, the estimated number of harbor seals in Puget Sound in the water is 549. The geographic area for this stock, estimated via ArcMap (Figure D-9), is 994 km^2. Therefore, the density of harbor seals year round in the waters of the Keyport range was estimated as 0.55/km^2 (Table D-1).

Studies of harbor seal diving behavior have been conducted in several locations on various age, physiological and sex classes. Harbor seals feed on fish, octopus, squid, shrimp and other available prey (Reeves et al. 2002), and have been observed eating Pacific herring and salmon in Washington inland waters (Suryan and Harvey 1998). They make mostly U-shaped (or square) dives when foraging, but also V-shaped, "wiggle", and skewed dives (Baechler et al. 2002), and may spend ~85% of the day diving for food (Reeves et al. 2002). Bowen et al. (1999) found that lactating females from Sable Island, Nova Scotia, spent 45% of time on land with their pups, 55% of time at sea and only 9% of the total time actively diving, indicating that there is widespread variation within the species. Bowen et al. (1999) also determined that about half of the total dive time was spent at the bottom of the dive. Eguchi and Harvey (2005) found that median depth and duration of dive were positively correlated with body mass, and large adult males generally dove deeper and longer than the smaller adult females. Approximately 80% of the dives recorded by Eguchi and Harvey (2005) of harbor seals in Monterey Bay, California, were U-shaped, and most of those were <100 m (mean 51.9 m for males; 39.8 m for females). The deepest dive was 481 m. Foraging dive bouts consisting of several rapidly occurring U-shaped dives were separated from one another by equally long bouts of non-foraging dives to <3 m (see Eguchi and Harvey 2005; Figure 2). Approximately 50% of total time was spent at the surface in non-foraging mode. Based largely on the information from Eguchi and Harvey (2005), the following are estimated time at depth for harbor seals: 50% at <3 m, 20% at 3-50 m, 25% at 51-100 m and 5% at >100 m.

D.8 CARNIVORES – SEA OTTER

Sea Otter – QUTR Site

Sea otters were exterminated from the Washington coast via hunting by the early 1900s, and were reintroduced in 1969 and 1970 via transplantation from otter populations in Alaska. The reintroduced population has been increasing annually at an average rate of 8.2% (Lance et al. 2004); the latest published count based on intensive aerial surveys conducted in 2005 is 814 (Jameson and Jeffries 2005). Sea otter range in Washington extends from just south of Destruction Island to Pillar Point in the Strait of Juan de Fuca. North of La Push the rate of annual increase is ~3.5% and the population may be reaching density equilibrium. However, south of LaPush, the annual rate of increase is ~20%, and a greater proportion of sea otters are found in that area (Jameson and Jeffries 2005). Occasionally individuals are seen within Puget Sound, but occurrence is very rare (Lance et al. 2004). Sea otters are entirely marine and rarely venture onto land; birthing and nursing take place in coastal waters and there is no seasonal molt. They remain in extreme nearshore waters, within 2 km of shore and usually less than 37 m depth (Lance et al. 2004). They are capable of ranging widely along the coast, and may shift distribution seasonally in response to food availability or storm events. Density (animals per km of coast) was provided for 2004 for each of three coastal segments. The density for the southern segment from Quillayute Needles to south of Destruction Island (Figure D-10) was 16.1 (410 otters/25.5 km) (Lance et al. 2004; Table 6). Using the 2005 count for the south segment (437) and area instead of coastline distance (25.5 km * 2 km = 51 km), density for sea otters year round would be 8.57 otters/km^2 (Table D-1). Sea otter distribution would not extend far enough offshore to occur in the QUTR Site so density for QUTR is zero. Density is also zero for the DBRC and Keyport Range sites.

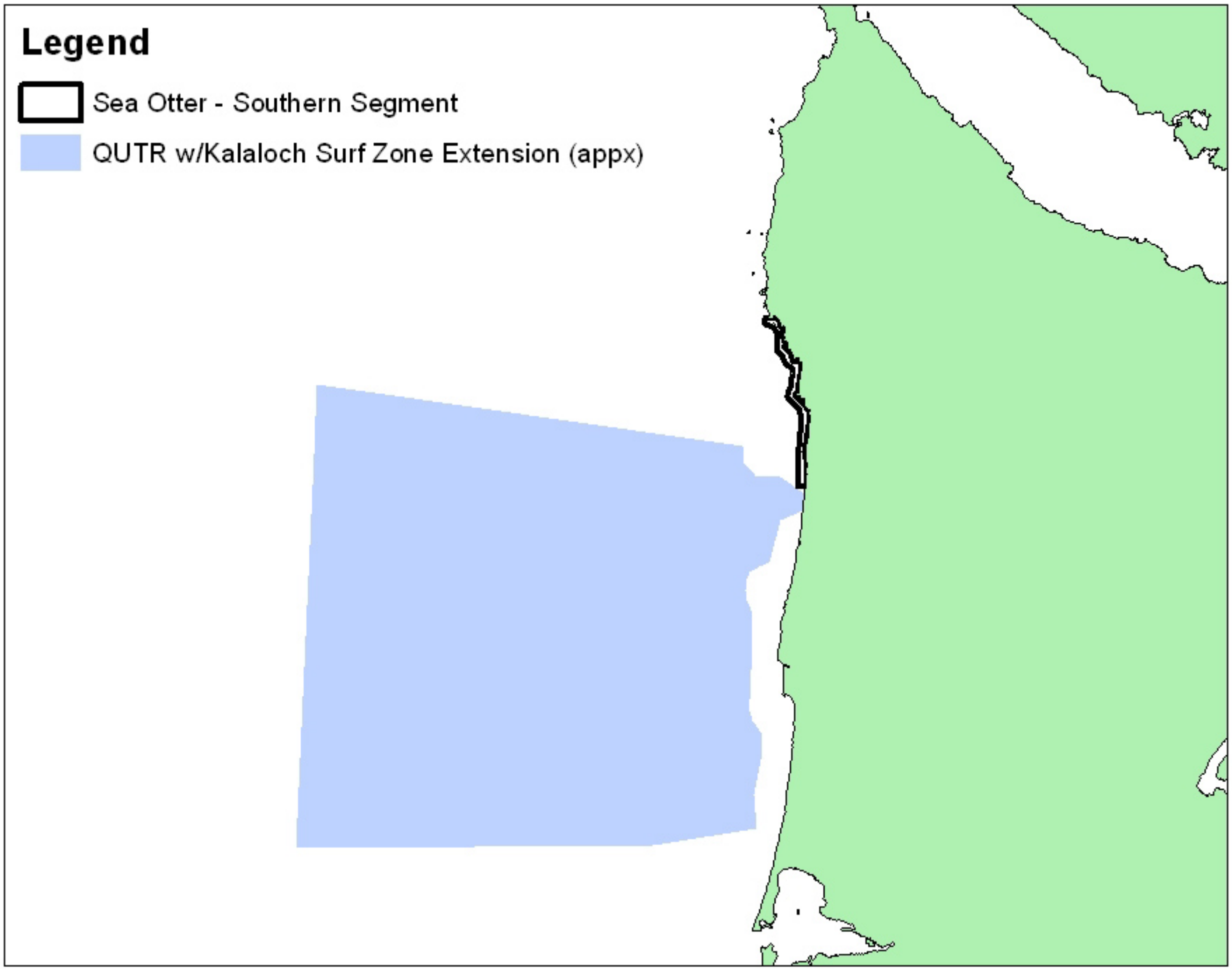

Figure D-10. Area of Sea Otter Southern Segment Range Used to Calculate Density. Note that distribution does not overlap that of the QUTR Site.

Table D-3: Summary of Marine Mammal Depth and Diving Information for Species Found in the NAVSEA NUWC Keyport Range Complex

NOTE: Some species that are not endemic to the Pacific Northwest are included because data on their depth and diving preferences were extrapolated to Washington species.

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
MYSTICETES - Baleen whales										
Blue whale	Euphausiid crustaceans, including *Euphausia* sp and *Thysanoessa* sp	Coastal as well as offshore	Sears (2002); Croll et al. (2001); Acevedo et al. (2002); Bannister (2002)		Feeding at depth	Northeast Pacific (Mexico, California)	Mean depth 140 +- 46 m; mean dive time 7.8 +- 1.9 min		Seven whales/ May-August/Time-depth-recorder	Croll et al. (2001)
Blue whale					Feeding near surface; surface intervals between deeper dives	Northeast Pacific (central California)	Mean depth 105 +- 13 m; mean dive time 5.8 +- 1.5 min	78% in 0-16 m; 9% in 17-32; 13% in >32 m; most dives to <16 m and 96-152 m ranges, but only 1.2% of total time was spent in deeper range	One whale/ August-September/ Satellite depth-sensor-tag	Lagerquist et al. (2000)
Blue whale					Non-feeding	Northeast Pacific (Mexico, California)	Mean depth 68 +- 51 m; mean dive time 4.9 +- 2.5 min; most dives to ~30 m with occasional deeper V-shaped dives to >100m		Seven whales/ May-August/Time-depth-recorder	Croll et al. (2001)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Fin whale	Planktonic crustaceans, including *Thyanoessa* sp and *Calanus* sp, as well as scholling fishes such as capelin (*Mallotus*), herring (*Clupea*) and mackerel (*Scomber*)	Pelagic with some occurrence over continental shelf areas, including in island wake areas of Bay of Fundy	Aguilar (2002); Croll et al. (2001); Acevado et al. (2002): Notarbartolo-di-Sciara et al. (2003); Bannister (2002); Johnston et al. (2005); Watkins and Schevill (1979)		Feeding at depth	Northeast Pacific (Mexico, California)	Mean depth 98 +- 33 m; mean dive time 6.3+-1.5 min		Fifteen whales/ April-October/Time-depth-recorder	Croll et al. (2001)
Fin whale					Non-feeding	Northeast Pacific (Mexico, California)	Mean depth 59 +-30 m; mean dive time 4.2 +-1.7 min; most dives to ~ 30 m with occasional deeper V-shaped dives to >90 m		Fifteen whales/ April-October/Time-depth-recorder	Croll et al. (2001)
Fin whale					Feeding	Mediterranean (Ligurian Sea)	Shallow dives (mean 26-33 m, with all <100m) until late afternoon; then dives in excess of 400 m (perhaps to 540 m); in one case a whale showed deep diving in midday; deeper dives probably were to feed on specific prey (*Meganyctiphanes norvegica*) that undergo diel vertical migration		Three whales/ Summer/ Velocity-time-depth-recorder	Panigada et al. (1999); Panigada et al. (2003); Panigada et al. (2006)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Fin whale					Traveling	Mediterranean (Ligurian Sea)	Shallow dives (mean 9.8 +- 5.3 m, with max 20 m) , shorter dive times and slower swimming speed indicate travel mode; deep dives (mean 181.3 +-195.4 m, max 474 m), longer dive times and faster swimming speeds indicate feeding mode		One whale/ Summer/ Velocity-time-depth-recorder	Jahoda et al. (1999)
Fin whale					Feeding	Northeast Pacific (Southern California Bight)	Mean dive depth 248+-18 m; total dive duration mean 7.0+-1.0 min with mean descent of 1.7+-0.4 min and mean ascent of 1.4+-0.3 min; 60% (i.e., 7.0 min) of total time spent diving with 40% (i.e., 4.7 min) total time spent near sea surface (<50m)	44% in 0-49m (includes surface time plus descent and ascent to 49 m); 23% in 50-225 m (includes descent and ascent times taken from Table 1 minus time spent descending and ascending through 0-49 m); 33% at >225 m (total dive duration minus surface, descent and ascent times)	Seven whales/ August/ Bioacoustic probe	Goldbogen et al. (2006)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Fin whale					Feeding	Northeast Pacific (Southern California Bight)	Distribution of foraging dives mirrored distribution of krill in water column, with peaks at 75 and 200-250 m.		Two whales/ September-October/ Time-depth-recorder	Croll et al. (2001)
Sei whale	Copepods, amphipods, euphausiids, shoaling fish and squid	More open ocean than coastal, but occasionally move close to shore to opportunistically feed	Horwood (2002); Jefferson et al. (1993); Nemoto and Kawamura (1977); Bannister (2002); Watkins and Schevill (1979); Clarke (1986)		Feeding	Northwest Pacific - coastal	Skim feeder that takes swarms in low density		Several/ Year-round/ Stomach content analysis	Nemoto and Kawamura (1977)
Sei whale					Feeding	Northern Atlantic (southern Gulf of Maine)	Lunge-feeding just below surface, surface skim feeding, gulping; likely feeding on krill		29 animals/ July-September/ visual observations	Weinrich et al. (1986)
Minke whale	Regionally dependent; can include euphausiids, copepods, small fish and squids; Japanese anchovy preferred in western North Pacific, capelin and krill in the Barents Sea; armhook squids in North Pacific	Coastal, inshore and offshore; known to concentrate in areas of highest prey density, including during flood tides	Perrin and Brownell (2002); Jefferson et al. (1993); Murase et al. (2007); Bannister (2002); Lindstrom and Haug (2001); Johnston et al. (2005); Hoelzel et al. (1989); Haug et al. (2002); Haug et al. (1995); Haug et al. (1996); Konishi and Tamura (2007); Clarke (1986)		Feeding, Searching	North Atlantic (Norway)	Searching for capelin at less than 20 m, then lunge-feeding at depths from 15 to 55 m, then searching again at shallower depths	Based on time series in Figure 2, 47% of time was spent foraging from 21-55 m; 53% of time was spent searching for food from 0-20 m	One whale/ August/ Dive-depth-transmitters	Blix and Folkow (1995)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Minke whale					Feeding	North Pacific (San Juan Islands)	80% of feeding occurred over depths of 20-100m; two types of feeding observed both near surface - lunge feeding and bird association		23 whales/ June-September/ behavioral observations	Hoelzel et al. (1989)
Humpback whale	Pelagic schooling euphausiids and small fish including capelin, herring, mackerel, croaker, spot, and weakfish	Coastal, inshore, near islands and reefs, migration through pelagic waters	Clapham (2002); Hain et al. (1995); Laerm et al. (1997); Bannister (2002); Watkins and Schevill (1979)		Feeding	North Atlantic (Stellwagen Bank)	Depths <40 m		Several whales/ August/ Visual Observations	Hain et al. (1995)
Humpback whale					Feeding (possible)	Tropical Atlantic (Bermuda)	Dives to 240 m		One whale/ April/ VHF tag	Hamilton et al. (1997)
Humpback whale					Feeding (in breeding area)	Tropical Atlantic (Samana Bay - winter breeding area)	Not provided; lunge feeding with bubblenet		One whale/ January/ Visual observations	Baraff et al. (1991)
Humpback whale					Breeding	North Pacific (Hawaii)	Depths in excess of 170 m recorded; some depths to bottom, others to mid- or surface waters; dive duration was not necessarily related to dive depth; whales resting in morning with peak in aerial displays at noon	40% in 0-10 m, 27% in 11-20 m, 12% in 21-30 m, 4% in 31-40 m, 3% in 41-50 m, 2% in 51-60 m, 2% in 61-70 m, 2% in 71-80 m, 2% in 81-90 m, 2% in 91-100 m, 3% in >100 m (from Table 3	Ten Males/ February-April/ Time-depth-recorder	Baird et al. (2000); Helweg and Herman (1994)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Humpback whale					Feeding	Northeast Atlantic (Greenland)	Dive data was catalogued for time spent in upper 8 m as well as maximum dive depth; diving did not extend to the bottom (~1000 m) with most time in upper 4 m of depth with few dives in excess of 400 m	37% of time in <4 m, 25% of time in 4-20 m, 7% of time in 21-35m, 4% of time in 36-50 m, 6% of time in 51-100 m, 7% of time in 101-150 m, 8% of time in 151-200 m, 6% of time in 201-300 m, and <1% in >300 m (from Figure 3.10)	Four whales/ June-July/ Satellite transmitters	Dietz et al. (2002)
Humpback whale					Feeding	North Pacific (Southeast Alaska)	Dives were short (<4 min) and shallow (<60 m); deepest dive to 148m; percent of time at surface increased with increased dive depth and with dives exceeding 60 m; dives related to position of prey patches		Several whales/ July-September/ Passive sonar	Dolphin (1987); Dolphin (1988)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Gray whale	Amphipods, including *Ampelisca* sp, and other organisms living in the sea floor; also occasionally surface skim and engulfing; dependent on location; euphausiids along frontal systems may also be important	Continental shelf, 4-120 m depth	Dunham and Duffus (2002); Jones and Swartz (2002); Bannister (2002); Yazvenko et al. (2007); Bluhm et al. (2007)		Migrating	Northeast Pacific (coastal Baja California to northern California)	30 of 36 locations in depths <100m deep (mean 39 m); consistent speed indicating directed movement		One whale/ February/ Satellite tag	Mate and Urban Ramirez (2003)
Gray whale					Feeding	Bering and Chukchi Seas	Depths at feeding locations from 5-51 m depth		Several whales/ July-November/ Aerial surveys and benthic sampling	Clarke et al. (1989); Clarke and Moore (2002); Moore et al. (2003)
Gray whale					Feeding	Northeast Pacific (Kodiak Island)	Feeding on cumacean invertebrates		Several whales/ Year-round/ Aerial surveys	Moore et al. (2007)

GENERAL INFORMATION				DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**	**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Gray whale				Feeding	Northeast Pacific (Vancouver Island)	Majority of time was spent near the surface on interventilation dives (<3 m depth) and near the bottom (extremely near shore in a protected bay with mean dive depth of 18 m, range 14-22 m depth; little time spent in the water column between surface and bottom.	40% of time at <4 m (surface and interventilation dives), 38% of time at 3-18 m (active migration), 22% of time at >18 m (foraging).	One whale/ August/ Time-depth recorder	Malcolm et al. (1995/96); Malcolm and Duffus (2000)
ODONTOCETES - Toothed whales									
Sperm whale	Squids and other cephalopods, demersal and mesopelagic fish; varies according to region	Deep waters, areas of upwelling	Whitehead (2002); Roberts (2003); Clarke (1986)	Feeding	Mediterranean Sea	Overall dive cycle duration mean = 54.78 min, with 9.14 min (17% of time) at the surface between dives; no measurement of depth of dive		16 whales/ July-August/ visual observations and click recordings	Drouot et al. (2004)
Sperm whale				Feeding	South Pacific (Kaikoura, New Zealand)	83% of time spent underwater; no change in abundance between summer and winter but prey likely changed between seasons		>100 whales/ Year-round/ visual observations	Jacquet et al. (2000)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	Equatorial Pacific (Galapagos)	Fecal sampling indicated four species of cephalopods predominated diet, but is likely biased against very small and very large cephalopods; samples showed variation over time and place		Several whales/ January-June/ fecal sampling	Smith and Whitehead (2000)
Sperm whale					Feeding	Equatorial Pacific (Galapagos)	Dives were not to ocean floor (2000-4000 m) but were to mean 382 m in one year and mean of 314 in another year; no diurnal patterns noted; general pattern was 10 min at surface followed by dive of 40 min; clicks (indicating feeding) started usually after descent to few hundred meters		Several whales/ January-June/ acoustic sampling	Papastavrou et al. (1989)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	North Pacific (Baja California)	Deep dives (>100m) accounted for 26% of all dives; average depth 418 +- 216 m; most (91%) deep dives were to 100-500 m; deepest dives were 1250-1500m; average dive duration was 27 min; average surface time was 8.0; whale dives closely correlated with depth of squid (200-400 m) during day; nighttime squid were shallower but whales still dove to same depths	74% in <100 m; 24% in 100-500 m; 2% in >500m	Five whales/ October-November/ Satellite-linked dive recorder	Davis et al. (2007)
Sperm whale					Resting/ socializing	North Pacific (Baja California)	Most dives (74%) shallow (8-100 m) and short duration; likely resting and/or socializing		Five whales/ October-November/ Satellite-linked dive recorder	Davis et al. (2007)
Sperm whale					Feeding	North Atlantic (Norway)	Maximum dive depths near sea floor and beyond scattering layer		Unknown # male whales/ July/ hydrophone array	Wahlberg (2002)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	North Pacific (Southeast Alaska)	Maximum dive depth if 340 m when fishing activity was absent; max dive depth during fishing activity was 105 m		Two whales/ May/ acoustic monitoring	Tiemann et al. (2006)
Sperm whale					Feeding	Northwest Atlantic (Georges Bank)	Dives somewhat more U-shaped than observed elsewhere; animals made both shallow and deep dives; average of 27% of time at surface; deepest dive of 1186 m while deepest depths in area were 1500-3000 m so foraging was mid-water column; surface interval averaged 7.1 min		Nine Whales/ July 2003/ DTAG	Palka and Johnson (2007)
Sperm whale					Feeding	Northwest Atlantic (Georges Bank)	37% of total time was spent near surface (0-10m); foraging dive statistics provided in Table 1 and used to calculate percentages of time in depth categories, adjusted for total time at surface	48% in <10 m; 3% in 10-100 m; 7% in 101-300 m; 7% in 301-500 m; 4% in 501-636 m; 31% in >636 m	Six females or immatures/ September-October/ DTAG	Watwood et al. (2006)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	Mediterranean Sea	20% of total time was spent near surface (0-10m); foraging dive statistics provided in Table 1 and used to calculate percentages of time in depth categories, adjusted for total time at surface	35% in <10 m; 4% in 10-100 m; 9% in 101-300 m; 9% in 301-500 m; 5% in 501-623 m; 38% in >636 m	Eleven females or immatures/ July/ DTAG	Watwood et al. (2006)
Sperm whale					Feeding	Gulf of Mexico	28% of total time was spent near surface (0-10m); foraging dive statistics provided in Table 1 and used to calculate percentages of time in depth categories, adjusted for total time at surface	41% in <10 m; 4% in 10-100 m; 8% in 101-300 m; 7% in 301-468 m; 40% >468 m	20 females or immatures/ June-September/ DTAG	Watwood et al. (2006)

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Sperm whale					Feeding/ Resting	North Pacific (Japan)	Dives to 400-1200 m; active bursts in velocity at bottom of dive suggesting search-and-pursue strategy for feeding; 14% of total time was spent at surface not feeding or diving at all, with 86% of time spent actively feeding; used numbers from Table 1 to determine percentages of time in each depth category during feeding then adjusted by total time at surface	31% in <10 m (surface time); 8% in 10-200 m; 9% in 201-400 m; 9% in 401-600 m; 9% in 601-800m; 34% in >800 m	One female/ June/ Time-depth-recorder	Amano and Yoshioka (2003)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	North Pacific (Japan)	Diel differences in diving in one location offshore Japan, with deeper dives (mean 853 m) and faster swimming during the day than at night (mean 469 m); other location along Japan's coast showed no difference between day and night dives; most time (74%) spent on dives exceeding 200 m; surface periods of 2.9 h at least once per day; max depth recorded 1304 m		Ten whales/ May-June, October/ depth data loggers and VHF radio transmitters	Aoki et al. (2007)
Sperm whale					Feeding/ Resting	North Atlantic (Caribbean)	Whales within 5 km of shore during day but moved offshore at night; calves remained mostly at surface with one or more adults; night time tracking more difficult due to increased biological noise from scattering layer; both whales spent long periods of time (>2hr) at surface during diving periods		Two whales/ October/ Acoustic transponder	Watkins et al. (1993)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale						North Atlantic (Caribbean)	Dives did not approach bottom of ocean (usually >200 m shallower than bottom depth); day dives deeper than night dives but not significantly; 63% of total time in deep dives with 37% of time near surface or shallow dives (within 100 m of surface)		One whale/ April/ Time-depth tag	Watkins et al. (2002)
Sperm whale					Feeding	Northern Pacific (Hawaii)	Cephalopods of several genera recovered		Two animals/ unknown/ stomach contents	Clarke and Young (1998)
Sperm whale					Occurrence	Mediterranean Sea (Alborian Sea south of Spain)	Preferred waters >700m		Vessel transects	Canadas et al. (2002)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Sperm whale					Feeding	Arctic Ocean (Norway)	Dives from 14-1860 m with median of 175 m; clicking (searching for prey) began at 14-218 m and stopped at 1-1114 m, and whale spent 91% of overall dives emitting clicks; shallower dives were apparently to target more sparse prey while deep dives led to frequent prey capture attempts and were likely within denser food layers		Four adult males/ July/ DTAG	Teloni et al. (2007)
Pygmy sperm whale	Mid and deep water cephalopods, fish, crustaceans; probably feeding at or near bottom, possibly using suction feeding	Continental slope and deep zones of shelf, epi- and meso-pelagic zones	McAlpine (2002); McAlpine et al. (1997); Clarke (1986)		Feeding	Northwest Atlantic (Canada)	Prey items included squid beaks, fish otolith and crustacean; squids representative of mesopelagic slope-water community		One whale/ December/ Stomach contents	McAlpine et al. (1997)
Pygmy sperm whale					Feeding	Southwest Atlantic (Brazil)	Small to medium-sized cephalopods from offshore regions; cephalopods and fish found in animals from shelf regions		unknown animals/ unknown/ stomach contents	Santos and Haimovici (2001)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Pygmy sperm whale					Feeding	South Pacific (New Zealand)	Primarily cephalopod prey of genus *Histioteuthis* sp, mostly immatures, which is know to undergo vertical migrations; also mysids that are usually found at 650 m during day and between 274 and 650 m at night; some prey species also found in shallower (<100 m) depths in trawls		27 whales/ Year round/ Stomach contents	Beatson (2007)
Dwarf sperm whale	Likely feeds in shallower water than *K breviceps*; otherwise food is similar	Continental slope and deep zones of shelf, epi- and meso-pelagic zones	McAlpine (2002); Clarke (1986)							

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Blainville's beaked whale	Feed primarily on mesopelagic squid (*Histioteuthis, Gonatus*) and some mesopelagic fish; most prey probably caught at >200 m; likely suction feeders based on lack of teeth and enlarged hyoid bone and tongue muscles		Pitman (2002); Clarke (1986)		Feeding	Northeast Pacific (Hawaii)	Max dive depth = 1408 m; identified at least three dive categories including inter-ventilation (<5 m), long duration (>800m, U-shaped but with inflections in bottom depth), and intermediate duration (6-300 m, U-shaped); dive cycle usually included one long duration,~8 intermediate duration and several shallow interventilation dives; one surface interval of >154 min; no difference between day and night diving		Four whales/ September-November/ Time-depth recorders	Baird et al. (2006a); Baird et al. (2005a)
Blainville's beaked whale					Feeding	Northeast Pacific (Hawaii)	Mean max dive depth = 1365 m; whales appeared to coordinate dives to ~600 m after which coordination of depths was not prevalent; dives >800 m (>65 min) occurred once/2.5 hour; likely feeding in mid-depth, not bottom feeding		Three whales/ March-April/ Time-depth recorders	Baird et al. (2006c)

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Blainville's beaked whale					Feeding	Northeast Atlantic (Canary Islands)	Two types of dive, U-shaped deep foraging dives (>500 m, mean 835m) and shallower non-foraging dives (<500 m, mean 71 m); depth distribution taken from information in Table 2	26% in <2 m (surface); 41% in 2-71 m; 2% in 72-200 m; 4% in 201-400 m; 4% in 401-600 m; 4% in 601-835; 19% in >835 m	Three whales/ June/ DTAGs	Tyack et al. (2006)
Blainville's beaked whale					Feeding	Northeast Atlantic (Canary Islands)	Deep dives broken into three phases: silent descent, vocal-foraging (including search, approach and terminal phases) and silent ascent; vocalizations not detected <200m depth; detected when whales were as deep as 1267 m; vocalizations ceased when whale started ascending from dive; clicks ultrasonic with no significant energy below 20 kHz		Two whales/ September/ DTAGs	Johnson et al. (2004); Madsen et al. (2005)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Baird's beaked whale	Benthic fishes and cephalopods, also pelagic fish including mackerel and sardine; primarily squid off northern coast of Hokkaido and deep sea fish off Pacific coast of Japan	Deep waters over continental slope	Kasuya (2002); Kasuya (1986); Walker et al. (2002); Clarke (1986)		Feeding	Northwest Atlantic (Japan)	Whales caught at depths of ~1000 m; stomach contents included prey species normally found from 1100-1300 m; likely feeding at or near bottom		Several whales/ August-September/ Stomach contents	Ohizumi et al. (2003)
Northern bottlenose whale	Squid of genus *Gonatus* and *Taonius* and occasionally fish and benthic invertebrates	Deep waters >500 m; can dive to >1400 m	Gowans (2002); Kasuya (2002); Clarke and Kristensen (1980); Clarke (1986)		Feeding	Northeast Atlantic (Nova Scotia "Gully")	Most (62-70%, average = 66%) of the time was spent diving (deeper than 40 m); most dives somewhat V-shaped; shallow dives (<400 m) and deep dives (>800 m); whales spent 24-30% (therefore, average of 27%) of dives at 85% maximum depth indicating they feed near the bottom; deepest dive 1453 m; depth distribution taken from info in Table 1	34% at 0-40 m, 39% at 41-800 m, 27% at >800 m	Two whales/ June-August/ Time-depth recorders	Hooker and Baird (1999)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Killer whale	Diet includes fish (salmon, herring, cod, tuna) and cephalopods, as well as other marine mammals (pinnipeds, dolphins, mustelids, whales) and sea birds; most populations show marked dietary specialization	Widely distributed but more commonly seen in coastal temperate waters of high productivity	Ford (2002); Estes et al. (1998); Ford et al. (1998); Saulitis et al. (2000); Baird et al. (2006b)		Feeding	North Pacific (Puget Sound)	Resident-type (fish-eater) whales; maximum dive depth recorded 264 m with maximum depth in study area of 330 m; population appeared to use primarily near-surface waters most likely because prey was available there; some difference between day and night patterns and between males and females depth distribution info from Table 5 in Baird et al. (2003)	96% at 0-30 m; 4% at >30 m	Eight whales/ Summer-fall/ Time-depth recorders	Baird et al. (2005b); Baird et al. (2003)
Killer whale					Feeding	Southwest Atlantic (Brazil)	Small to medium-sized cephalopods, both offshore and coastal		Unknown animals/ unknown/ stomach contents	Santos and Haimovici (2001)
Risso's dolphin	Primarily squid eaters and presumably eat mainly at night; known to feed on oceanic species that are also bioluminescent	Water depths from 400-1000 m but also on continental shelf; utilize steep sections of continental slope in GOM (350-975 m)	Baird (2002); Baumgartner (1997); Bello (1992b); Clarke (1986)		Feeding	Mediterranean (western)	Prey items were mainly squids and octopods, and indicated that most feeding occurs on the middle slope from 600-800 m		15 animals/ year round/ stomach contents	Blanco et al. (2006)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Risso's dolphin					Feeding	Mediterranean (Turkey)	Prey species (pelagic cephalopods) show greater degree of vertical distribution compared to those utilized by *S. coeruleoalba*; may indicate they dive deeper or are more likely to feed at night		Two animals/ May-June/ stomach contents	Ozturk et al. (2007)
Risso's dolphin					Feeding	Mediterranean (Ligurian Sea)	Diet composed of cephalopods found at daytime depths in excess of 300 m and which may undertake vertical migrations at night		One animal/ August/ stomach contents	Wurtz et al. (1992)
Risso's dolphin					Feeding	Northern Pacific (Hawaii)	Cephalopods of several genera recovered		One animal/ unknown/ stomach contents	Clarke and Young (1998)
Risso's dolphin					Feeding	North Atlantic (England)	Squid, octopod and cuttlefish were present, all live on the continental shelf		One animal/ May/ stomach contents	Clarke and Pascoe (1985)
Risso's dolphin					Occurrence	Mediterranean Sea (Alborian Sea south of Spain)	Found in waters >600 m with no sightings <400 m		Vessel transects	Canadas et al. (2002)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Striped dolphin					Feeding	Mediterranean (western)	Mixed diet of muscular and gelatinous body squids, mainly consisting of oceanic and pelagic or bathypelagic species		28 animals/ unknown/ stomach contents	Blanco et al. (1995)
Striped dolphin					Feeding	North Pacific (Japan)	Myctophid fish accounted for 63% of prey		Unknown animals/ unknown/ stomach contents	Archer and Perrin (1999)
Striped dolphin					Feeding	Mediterranean (Ligurian Sea)	Diet composed of cephalopods, crustaceans and bony fishes; cephalopods and bony fishes apparently equal in importance; likely feeding in offshore waters and possibly in the upper water column; opportunistic feeders		23 animals/ unknown/ stomach contents	Wurtz and Marrale (1993)
Striped dolphin					Feeding	Mediterranean Sea (Ionian Sea)	Prey items included cephalopods, fish and shrimp; feeding likely was benthopelagic although feeding may have taken advantage of species undergoing night time vertical migrations as		One animal/ May/ stomach contents	Bello (1992b)

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	Food Preference	Depth or Oceanic Preference	References		Behavioral State	Geographic Region	Depth Information	Depth Distribution	Sample Size/ Time of Year/Method	References
							well			
Striped dolphin					Feeding	North Atlantic (Ireland)	Remains included Gadidae, Clupeidae and cephalopods		Seven animals/ year round/ stomach contents	Berrow and Rogan (1996)
Striped dolphin					Occurrence	Mediterranean Sea (Alborian Sea south of Spain)	Found rarely on continental shelf waters and rather in waters >600 m		Vessel transects	Canadas et al. (2002)
Striped dolphin	Feed on pelagic fish and squid; squid make up 50-100% of stomach contents in Mediterranean samples	Continental slope, convergence zones and areas of upwelling; ranges of known prey and presence of luminescent organs in prey indicate feeding at night, possibly 200-700 m	Archer (2002); Archer and Perrin (1999); Clarke (1986)		Feeding	Mediterranean (Turkey)	Prey species (pelagic cephalopods) show lesser degree of vertical distribution compared to those utilized by *G. griseus*		Three animals/ May-June/ stomach contents	Ozturk et al. (2007)
Pantropical spotted dolphin	Small epipelagic fishes, squids and crustaceans for offshore forms; near shore forms may feed on benthic fishes; perhaps some nocturnal feeding; probably opportunistic	Near shore and offshore, with possible shifts closer to shore in fall and winter; in eastern tropical Pacific often found in association with tuna; diet suggest feeding at night on	Perrin (2002a); Richard and Barbeau (1994); Robertson and Chivers (1987); Clarke (1986)		Feeding	Southwest Pacific (Taiwan)	Feed primarily on mesopelagic prey, particularly myctophid lanternfish and cephalopods, with some seasonal differences; night distribution of prey appears to be 0-200 m while		45 animals/ year round/ stomach contents	Wang et al. (2003)

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		vertically migrating prey					daytime distribution of prey is >300 m			
Pantropical spotted dolphin					Feeding	North Pacific (Hawaii)	Dives deeper at night (mean = 57 m, max = 213 m) than during day (mean = 13 m, max = 122 m) indicating night diving takes advantage of vertically migrating prey; during daytime, 89% of time was within 0-10 m; depth distribution taken from info in figure 4	For activities conducted during daytime-only, the depth distribution would be 89% at 0-10 m, 10% at 11-50 m, 1% at 51-122 m; for activities conducted over a 24-hour period, the depth distribution needs to be modified to reflect less time at surface and deeper depth dives; 80% at 0-10 m, 8% at 11-20 m, 2% at 21-30 m, 2% at 31-40 m, 2% at 41-50 m, and 6% at 51-213 m.	Six animals/ year round/ time-depth recorders	Baird et al. (2001)
Pantropical spotted dolphin					Feeding	Northern Pacific (Hawaii)	Remains of cephalopods and fish recovered		One animal/ unknown/ stomach contents	Clarke and Young (1998)

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Pantropical spotted dolphin					Feeding/ travelling	Eastern Tropical Pacific	Daytime dives to 5-20 m (above thermocline) and U-shaped (travelling dives); nighttime dives were deeper and below thermocline, characterized by rapid up and down movements at depth (foraging dives); deepest dive to 200 m though most were not that deep		Nine animals/ August-October/ time-depth recorders	Chivers and Scott (2002)
Pacific white-sided dolphin	Lanternfish, anchovies, hake and squid; also herring, salmon, cod, shrimp and capelin	Mostly pelagic and temperate; may synchronize movements with anchovy and other prey	van Waerebeek and Wursig (2002); Clarke (1986)		Feeding	Northeast Pacific (British Columbia inland waters)	Prey collected included herring, capelin, Pacific sardine and possibly eulachon		Unknown/ year round/ dipnet collection of prey	Morton (2000)
Atlantic white-sided dolphin	Herring, small mackerel, gadid fishes, smelts, hake, sand lances, squid; likely change from season to season	Continental shelf and slope from deep oceanic areas to occasionally coastal waters	Cipriano (2002); Clarke (1986)			North Atlantic (Gulf of Maine)	Most (89%) of time spent submerged; most (76%) dives were <1 min duration and none were for longer that 4 minute duration		One animal/ February/ satellite-monitored radio tag	Mate et al. (1994)
Atlantic white-sided dolphin					Feeding	North Atlantic (Ireland)	Most frequent prey were mackerel and silvery pout		Four animals/ year round/ stomach contents	Berrow and Rogan (1996)
White-beaked dolphin	Mesopelagic fish, especially cod, whiting and other gadids, and squid		Kinze (2002); Clarke (1986)		Feeding	North Atlantic (Ireland)	Stomach contained Gadoid fish and scad remains		One animal/ year round/ stomach contents	Berrow and Rogan (1996)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Short-beaked common dolphin	Small mesopelagic fishes and squids in the deep scattering layer; epipelagic schooling fishes and market squids	Wide range of habitats, including upwelling areas, oceanic and near shore regions	Perrin (2002b); Clarke (1986)		Feeding	Southwest Atlantic (Brazil)	Cephalopods and fish found in animals from shelf regions		Two animals/ unknown/ stomach contents	Santos and Haimovici (2001)
Short-beaked common dolphin					Feeding	Northeast Atlantic (Bay of Biscay)	Oceanic diet dominated by myctophid fishes (90%), with less reliance on cephalopods; appear to forage preferentially on small schooling, vertically migrating mesopelagic fauna at dusk and early evening		63 animals/ June-August/ stomach contents	Pusineri et al. (2007)
Short-beaked common dolphin					Feeding	Unknown	Dives to 200 m, apparently from study reported by Evans (1994)		Unknown/ unknown/ unknown	Perrin (2002b)
Short-beaked common dolphin					Feeding	Western North Pacific	Primarily myctophid fishes and other warm water fish species; most prey species found are those that migrate vertically to shallower depth at night (within few hundred m) or inhabit upper layer of ocean		Ten animals/ September/ stomach contents	Ohizumi et al. (1998)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Short-beaked common dolphin					Feeding	Mediterranean Sea	Diet of shoaling fish and eurybathic cephalopods and crustceans			Bearzi et al. (2003)
Short-beaked common dolphin					Feeding	Mediterranean Sea (Algeria)	Diet composed of pelagic fishes (94%) and cephalopods (6%); most prey of low commercial value		Ten animals/ unknown/ stomach contents	Boutiba and Abdelghani (1996)
Short-beaked common dolphin					Feeding	North Pacific	Fish accounted for 94% of the diet (mostly myctophid fish), with squids making up 6% of diet		Seven animals/ May-November/ stomach contents	Chou et al. (1995)
Short-beaked common dolphin					Feeding	North Atlantic (mid-Atlantic Bight offshore New Jersey)	Atlantic mackerel and long-finned squid		Four animals/ March-April/ stomach contents	Overholtz and Waring (1991)
Short-beaked common dolphin					Feeding	Mediterranean Sea (Ligurian Sea)	Prey consisted of offshore species of fish, decapod crustaceans and cephalopods; similar diet to that found in striped dolphins		Three animals/ unknown/ stomach contents	Relini and Relini (1993)
Short-beaked common dolphin					Feeding	North Atlantic (Portuguese coast)	Prey remains mostly fish (90%), especially blue whiting and sardine, followed by cephalopods (10%)		26 animals/ year round/ stomach contents	Silva and Sequeira (1997)
Short-beaked common dolphin					Feeding	Indian Ocean (South Africa)	Feeding associated with northward		297 animals/ year round/	Young and Cockcroft (1994)

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							sardine migration; most prey were pelagic shoaling species, mostly South African pilchard, and squid		stomach contents	
Short-beaked common dolphin					Feeding	North Atlantic (Ireland)	Remains included Gadidae, Clupeidae and cephalopods		27 animals/ year round/ stomach contents	Berrow and Rogan (1996)
Long-beaked common dolphin	Small mesopelagic fishes and squids in the deep scattering layer; epipelagic schooling fishes and market squids	Somewhat shallower and warmer water than short-beaked; closer to the coast	Perrin (2002b)		Feeding	Unknown	Unknown	Dives to 200 m, apparently from study reported by Evans (1994)	Unknown	Perrin (2002b)
Northern right whale dolphin	Squid and lanternfish, also Pacific hake, saury and mesopelagic fish		Lipsky (2002); Clarke (1986)		Feeding	North Pacific	Fish accounted for 89% of the diet (mostly myctophid fish), with squids making up 11% of diet		Seven animals/ May-November/ stomach contents	Chou et al. (1995)
Spinner dolphin	Small mesopelagic fishes, although subpopulations consume benthic fishes; also cephalopods	Pantropical; often high-seas, but coastal populations are also known; dives to 600 m or deeper	Perrin (2002c); Benoit-Bird and Au (2003); Clarke (1986)		Feeding	Southwest Pacific (Sulu Sea, Philippines)	Mainly feed on mesopelagic crustaceans, cephalopods and fish that undertake vertical migrations to about 200 m at night, with less reliance on non-migrating species found to about 400 m; take smaller prey than Fraser's		45 animals/ unknown/ stomach contents	Dolar et al. (2003)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
							feeding in same area			
Spinner dolphin					Feeding	North Pacific (Hawaii)	Extremely close association with small, mesopelagic fishes; mean depth always within 10 m of the depth of the highest prey density; feeding at night occurs between 0-400 m as that is the nighttime prey distribution (prey distribution during the day is estimated at 400-700 m); did not spend entire night offshore but often within 1 km of shore if prey density was highest there	100% at 0-50 m; nighttime: 100% at 0-400 m.	Several animals/ June and November/ active acoustic surveys	Benoit-Bird and Au (2003)
Dall's porpoise	Small schooling and mesopelagic fish and cephalopods	Deep offshore as well as deeper near shore waters; diurnal as well as nocturnal feeders to take advantage of prey availability	Jefferson (2002), Amano et al. (1998); Clarke (1986)		Travelling	North Pacific (Puget Sound)	Feasibility study to determine if Dall's could be successfully tagged with suction cup tag; depth distribution info from Table 2 and excludes initial dive data when animal responded to tag event	39% at <1 m, 8% at 1-10 m, 45% at 11-40 m and 8% at >40 m	One animal/ August/ time-depth recorder	Hanson and Baird (1998)

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Harbor porpoise	Fish and squid eaters; fish with high fat content including herring, sprat, and anchovy	Forage near bottom in waters less than 200 m; can dive to >220 m	Bjorge and Tolley (2002); Clarke (1986)		Feeding	North Atlantic (Ireland)	Most frequent prey were *Trisopterus*, whiting, *Merlangius* and sprat; mostly pelagic species		26 animals/ year round/ stomach contents	Berrow and Rogan (1996)
Harbor porpoise					Feeding/ migrating	Northwest Pacific (Japan)	>90% of dives were <10 m; maximum dive depth of 65 m with mean of 3.8 m		One animal/ July/ micro data logger	Otani et al. (2000)
Harbor porpoise					Feeding/ migrating	Northwest Pacific (Japan)	Diving occurred almost continuously with little long-term surface time; maximum depths of 99 and 71 m, with >70% of diving time at <21 m; shallow dives (<21 m) V-shaped with little bottom time; deeper dives (>90 m) U-shaped with noticeable bottom time; depth distribution taken from Figure 3	75% at 0-20 m, 15% at 21-40 m, and 10% at >40 m.	Two females/ April-May/ micro-dataloggers	Otani et al. (1998)
Harbor porpoise					Feeding	Northeast Atlantic	Shift from predation on clupeid fish (herring and sprat) to sand eels and gadoid fish (whiting) following decline in herring stocks		Literature review of stomach content papers	Santos and Pierce (2003)

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Harbor porpoise					Feeding	Northwest Atlantic (Bay of Fundy)	Maximum recorded depth was 226 m, with mean dive depths of 14 to 41 m; long, deep dives infrequent; most dives were U-shaped with bottom time accounting for 27-39% of total dive time (bottom time does not equal ocean bottom); 33-60% of time spent within top 2 m of surface		Seven animals/ August-September, time-depth recorders	Westgate et al. (1995)
Harbor porpoise						Northwest Atlantic (Bay of Fundy, Gulf of Maine)	Most of time (55%) was spent in water depth ranging from 92-183 m, with only 12% of time spent in water >183 m deep; 3-7% of total time was spent at the surface		Nine animals/ August/ satellite-linked transmitters	Read and Westgate (1997)
CARNIVORES - Pinnipeds and sea otters										

GENERAL INFORMATION					DEPTH SPECIFIC INFORMATION					
Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Northern fur seal	Small fish and squid in deep water and along the shelf break; Pacific herring, squid and walleye pollock dominated in the Gulf of Alaska, British Columbia, Washington and Oregon; northern anchovy and squid primary in Oregon, Washington and California	Deep dives occur on the shelf and feeding probably occurs near the bottom	Gentry (2002); Ream et al. (2005)				Maximum dive depth 256 m		Two females/ July/ time-depth recorders	Ponganis et al. (1992)
Northern fur seal					Feeding	North Pacific (Bering Sea)	Mean dive depth 68 m (range 32-150 m); mean maximum depth 168 m (range 86-207 m); two types of dives, shallow (<75 m; mean = 30 m; occur at night) and deep (>75 m; mean = 130 m; occur during day and night); total activity budget during feeding trips was 57% active at surface, 26% diving and 17% resting; depth distribution info from Gentry and others	Daytime: 74% at <2 m, 24% at 2-260 m; night time: 74% at <2 m, 24% at 2-75 m	Seven females/ July/ time-depth recorders	Gentry et al. (1986)
Northern fur seal					Feeding	North Pacific (Bering Sea)	Mean dive depth of 17.5 m, with a maximum depth of 175 m; diving deeper in the		19 juvenile males/ July-September/ satellite	Sterling and Ream (2004)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
							daytime than during nighttime, perhaps reflecting the different distribution of prey (especially juvenile pollock) that undertake night time vertical migrations, and also differed between inner-shelf, mid-shelf, outer-shelf and off-shelf locations; deeper diving tended to occur on-shelf, with shallower diving off-shelf		transmitters	
Northern fur seal					Feeding	North Pacific (Bering Sea to California)	Higher dive rates during night time hours compared with daytime; variation in mean dive depth between migratory travelling and destination area (eastern North Pacific coast) where mean dive depth was <25 m; night time mean dive depths were greater during full moon than during new moon		Three females/ November-May/ satellite transmitters	Ream et al. (2005)

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Northern fur seal					Feeding	North Pacific (Bering Sea)	Activity budgets of lactating females of 44% locomoting, 23% diving and 33% resting at the surface		Four females/ August/ platform terminal transmitters	Insley et al. (2008)
Northern fur seal					Migrating	North Pacific (Bering Sea to Gulf of Alaska)	Diving behavior consistent regardless of habitat (pelagic or continental shelf); diving largely at night and in evening and morning with little diving during day suggesting feeding on vertically migrating prey	71% at <2 m, 14% at 2-5 m, 5% at 6-10 m, 6% at 11-25 m and 3% at 26-50 m	20 post-weaning pups/ November-May/ satellite-linked time-depth recorders	Baker (2007)
Steller sea lion	Fish, including walleye pollock, Pacific herring, sand lance, salmon, flounder, rockfish and cephalopods	Diets and feeding patterns change with seasons; population levels are related to prey with increasing populations correlated with diverse diets and decreasing populations correlated with diets of primarily one prey item; females feed mostly at night during breeding season; feeding occurs throughout the day during non-	Trites et al. (2007); Loughlin (2002); Merrick et al. (1994)		Feeding	North Pacific (southeast Alaska)	Characterized by relatively brief trips to sea that represent about on-half of total time, and by fairly frequent, short and shallow dives that occur mostly at night. Maximum depth recorded was 424 m; mean depth was 26.4 m, and 49% of all dives were <10 m.		13 females/ May-June, January/ satellite-linked time-depth recorders	Swain (1996)

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		breeding season								
Steller sea lion					Feeding	North Pacific (Gulf of Alaska)	Adult females forage close to land in summer (<20 km) and make brief trips (<2 days) and shallow dives (<30 m); in winter, divers are longer in distance (up to 300 km), time (up to several months) and deeper (>250 m), Average dive depth of 36.5 and 42.9 m		Two females/ unknown/ satellite-linked time-depth recorder	Merrick et al. (1994)

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Steller sea lion						North Pacific (Gulf of Alaska)	Adult females capable of foraging throughout GOA and Bering Sea, while young-of-year have smaller ranges and shallower dives; females in winter dove deepest (median 24 m, maximum >250 m, while young-of-year were shallowest (median 9 m, max 72 m); depth distribution taken from Figure 4 and represent averaging of all age/season classes	60% at 0-10 m, 22% at 11-20 m, 12% at 21-50 m, 5% at 51-100 m and 1% at >100 m.	15 animals/ June-July, November-March/ satellite-linked time-depth recorders and VHF transmitters	Merrick and Loughlin (1997)
Steller sea lion						North Pacific (Gulf of Alaska)	Young of year dove for shorter periods and shallower depths than yearlings; maximum dive depth was 288 m; long-range transits began at >10 months of age; depth distribution taken from Figure 2	78% in 0-10 m, 13% in 11-20 m, 7% in 21-50 m, and 2% in > 51 m	18 animals/ October-June/ satellite-linked time-depth recorders	Loughlin et al. (2003)
Steller sea lion						North Pacific (Washington)	Maximum dive depth was 328 m; depth distribution taken from Figure 2	28% in 0-10 m, 30% in 11-20 m, 18% in 21-50 m, 14% in 51-100 m and 10% in	Seven animals/ October-June/ satellite-linked time-depth recorders	Loughlin et al. (2003)

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								>100 m		
Steller sea lion						North Pacific (Gulf of Alaska)	Juveniles from western Alaska rookeries left on foraging trips at dusk and returned at dawn (taking advantage of pollock that vertically migrates and hauling out during the day), while juveniles from eastern Alaska rookeries left on foraging trips throughout the day and night, likely feeding on prey other than vertical migrants		129 animals/ August-November, January-May/ satellite dive recorders	Call et al. 2007)
Steller sea lion						North Pacific (Gulf of Alaska)	Round trip distance and duration of pups and juveniles increased with age, trip distance was greater for western rookeries than for eastern rookeries, trip duration was greater for females than males; 90% of		103 animals/ year round/ satellite dive recorders	Raum-Suryan et al. (2004)

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							trips were <=15 km from haul-outs; dispersals >500 km were undertaken only by males although dispersals of >120 km were common			
California sea lion	Feed on a wide assortment of fish, including anchovy, whiting, rockfish and mackerel, as well as cephalopods; diet depends on season, location and oceanographic conditions		Heath (2002); Costa et al. (2007)		Feeding	North Pacific (Channel Islands)	Generally shallow water divers but showed extensive variation in behavior among females; spent 67% of total time at sea (33% at rookery); with average dive depth of 58.2 m		25 females/ October-January/ time-depth recorders	Costa et al. (2007)
California sea lion					Feeding	North Pacific (Monterey Bay)	Larger males dived longer and spent less time at sea and more time hauled out; maximum dive depth of 575 m although mean dive depth was 32.2 m and 86% of dives were <50 m; 50% of total time at haulouts; 32% of time at surface and remainder of time was diving		25 males/ October-January/ satellite-relay data loggers	Costa et al. (2007)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
California sea lion					Feeding	North Pacific (Channel Islands)	Deepest dive estimated at 274 m but most dives were <80 m; less than 5% of all dives were >200 m; peak diving frequency near sunrise and sunset, but diving was recorded during all hours; activity patterns showed that ~33% spent diving, ~41% spent swimming between dives, ~23% at the surface during dive bouts, and 3% spent resting; seasonal and diel diving patterns suggested that prey presence strongly influences depth and duration of dives; depth distribution inferenced from text and various figures	26% at <2 m (surface), 41% at 2-10 m (swimming between dive bouts), 3% at 11-19 m, 17% at 20-60 m and 13% at >60 m.	10 females/ Jul-August/ Time-depth recorders	Feldkamp et al. (1989)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Northern elephant seal	Feed on deep-water squid and fish, and likely spend about 80% of their annual cycle at sea feeding; feed in meso-pelagic zone on vertically migrating squid	Deeper waters (>1000 m); males farther north than females	Hindell (2002); Stewart and DeLong (1993; 1995); LeBoeuf et al. (1988); Asaga et al. (1994); LeBoeuf (1994)		Feeding	North Pacific	Dive continuously for 8-10 months/year; dispersion and migratory patterns related to oceanographic features and areas of biological productivity; primarily squid eaters; males travel farther than females; females submerged 91% and males submerged 88% of time at sea; dive continuously; average depth for females was 479 m (post-molt) and 518 m (post-breeding) and for males 364 m (post-breeding) and 366 m (post-molt)		36 adults (both sexes)/ February-August/ dive and location recorders	Stewart and Delong (1993)
Northern elephant seal					Feeding	North Pacific	seals use same foraging areas during post-breeding and post-molting periods; sexes are segregated geographically		36 adults (both sexes)/ January-February; May; July/ geographic location time depth recorders	Stewart and DeLong (1995)

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Northern elephant seal					Feeding	North Pacific	little time at depths <200 m or >800 m; post-breeding migration is directed northward and quick until feeding areas are obtained; dives in transit are shallower than those on foraging grounds		14 adults (both sexes)/ February-July/ geographic location time depth recorders	Stewart and DeLong (1994)
Northern elephant seal					Feeding	North Pacific	Sea surface temperature appears to influence female forage area choice; foraging occurred in near shore areas of Gulf of Alaska, offshore Gulf of Alaska, near shore off Washington and Oregon and offshore between 40 and 50 N		12 adult females/ year round/ time depth recorders	Simmons et al. (2007)
Northern elephant seal					Feeding	North Pacific	Post-lactation monitoring; 86% of time at-sea spent submerged; maximum dive of 894 m, but dives >700 m were rare; modal dive depths between 350 and 650 m; continuous deep diving while at-sea; night dives		Seven adult females/ February-March/ time-depth recorders	LeBoeuf et al. (1988)

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							were more numerous, shallower and of shorter duration; most dives types D (deep and u-shaped)			
Northern elephant seal					Feeding	North Pacific	Mean depth of dive 333 m; maximum dive 630 m; 6% of all dives <200 m		One adult female/ February/ time-depth recorder	LeBoeuf et al. (1986)
Northern elephant seal					Feeding	North Pacific	Differences in foraging locations and behavior between males and females; females exhibited pelagic diving with varying dive depths depending on prey location in deep scattering layer; males exhibited pelagic diving as well as flat-bottom benthic dives near continental margins; males migrated to northern Gulf of Alaska and eastern Aleutians with females distributed west to 150 W between 44 and 52 N		32 adults (both sexes)/ March-July/ radio-telemetry	LeBoeuf et al. (1993)

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Northern elephant seal					Transiting	North Pacific	90% of time submerged; mean depth 289 m; directed swimming even while submerged used prolonged gliding during dive descents which reduces cost of transport and can increase the duration of the dive		One adult female/ April/ video and satellite telemetry	Davis et al. (2001)
Northern elephant seal					Feeding	North Pacific	Type D (foraging) dives account for 75-80% of all dives; type A (transit dives) rarely occurred in series; type C dives were shallowest; depth distribution information from table 17.3, type D dives which are foraging dives as they are the most common	9% at <2 m, 11% at 2-100 m, 11% at 101-200 m, 11% at 201-300 m, 11% at 301-400 m, 11% at 401-500 m and 36% at >500 m.	Two adult females/ February-May/ time-depth recorders	Asaga et al. (1994)

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Northern elephant seal					Feeding	North Pacific	Transit dives in males cover large horizontal distances and are shallower than pelagic dive depths; transit dives in females and juveniles are both for transiting and search for prey patches; foraging dives have steeper angles than transit dives in females, but angles are not noticeably different in juveniles; swim speeds were similar across age and sex		16 animals (various ages)/ April-May/ time-depth recorders and platform terminal transmitters	Hassrick et al. (2007)
Northern elephant seal					Feeding	North Pacific	Males feed primarily from coastal Oregon to western Aleutian Islands, along continental margin and feed primarily on benthic organisms, migration is direct to forage areas across Pacific; females have wider foraging area from 38-60 N and from the coast to 172 E, and forage on pelagic prey in		47 adults (both sexes)/ March-June, September-December/ time-depth swim speed recorders	LeBoeuf et al. (2000)

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							the water column, migration is more variable to take advantage of prey patches			
Northern elephant seal					Feeding, Transiting	North Pacific	Different types of dives serve three general functions: type AB dives are transit dives (covering great horizontal distance and with shallow ascent and descent angles); type C dives are "processing" dives for internal processes such as digestions (slower swimming speed and short horizontal distance; type DE dives are foraging (both chasing prey pelagically and benthic foraging)		unknown	Crocker et al. (1994)

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Common Name	**Food Preference**	**Depth or Oceanic Preference**	**References**		**Behavioral State**	**Geographic Region**	**Depth Information**	**Depth Distribution**	**Sample Size/ Time of Year/Method**	**References**
Harbor seal	Feed on fish, octopus, squid, shrimp and other available prey; Pacific herring and salmon in Washington inland waters; may spend ~85% of the day diving for food		Reeves et al. (2002); Suryan and Harvey (1998); Baechler et al. (2002)		Feeding/ travelling	North Atlantic (Sable Island)	Two primary types of dives, U-shaped and V-shaped, with strong relationship between U-shaped and foraging; dive shapes differ between age and sex classes and behavioral state (e.g., pre-mating versus lactating)		Several/ May-June/ time-depth recorders	Baechler et al. (2002)
Harbor seal					Feeding	North Atlantic (Sable Island)	Lactating females spent 45% of time on land with their pups, 55% of time at sea and only 9% of the total time actively diving; pups often accompanied females but did not dive as long; maximum dive depth 59 m; mean dive depth 9-11 m		Twenty females/ May-June/ time-depth recorders	Bowen et al. (1999)

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Harbor seal					Feeding	North Pacific (Monterey Bay)	80% of dives classified as square (U-shaped) and associated with feeding; 11% were V-shaped dives associated with travelling; deepest dive 481 m; most dives to 5-100 m; foraging mostly at mid-depth (median 52 m for males and 40 m for females); depth distribution inferred from text	50% at <3 m, 20% at 3-50 m, 25% at 51-100 m and 5% at >100 m.	Twenty animals/ year round/ time-depth recorders	Eguchi and Harvey (2005)
Harbor seal					Feeding	North Atlantic (Svalbard)	50% of diving was <40 m and 95% of diving was <250 m; maximum dive depth of 452 m, most maximum dive depths were 100-200 m and may have been to sea floor or intermediate depths		Fourteen animals/ year round/ satellite-linked data recorders	Gjertz et al. (2001)
Harbor seal						North Atlantic (St. Lawrence Estuary)	Foraging (U-shaped) dives generally went to sea bottom (average depth of only 20 m); other dives were shallower (6-12 m); depth distribution from Table 6 for Type 1 dives	24% at <1 m; 25% at 1-20 m; 51% at >20 m	Eight animals/ June-September/ time-depth recorders	Lesage et al. (1999)

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APPENDIX E:
CETACEAN STRANDINGS AND THREATS

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E.1 INTRODUCTION

Strandings can be a single animal or several to hundreds. An event where animals are found out of their normal habitat is considered a stranding even though animals do not necessarily end up beaching (such as the July 2004 Hanalei Mass Stranding Event; Southall et al. 2006). Several hypotheses have been given for the mass strandings which include the impact of shallow beach slopes on odontocete sonar, disease or parasites, geomagnetic anomalies that affect navigation, following a food source in close to shore, avoiding predators, social interactions that cause other cetaceans to come to the aid of stranded animals, and human actions. Generally, inshore species do not strand in large numbers but generally just as a single animal. This may be due to their familiarity with the coastal area whereas pelagic species that are unfamiliar with obstructions or sea bottom tend to strand more often in larger numbers (Woodings 1995). The Navy has studied several stranding events in detail that may have occurred in association with Navy sonar activities. To better understand the causal factors in stranding events that may be associated with Navy sonar activities, the main factors, including bathymetry (i.e., steep drop offs), narrow channels (less than 35 nm), environmental conditions (e.g., surface ducting), and multiple sonar ships (see Section on Stranding Events Associated with Navy Sonar) were compared between the different stranding events.

E.1.1 What is a Stranded Marine Mammal?

When a live or dead marine mammal swims or floats onto shore and becomes "beached" or incapable of returning to sea, the event is termed a "stranding" (Geraci et al.1999; Perrin and Geraci 2002; Geraci and Lounsbury 2005; National Marine Fisheries Service [NMFS] 2007). The legal definition for a stranding within the U.S. is that "a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance." (16 United States Code [U.S.C.] 1421h).

The majority of animals that strand are dead or moribund (NMFS 2007). For animals that strand alive, human intervention through medical aid and/or guidance seaward may be required for the animal to return to the sea. If unable to return to sea, rehabilitation at an appropriate facility may be determined as the best opportunity for animal survival. An event where animals are found out of their normal habitat is may be considered a stranding depending on circumstances even though animals do not necessarily end up beaching (Southhall 2006).

Three general categories can be used to describe strandings: single, mass, and unusual mortality events. The most frequent type of stranding is a single stranding, which involves only one animal (or a mother/calf pair) (NMFS 2007).

Mass stranding involves two or more marine mammals of the same species other than a mother/calf pair (Wilkinson, 1991), and may span one or more days and range over several miles (Simmonds and Lopez-Jurado 1991; Frantzis 1998; Walsh et al. 2001; Freitas 2004). In North America, only a few species typically strand in large groups of 15 or more and include sperm whales, pilot whales, false killer whales, Atlantic white-sided dolphins, white-beaked dolphins, and rough-toothed dolphins (Odell 1987; Walsh et al. 2001). Some species, such as pilot whales, false-killer whales, and melon-headed whales occasionally strand in groups of 50 to 150 or more (Geraci et al. 1999). All of these normally pelagic off-shore species are highly sociable and usually infrequently encountered in coastal waters. Species that commonly strand in smaller numbers include pygmy killer whales, common dolphins, bottlenose dolphins, Pacific white-sided dolphin Frasier's dolphins, gray whale and humpback whale (West Coast only), harbor porpoise, Cuvier's beaked whales, California sea lions, and harbor seals (Mazzuca et al. 1999; Norman et al. 2004b; Geraci and Lounsbury 2005).

Unusual mortality events (UMEs) can be a series of single strandings or mass strandings, or unexpected mortalities (i.e., die-offs) that occur under unusual circumstances (Dierauf and Gulland 2001; Harwood 2002; Gulland 2006; NMFS 2007). These events may be interrelated: for instance, at-sea die-offs lead to increased stranding frequency over a short period of time, generally within one to two months. As published by the NMFS, revised criteria for defining a UME include (71 FR 75234, 2006):

(1) A marked increase in the magnitude or a marked change in the nature of morbidity, mortality, or strandings when compared with prior records.

(2) A temporal change in morbidity, mortality, or strandings is occurring.

(3) A spatial change in morbidity, mortality, or strandings is occurring.

(4) The species, age, or sex composition of the affected animals is different than that of animals that are normally affected.

(5) Affected animals exhibit similar or unusual pathologic findings, behavior patterns, clinical signs, or general physical condition (e.g., blubber thickness).

(6) Potentially significant morbidity, mortality, or stranding is observed in species, stocks or populations that are particularly vulnerable (e.g., listed as depleted, threatened or endangered or declining). For example, stranding of three or four right whales may be cause for great concern whereas stranding of a similar number of fin whales may not.

(7) Morbidity is observed concurrent with or as part of an unexplained continual decline of a marine mammal population, stock, or species.

UMEs are usually unexpected, infrequent, and may involve a significant number of marine mammal mortalities. As discussed below, unusual environmental conditions are probably responsible for most UMEs and marine mammal die-offs (Vidal and Gallo-Reynoso 1996; Geraci et al. 1999; Walsh et al. 2001; Gulland and Hall 2005).

E.1.2 United States Stranding Response Organization

Stranding events provide scientists and resource managers information not available from limited at-sea surveys, and may be the only way to learn key biological information about certain species such as distribution, seasonal occurrence, and health (Rankin 1953; Geraci and Lounsbury 2005). Necropsies are useful in attempting to determine a reason for the stranding, and are performed on stranded animals when the situation and resources allow.

In 1992, Congress amended the MMPA to establish the Marine Mammal Health and Stranding Response Act (MMHSRA) under authority of the Department of Commerce, National Marine Fisheries Service. The MMHSRP was created out of concern started in the 1980s for marine mammal mortalities, to formalize the response process, and to focus efforts being initiated by numerous local stranding organizations and as a result of public concern.

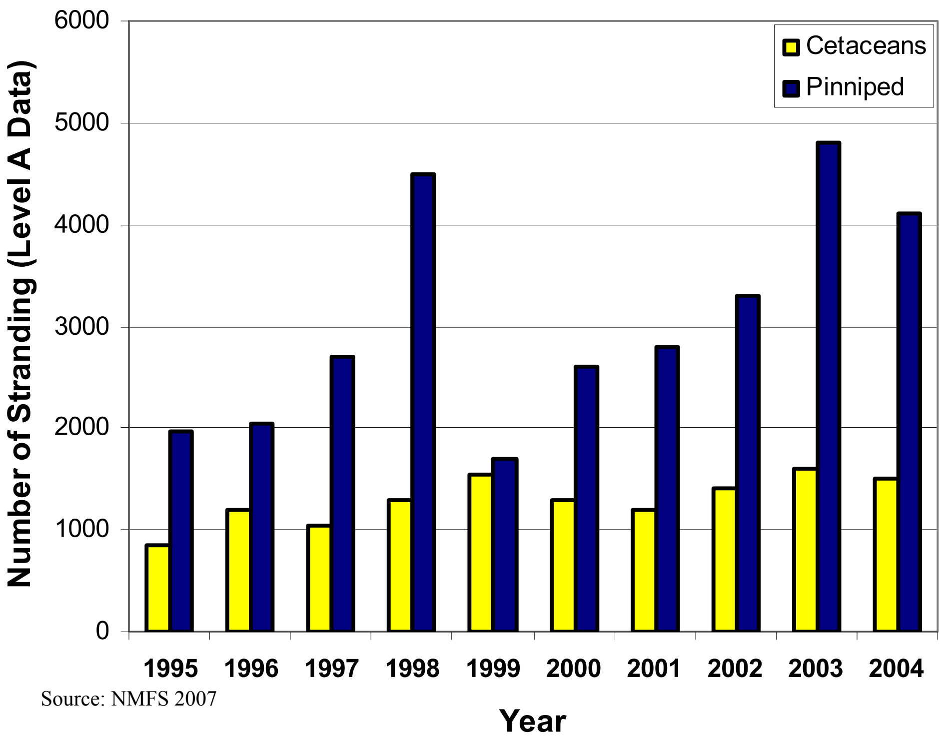
Major elements of the MMHSRP include (NMFS 2007):

- National Marine Mammal Stranding Network
- Marine Mammal UME Program
- National Marine Mammal Tissue Bank (NMMTB) and Quality Assurance Program
- Marine Mammal Health Biomonitoring, Research, and Development
- Marine Mammal Disentanglement Network
- John H. Prescott Marine Mammal Rescue Assistance Grant Program (a.k.a. the Prescott Grant Program)
- Information Management and Dissemination.

The United States has a well-organized network in coastal states to respond to marine mammal strandings. Overseen by the NMFS, the National Marine Mammal Stranding Network is comprised of smaller organizations manned by professionals and volunteers from nonprofit organizations, aquaria, universities, and state and local governments trained in stranding response, animal health, and diseased investigation. Currently, 141 organizations are authorized by NMFS to respond to marine mammal strandings (National Marine Fisheries Service 2007c). Through a National Coordinator and six regional coordinators, NMFS authorizes and oversees stranding response activities and provides specialized training for the network.

- NMFS Regions and Associated States and Territories
- NMFS Northeast Region- ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA
- NMFS Southeast Region- NC, SC, GA, FL, AL, MS, LA, TX, PR, VI
- NMFS Southwest Region- CA
- NMFS Northwest Region- OR, WA
- NMFS Alaska Region- AK
- NMFS Pacific Islands Region- HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands (CNMI)

Stranding reporting and response efforts over time have been inconsistent, although effort and data quality within the U.S. have been improving within the last 20 years (NMFS 2007). Given the historical inconsistency in response and reporting, however, interpretation of long-term trends in marine mammal stranding is difficult (NMFS 2007). During the past decade (1995 – 2004), approximately 40,000 stranded marine mammals (with cetaceans comprising about 12,400) have been reported by the regional stranding networks (Figure E-1), averaging 3,600 strandings reported per year (NMFS 2007). The highest number of strandings were reported between the years 1998 and 2003 (NMFS 2007). Detailed regional stranding information including most commonly stranded species can be found in Zimmerman (1991), Geraci and Lounsbury (2005), and NMFS (2007).



Source: NMFS 2007

Figure E-1. United States Annual Cetacean And Pinniped Stranding From 1995-2004.

E.2 UNUSUAL MORTALITY EVENTS (UMES)

Table E-1 contains a list of documented UMEs within the U.S.

Table E-1. Documented UMEs within the United States.

Year	Composition	Determination
1993	Harbor seals, Steller sea lions, and California sea lions on the central Washington coast	Human Interaction
1993/1994	Bottlenose dolphins in the Gulf of Mexico	Morbillivirus
1994	Common dolphins in California	Cause not determined
1996	Right whales off Florida/Georgia coast	Evidence of human interactions
1996	Manatees on the west coast of Florida	Brevetoxin
1996	Bottlenose dolphins in Mississippi	Cause not determined
1997	Harbor seals in California	Unknown infectious respiratory disease
1997	Pinnipeds on the Pacific coast	El Niño
1998	California sea lions in central California	Harmful algal bloom; Domoic acid
1999	Harbor porpoises on the East Coast	Determined not to meet criteria for UME because of multiplicity of causes
1999/2000	Bottlenose dolphins in the Panhandle of Florida	Harmful algal bloom is suspected; still under investigation
1999/2000	Gray whales from Alaska to Mexico	Still under investigation
2004	Bottlenose dolphins along the Florida Panhandle	Uncertain, red tide is suspected
2005	Bottlenose dolphins, manatees, sea turtles, and seabirds in west central Florida	Unknown

Source: NMFS 2007c

E.3 THREATS TO MARINE MAMMALS AND POTENTIAL CAUSES FOR STRANDING

Reports of marine mammal strandings can be traced back to ancient Greece (Walsh et al. 2001). Like any wildlife population, there are normal background mortality rates that influence marine mammal population dynamics, including starvation, predation, aging, reproductive success, and disease (Geraci et al. 1999; Carretta et al. 2007). Strandings in and of themselves may be reflective of this natural cycle or, more recently, may be the result of anthropogenic sources (i.e., human impacts). Current science suggests that multiple factors, both natural and man-made, may be acting alone or in combination to cause a marine mammal to strand (Geraci et al. 1999; Culik 2002; Perrin and Geraci 2002; Hoelzel 2003; Geraci and Lounsbury 2005; NRC 2006). While post-stranding data collection and necropsies of dead animals are attempted in an effort to find a possible cause for the stranding, it is often difficult to pinpoint exactly one factor that can be blamed for any given stranding. An animal suffering from one ailment becomes susceptible to various other influences because of its weakened condition, making it difficult to determine a primary cause. In many stranding cases, scientists never learn the exact reason for the stranding.

Specific potential stranding causes can include both natural and human influenced (anthropogenic) causes listed below and described in the following sections:

- Natural Stranding Causes
    - Disease
    - Natural toxins
    - Weather and climatic influences
    - Navigation errors
    - Social cohesion
    - Predation
- Human Influenced (Anthropogenic) Stranding Causes
    - Fisheries interaction
    - Ship strike
    - Commercial and Private Marine Mammal Viewing
    - Pollution and ingestion
    - Noise

E.3.1 Natural Stranding Causes

Significant natural causes of mortality, die-offs, and stranding discussed below include disease and parasitism; marine neurotoxins from algae; navigation errors that lead to inadvertent stranding; and climatic influences that impact the distribution and abundance of potential food resources (i.e., starvation). Other natural mortality not discussed in detail includes predation by other species such as sharks (Cockcroft et al. 1989; Heithaus 2001), killer whales (Constantine et al. 1998; Guinet et al. 2000; Pitman et al. 2001), and some species of pinniped (Hiruki et al. 1999; Robinson et al. 1999).

E.3.1.1 Disease

Like other mammals, marine mammals frequently suffer from a variety of diseases of viral, bacterial, parasites and fungal origin (Visser et al. 1991; Dunn et al. 2001; Harwood 2002; National Oceanic and Atmospheric Administration 2006). Gulland and Hall (2005) provide a more detailed summary of individual and population effects of marine mammal diseases.

Microparasites such as bacteria, viruses, and other microorganisms are commonly found in marine mammal habitats and usually pose little threat to a healthy animal (Geraci et al. 1999). For example, long-finned pilot whales that inhabit the waters off of the northeastern coast of the U.S. are carriers of the morbillivirus, yet have grown resistant to its usually lethal effects (Geraci et al. 1999). Since the 1980s, however, virus infections have been strongly associated with marine mammal die-offs (Domingo et al. 1992; Geraci and Lounsbury 2005). Morbillivirus is the most significant marine mammal virus and suppresses a host's immune system, increasing risk of secondary infection (Harwood 2002). A bottlenose dolphin UME in 1993 and 1994 was caused by infectious disease. Die-offs ranged from northwestern Florida to Texas, with an increased number of deaths as it spread (NMFS 2007c). A 2004 UME in Florida was also associated with dolphin morbillivirus (NMFS 2004). Influenza A was responsible for the first reported mass mortality in the U.S., occurring along the coast of New England in 1979-1980

(Geraci et al. 1999; Harwood 2002). Canine distemper virus (a type of morbillivirus) has been responsible for large scale pinniped mortalities and die-offs (Grachev et al. 1989; Kennedy et al. 2000; Gulland and Hall 2005), while a bacteria, *Leptospira pomona*, is responsible for periodic die-offs in California sea lions about every four years (Gulland et al. 1996; Gulland and Hall 2005). It is difficult to determine whether microparasites commonly act as a primary pathogen, or whether they show up as a secondary infection in an already weakened animal (Geraci et al. 1999). Most marine mammal die-offs from infectious disease in the last 25 years, however, have had viruses associated with them (Simmonds and Mayer 1997; Geraci et al. 1999; Harwood 2002).

Macroparasites are usually large parasitic organisms and include lungworms, trematodes (parasitic flatworms), and protozoans (Geraci and St.Aubin 1987; Geraci et al. 1999). Marine mammals can carry many different types, and have shown a robust tolerance for sizeable infestation unless compromised by illness, injury, or starvation (Morimitsu et al. 1987; Dailey et al. 1991; Geraci et al., 1999). Nasitrema, a usually benign trematode found in the head sinuses of cetaceans (Geraci et al. 1999), can cause brain damage if it migrates (Ridgway and Dailey 1972). As a result, this worm is one of the few directly linked to stranding in the cetaceans (Dailey and Walker 1978; Geraci et al. 1999).

Non-infectious disease, such as congenital bone pathology of the vertebral column (osteomyelitis, spondylosis deformans, and ankylosing spondylitis [AS]), has been described in several species of cetacean (Paterson 1984; Alexander et al. 1989; Kompanje 1995; Sweeny et al. 2005). In humans, bone pathology such as AS, can impair mobility and increase vulnerability to further spinal trauma (Resnick and Niwayama 2002). Bone pathology has been found in cases of single strandings (Paterson 1984; Kompanje 1995), and also in cetaceans prone to mass stranding (Sweeny et al. 2005), possibly acting as a contributing or causal influence in both types of events.

E.3.1.2 Naturally Occurring Marine Neurotoxins

Some single cell marine algae common in coastal waters, such as dinoflagellates and diatoms, produce toxic compounds that can accumulate (termed bioaccumulation) in the flesh and organs of fish and invertebrates (Geraci et al. 1999; Harwood 2002). Marine mammals become exposed to these compounds when they eat prey contaminated by these naturally produced toxins although exposure can also occur through inhalation and skin contact (Van Dolah 2005). Figure E-2 shows U.S. animal mortalities from 1997-2006 resulting from toxins produced during harmful algal blooms.

In the Gulf of Mexico and mid- to southern Atlantic states, "red tides," a form of harmful algal bloom, are created by a dinoflagellate (*Karenia brevis*). *K. brevis* is found throughout the Gulf of Mexico and sometimes along the Atlantic coast (Van Dolah 2005; NMFS 2007). It produces a neurotoxin known as brevetoxin. Brevetoxin has been associated with several marine mammal UMEs within this area (Geraci 1989; Van Dolah et al. 2003; NMFS 2004; Flewelling et al. 2005; Van Dolah 2005; NMFS 2007). On the U.S. west coast and in the northeast Atlantic, several species of diatoms produce a toxin called domoic acid which has also been linked to marine mammal strandings (Geraci et al. 1999; Van Dolah et al. 2003; Greig et al. 2005; Van Dolah 2005; Brodie et al. 2006; NMFS 2007; Bargu et al. 2008; Goldstein et al. 2008). Other algal toxins associated with marine mammal strandings include saxitoxins and ciguatoxins and are summarized by Van Dolah (2005).

Source: Woods Hole Oceanographic Institute (WHO) http://www.whoi.edu/redtide/HABdistribution/HABmap.html

Figure E-2. U.S. Animal Mortalities From Harmful Algal Blooms (1997-2006)

E.3.1.3 Weather Events and Climate Influences

Severe storms, hurricanes, typhoons, and prolonged temperature extremes may lead to localized marine mammal strandings (Geraci et al. 1999; Walsh et al. 2001). Hurricanes may have been responsible for mass strandings of pygmy killer whales in the British Virgin Islands and Gervais' beaked whales in North Carolina (Mignucci-Giannoni et al. 2000; Norman and Mead 2001). Storms in 1982-1983 along the California coast led to deaths of 2,000 northern elephant seal pups (Le Boeuf and Reiter 1991). Ice movement along southern Newfoundland has forced groups of blue whales and white-beaked dolphins ashore (Sergeant 1982). Seasonal oceanographic conditions in terms of weather, frontal systems, and local currents may also play a role in stranding (Walker et al. 2005).

The effect of large scale climatic changes to the world's oceans and how these changes impact marine mammals and influence strandings is difficult to quantify given the broad spatial and temporal scales involved, and the cryptic movement patterns of marine mammals (Moore 2005; Learmonth et al. 2006). The most immediate, although indirect, effect is decreased prey availability during unusual conditions. This, in turn, results in increased search effort required by marine mammals (Crocker et al. 2006), potential starvation if not successful, and corresponding stranding due directly to starvation or succumbing to disease or predation while in a more weakened, stressed state (Selzer and Payne 1988; Geraci et al. 1999; Moore 2005; Learmonth et al. 2006; Weise et al. 2006).

Two recent papers examined potential influences of climate fluctuation on stranding events in southern Australia, including Tasmania, an area with a history of more than 20 mass stranding since the 1920s (Evans et al. 2005; Bradshaw et al. 2006). These authors note that patterns in animal migration, survival, fecundity, population size, and strandings will revolve around the availability and distribution of food resources. In southern Australia, movement of nutrient-rich waters pushed closer to shore by periodic meridinal winds (occurring about every 12 – 14 years) may be responsible for bringing marine mammals closer to land, thus increasing the probability of stranding (Bradshaw et al. 2006). The papers conclude, however, that while an overarching model can be helpful for providing insight into the prediction of strandings, the particular reasons for each one are likely to be quite varied.

E.3.1.4 Navigation Error

Geomagnetism- It has been hypothesized that, like some land animals, marine mammals may be able to orient to the Earth's magnetic field as a navigational cue, and that areas of local magnetic anomalies may influence strandings (Bauer et al. 1985; Klinowska 1985; Kirschvink et al. 1986; Klinowska, 1986; Walker et al. 1992; Wartzok and Ketten 1999). In a plot of live stranding positions in Great Britain with magnetic field maps, Klinowska (1985; 1986) observed an association between live stranding positions and magnetic field levels. In all cases, live strandings occurred at locations where magnetic minima, or lows in the magnetic fields, intersect the coastline. Kirschvink et al. (1986) plotted stranding locations on a map of magnetic data for the east coast of the U.S., and were able to develop associations between stranding sites and locations where magnetic minima intersected the coast. The authors concluded that there were highly significant tendencies for cetaceans to beach themselves near these magnetic minima and coastal intersections. The results supported the hypothesis that cetaceans may have a magnetic sensory system similar to other migratory animals, and that marine magnetic topography and patterns may influence long-distance movements (Kirschvink et al. 1986). Walker et al. (1992) examined fin whale swim patterns off the northeastern U.S. continental shelf, and reported that migrating animals aligned with lows in the geometric gradient or intensity. While a similar pattern between magnetic features and marine mammal strandings at New Zealand stranding sites was not seen (Brabyn and Frew, 1994), mass strandings in Hawaii typically were found to occur within a narrow range of magnetic anomalies (Mazzuca et al. 1999).

Echolocation Disruption in Shallow Water- Some researchers believe stranding may result from reductions in the effectiveness of echolocation within shallow water, especially with the pelagic species of odontocetes who may be less familiar with coastline (Dudok van Heel 1966; Chambers and James 2005). For an odontocete, echoes from echolocation signals contain important information on the location and identity of underwater objects and the shoreline. The authors postulate that the gradual slope of a beach may present difficulties to the navigational systems of some cetaceans, since it is common for live strandings to occur along beaches with shallow, sandy gradients (Brabyn and McLean 1992; Mazzuca et al. 1999; Maldini et al. 2005; Walker et al. 2005). A contributing factor to echolocation interference in turbulent, shallow water is the presence of microbubbles from the interaction of wind, breaking waves, and currents. Additionally, ocean water near the shoreline can have an increased turbidity (e.g., floating sand or silt, particulate plant matter, etc.) due to the run-off of fresh water into the ocean, either from rainfall or from freshwater outflows (e.g., rivers and creeks). Collectively, these factors can reduce and scatter the sound energy within echolocation signals and reduce the perceptibility of returning echoes of interest.

E.3.1.5 Social Cohesion

Many pelagic species such as sperm whale, pilot whales, melon-head whales, and false killer whales, and some dolphins occur in large groups with strong social bonds between individuals. When one or more animals strand due to any number of causative events, then the entire pod may follow suit out of social cohesion (Geraci et al. 1999; Conner 2000; Perrin and Geraci 2002; NMFS 2007).

E.3.1.6 Predation

Many species of marine mammal serve as prey to other animals and forms of marine life, including sharks and even other marine mammals. Predation from sharks is considered to be a contributing factor in the decline of the Hawaiian monk seal (Geraci et al., 1999). A stranded marine mammal will sometimes show signs of interactions with predators such as bites, teeth marks, and other injuries, which occasionally are severe enough to have been the primary cause of injury, death, and stranding.

E.3.2 Anthropogenic Stranding Causes and Potential Risks

With the exception of historic whaling in the 19th and early part of the 20th century, over the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci et al. 1999; NMFS 2007). These include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), direct trauma (vessel strikes), and noise (National Oceanic and Atmospheric Administration, 2006; Nelson et al., 2007). Figure E-3 shows potential worldwide risk to small toothed cetaceans by source.

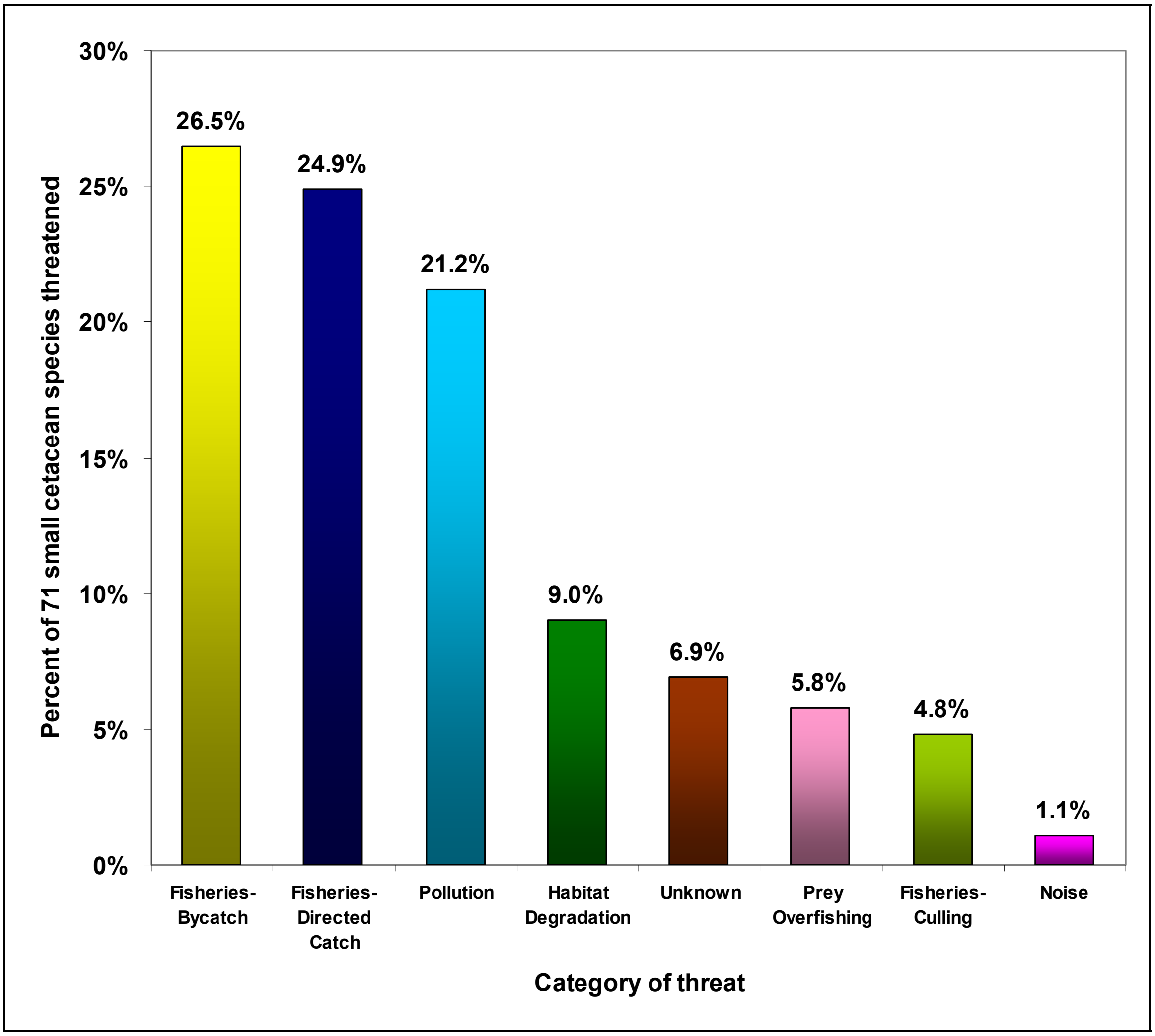
E.3.2.1 Fisheries Interaction: By-Catch, Directed Catch, and Entanglement

The incidental catch of marine mammals in commercial fisheries is a significant threat to the survival and recovery of many populations of marine mammals (Geraci et al. 1999; Culik 2002; Carretta et al. 2004; Geraci and Lounsbury 2005; NMFS 2007). Interactions with fisheries and entanglement in discarded or lost gear continue to be a major factor in marine mammal deaths worldwide (Geraci et al. 1999; Nieri et al. 1999; Geraci and Lounsbury 2005; Read et al. 2006; Zeeberg et al. 2006). For instance, baleen whales and pinnipeds have been found entangled in nets, ropes, monofilament line, and other fishing gear that has been discarded out at sea (Geraci et al. 1999; Campagna et al. 2007).

Bycatch- Bycatch is the catching of non-target species within a given fishing operation and can include non-commercially used invertebrates, fish, sea turtles, birds, and marine mammals (NRC 2006). Read et al. (2006) attempted to estimate the magnitude of marine mammal bycatch in U.S. and global fisheries. Data on marine mammal bycatch within the United States was obtained from fisheries observer programs, reports of entangled stranded animals, and fishery logbooks, and was then extrapolated to estimate global bycatch by using the ratio of U.S. fishing vessels to the total number of vessels within the world's fleet (Read et al. 2006). Within U.S. fisheries, between 1990 and 1999 the mean annual bycatch of marine mammals was 6,215 animals, with a standard error of +/- 448 (Read et al. 2006).

Eight-four percent of cetacean bycatch occurred in gill-net fisheries, with dolphins and porpoises constituting most of the cetacean bycatch (Read et al. 2006). Over the decade there was a 40 percent decline in marine mammal bycatch, which was significantly lower from 1995-1999 than it was from 1990-1994 (Read et al. 2006). Read et al. (2006) suggests that this is primarily due to effective conservation measures that were implemented during this time period.

Read et al. (2006) then extrapolated this data for the same time period and calculated an annual estimate of 653,365 of marine mammals globally, with most of the world's bycatch occurring in gill-net fisheries. With global marine mammal bycatch likely to be in the hundreds of thousands every year, bycatch in fisheries will be the single greatest threat to many marine mammal populations around the world (Read et al. 2006).



(Source: Culik 2002)

Figure E-3. Human Threats to World Wide Small Cetacean Populations

Entanglement- Entanglement in active fishing gear is a major cause of death or severe injury among the endangered whales in the action area. In the 2006-2007 whale season in Hawaii, the stranding network received reports of 26 entanglements (National Oceanic and Atmospheric Administration, 2006). Entangled marine mammals may die as a result of drowning, escape with pieces of gear still attached to their bodies, or manage to be set free either of their own accord or by fishermen. Many large whales carry off gear after becoming entangled (Read et al. 2006). Many times when a marine mammal swims off with gear attached, the end result can be fatal. The gear may be become too cumbersome for the animal or it can be wrapped around a crucial body part and tighten over time. Stranded marine mammals frequently exhibit signs of previous fishery interaction, such as scarring or gear attached to their bodies, and the cause of death for many stranded marine mammals is often attributed to such interactions (Baird and Gorgone 2005). Marine mammals that die or are injured in fisheries activities may not wash ashore; therefore stranding data may underestimate fishery-related mortalities and serious injuries (NMFS 2005a).

From 1993 through 2003, 1,105 harbor porpoises were reported stranded from Maine to North Carolina, many of which had cuts and body damage suggestive of net entanglement (NMFS 2005e). In 1999 it was possible to determine that the cause of death for 38 of the stranded porpoises was from fishery interactions, with one additional animal having been mutilated (right flipper and fluke cut off) (NMFS 2005e). In 2000, one stranded porpoise was found with monofilament line wrapped around its body (NMFS 2005e). In 2003, nine stranded harbor porpoises were attributed to fishery interactions, with an additional three mutilated animals (NMFS 2005e). An estimated 78 baleen whales were killed annually in the offshore southern California/Oregon drift gillnet fishery during the 1980s (Heyning and Lewis 1990). From 1998-2005, based on observer records, five fin whales (CA/OR/WA stock), 12 humpback whales (ENP stock), and six sperm whales (CA/OR/WA stock) were either seriously injured or killed in fisheries off the mainland west coast of the U.S. (California Marine Mammal Stranding Network Database 2006).

E.3.2.2 Ship Strike

Vessel strikes to marine mammals are another cause of mortality and stranding (Laist et al. 2001; Geraci and Lounsbury 2005; de Stephanis and Urquiola 2006). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus 2001; Laist et al. 2001; Vanderlaan and Taggart 2007).

In the 2006-2007 whale season in Hawaii, the stranding network saw an increase in the number of vessel collisions with whales (none involving military vessels) having recorded eight ship strikes (National Oceanic and Atmospheric Administration, 2006). Three of these collisions with marine mammals were known to have caused injury to the animal.

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus 2001; Laist et al. 2001, Jensen and Silber 2004; Vanderlaan and Taggart 2007). In assessing records in which vessel speed was known, Laist et al. (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 knots although most vessels do travel greater than 15 kts. Jensen and Silber (2004) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these cases, 39 (or 67%) resulted in serious injury or death (19 or 33% resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 or 35% resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79%) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 percent to 75 % as vessel speed increased from 10 to 14 knots, and exceeded 90% at 17 knots. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death by pulling whales toward the vessel. Computer simulation modeling showed that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne 1999, Knowlton et al. 1995).

The growth in civilian commercial ports and associated commercial vessel traffic is a result in the globalization of trade. The Final Report of the NOAA International Symposium on "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology" stated that the worldwide commercial fleet has grown from approximately 30,000 vessels in 1950 to over 85,000 vessels in 1998

(NRC 2003; Southall et al. 2005). Between 1950 and 1998, the U.S. flagged fleet declined from approximately 25,000 to less than 15,000 and currently represents only a small portion of the world fleet. From 1985 to 1999, world seaborne trade doubled to 5 billion tons and currently includes 90 percent of the total world trade, with container shipping movements representing the largest volume of seaborne trade. It is unknown how international shipping volumes and densities will continue to grow. However, current statistics support the prediction that the international shipping fleet will continue to grow at the current rate or at greater rates in the future. Shipping densities in specific areas and trends in routing and vessel design are as, or more, significant than the total number of vessels. Densities along existing coastal routes are expected to increase both domestically and internationally. New routes are also expected to develop as new ports are opened and existing ports are expanded. Vessel propulsion systems are also advancing toward faster ships operating in higher sea states for lower operating costs; and container ships are expected to become larger along certain routes (Southall et al. 2005).

While there are reports and statistics of whales struck by vessels in U.S. waters, the magnitude of the risks of commercial ship traffic poses to marine mammal populations is difficult to quantify or estimate. In addition, there is limited information on vessel strike interactions between ships and marine mammals outside of U.S. waters (de Stephanis and Urquiola 2006). Laist et al. (2001) concluded that ship collisions may have a negligible effect on most marine mammal populations in general, except for regional based small populations where the significance of low numbers of collisions would be greater given smaller populations or populations segments.

U.S. Navy vessel traffic is a small fraction of the overall U.S. commercial and fishing vessel traffic. While U.S. Navy vessel movements may contribute to the ship strike threat, given the lookout and mitigation measures adopted by the U.S. Navy, probability of vessel strikes is greatly reduced. Furthermore, actions to avoid close interaction of U.S. Navy ships and marine mammals and sea turtles, such as maneuvering to keep away from any observed marine mammal and sea turtle are part of existing at-sea protocols and standard operating procedures. Navy ships have up to three or more dedicated and trained lookouts as well as two to three bridge watch standers during at-sea movements who would be searching for any whales, sea turtles, or other obstacles on the water surface. Such lookouts are expected to further reduce the chances of a collision.

E.3.2.3 Commercial and Private Marine Mammal Viewing

In addition to vessel operations, private and commercial vessels engaged in marine mammal watching also have the potential to impact marine mammals in Southern California. NMFS has promulgated regulations at 50 CFR 224.103, which provide specific prohibitions regarding wildlife viewing activities. In addition, NMFS launched an education and outreach campaign to provide commercial operators and the general public with responsible marine mammal viewing guidelines. In January 2002, NMFS also published an official policy on human interactions with wild marine mammals which states that: "NOAA Fisheries cannot support, condone, approve or authorize activities that involve closely approaching, interacting or attempting to interact with whales, dolphins, porpoises, seals, or sea lions in the wild. This includes attempting to swim, pet, touch or elicit a reaction from the animals."

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational, and scientific benefits, marine mammal watching is not without potential negative impacts. One concern is that animals become more vulnerable to vessel strikes once they habituate to vessel traffic (Swingle et al. 1993; Wiley et al. 1995). Another concern is that preferred habitats may become abandoned if disturbance levels are too high. A whale's behavioral response to whale watching vessels depends on the distance of the vessel from the whale, vessel speed, vessel direction, vessel noise, and the number of vessels (Amaral and Carlson 2005; Au and Green 2000; Erbe 2002; Magalhaes et al. 2002; Watkins 1986; Williams et al. 2002). The whale's responses changed with these different variables and, in some circumstances, the whales did not respond to the vessels, but in other circumstances, whales changed their vocalizations surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions. In addition to the information on whale watching, there is also direct evidence of pinniped haul out site (Pacific harbor seals) abandonment because of human disturbance at Strawberry Spit in San Francisco Bay (Allen 1991).

E.3.2.4 Ingestion of Plastic Objects and Other Marine Debris And Toxic Pollution Exposure

For many marine mammals, debris in the marine environment is a great hazard and can be harmful to wildlife. Not only is debris a hazard because of possible entanglement, animals may mistake plastics and other debris for food (NMFS 2007d). There are certain species of cetaceans, along with Florida manatees, that are more likely to eat trash, especially plastics, which is usually fatal for the animal (Geraci et al. 1999).

Between 1990 through October 1998, 215 pygmy sperm whales stranded along the U.S. Atlantic coast from New York through the Florida Keys (NMFS 2005a). Remains of plastic bags and other debris were found in the stomachs of 13 of these animals (NMFS 2005a). During the same time period, 46 dwarf sperm whale strandings occurred along the U.S. Atlantic coastline between Massachusetts and the Florida Keys (NMFS 2005d). In 1987 a pair of latex examination gloves was retrieved from the stomach of a stranded dwarf sperm whale (NMFS 2005d). 125 pygmy sperm whales were reported stranded from 1999 – 2003 between Maine and Puerto Rico; in one pygmy sperm whale found stranded in 2002, red plastic debris was found in the stomach along with squid beaks (NMFS 2005a).

Sperm whales have been known to ingest plastic debris, such as plastic bags (Evans et al. 2003; Whitehead 2003). While this has led to mortality, the scale to which this is affecting sperm whale populations is unknown, but Whitehead (2003) suspects it is not substantial at this time.

High concentrations of potentially toxic substances within marine mammals along with an increase in new diseases have been documented in recent years. Scientists have begun to consider the possibility of a link between pollutants and marine mammal mortality events. NMFS takes part in a marine mammal bio-monitoring program not only to help assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains and marine ecosystem health. Using strandings and bycatch animals, the program provides tissue/serum archiving, samples for analyses, disease monitoring and reporting, and additional response during disease investigations (NMFS 2007).

The impacts of these activities are difficult to measure. However, some researchers have correlated contaminant exposure to possible adverse health effects in marine mammals. Contaminants such as organochlorines do not tend to accumulate in significant amounts in invertebrates, but do accumulate in fish and fish-eating animals. Thus, contaminant levels in planktivorous mysticetes have been reported to be one to two orders of magnitude lower compared to piscivorous odontocetes (Borell 1993; O'Shea and Brownell 1994; O'Hara and Rice 1996; O'Hara et al. 1999).

The manmade chemical PCB (polychlorinated biphenyl), and the pesticide DDT (dichlorodiphyenyltrichloroethane), are both considered persistent organic pollutants that are currently banned in the United States for their harmful effects in wildlife and humans (NMFS, 2007c). Despite having been banned for decades, the levels of these compounds are still high in marine mammal tissue samples taken along U.S. coasts (NMFS 2007c). Both compounds are long-lasting, reside in marine mammal fat tissues (especially in the blubber), and can be toxic causing effects such as reproductive impairment and immunosuppression (NMFS 2007c).

Both long-finned and short-finned pilot whales have a tendency to mass strand throughout their range. Short-finned pilot whales have been reported as stranded as far north as Rhode Island, and long-finned pilot whales as far south as South Carolina (NMFS 2005b). For U.S. east coast stranding records, both species are lumped together and there is rarely a distinction between the two because of uncertainty in species identification (NMFS 2005b). Since 1980 within the Northeast region alone, between 2 and 120 pilot whales have stranded annually either individually or in groups (NMFS 2005b). Between 1999 and 2003 from Maine to Florida, 126 pilot whales were reported to be stranded, including a mass stranding of 11 animals in 2000 and another mass stranding of 57 animals in 2002, both along the Massachusetts coast (NMFS 2005b).

It is unclear how much of a role human activities play in these pilot whale strandings, and toxic poisoning may be a potential human-caused source of mortality for pilot whales (NMFS 2005b). Moderate levels of PCBs and chlorinated pesticides (such as DDT, DDE, and dieldrin) have been found in pilot whale blubber (NMFS 2005b). Bioaccumulation levels have been found to be more similar in whales from the same stranding event than from animals of the same age or sex (NMFS 2005b). Numerous studies have measured high levels of toxic metals (mercury, lead, and cadmium), selenium, and PCBs in pilot whales in the Faroe Islands (NMFS 2005b). Population effects resulting from such high contamination levels are currently unknown (NMFS 2005b).

Habitat contamination and degradation may also play a role in marine mammal mortality and strandings. Some events caused by man have direct and obvious effects on marine mammals, such as oil spills (Geraci et al. 1999). But in most cases, effects of contamination will more than likely be indirect in nature, such as effects on prey species availability, or by increasing disease susceptibility (Geraci et al. 1999).

U.S. Navy vessel operation between ports and exercise locations has the potential for release of small amounts of pollutant discharges into the water column. U.S. Navy vessels are not a typical source, however, of either pathogens or other contaminants with bioaccumulation potential such as pesticides and PCBs. Furthermore, any vessel discharges such as bilgewater and deck runoff associated with the vessels would be in accordance with international and U.S. requirements for eliminating or minimizing discharges of oil, garbage, and other substances, and not likely to contribute significant changes to ocean water quality.

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The manmade chemical PCB (polychlorinated biphenyl), and the pesticide DDT (dichlorodiphyenyltrichloroethane), are both considered persistent organic pollutants that are currently banned in the United States for their harmful effects in wildlife and humans (NMFS 2007c). Despite having been banned for decades, the levels of these compounds are still high in marine mammal tissue samples taken along U.S. coasts (NMFS 2007c). Both compounds are long-lasting, reside in marine mammal fat tissues (especially in the blubber), and can be toxic causing effects such as reproductive impairment and immunosuppression (NMFS 2007c).

Both long-finned and short-finned pilot whales have a tendency to mass strand throughout their range. Short-finned pilot whales have been reported as stranded as far north as Rhode Island, and long-finned pilot whales as far south as South Carolina (NMFS 2005b). For U.S. east coast stranding records, both species are lumped together and there is rarely a distinction between the two because of uncertainty in species identification (NMFS 2005b). Since 1980 within the Northeast region alone, between 2 and 120 pilot whales have stranded annually either individually or in groups (NMFS 2005b). Between 1999 and 2003 from Maine to Florida, 126 pilot whales were reported to be stranded, including a mass stranding of 11 animals in 2000 and another mass stranding of 57 animals in 2002, both along the Massachusetts coast (NMFS 2005b).

It is unclear how much of a role human activities play in these pilot whale strandings, and toxic poisoning may be a potential human-caused source of mortality for pilot whales (NMFS 2005b). Moderate levels of PCBs and chlorinated pesticides (such as DDT, DDE, and dieldrin) have been found in pilot whale blubber (NMFS 2005b). Bioaccumulation levels have been found to be more similar in whales from the same stranding event than from animals of the same age or sex (NMFS 2005b). Numerous studies have measured high levels of toxic metals (mercury, lead, and cadmium), selenium, and PCBs in pilot whales in the Faroe Islands (NMFS 2005b). Population effects resulting from such high contamination levels are currently unknown (NMFS 2005b).

Habitat contamination and degradation may also play a role in marine mammal mortality and strandings. Some events caused by man have direct and obvious effects on marine mammals, such as oil spills (Geraci et al. 1999). But in most cases, effects of contamination will more than likely be indirect in nature, such as effects on prey species availability, or by increasing disease susceptibility (Geraci et al. 1999).

U.S. Navy vessel operation between ports and exercise locations has the potential for release of small amounts of pollutant discharges into the water column. U.S. Navy vessels are not a typical source, however, of either pathogens or other contaminants with bioaccumulation potential such as pesticides and PCBs. Furthermore, any vessel discharges such as bilgewater and deck runoff associated with the vessels would be in accordance with international and U.S. requirements for eliminating or minimizing discharges of oil, garbage, and other substances, and not likely to contribute significant changes to ocean water quality.

E.3.2.5 Deep Water Ambient Noise

Urick (1983) provided a discussion of the ambient noise spectrum expected in the deep ocean. Shipping, seismic activity, and weather, are the primary causes of deep-water ambient noise. The ambient noise frequency spectrum can be predicted fairly accurately for most deep-water areas based primarily on known shipping traffic density and wind state (wind speed, Beaufort wind force, or sea state) (Urick 1983). For example, for frequencies between 100 and 500 Hz, Urick (1983) estimated the average deep water ambient noise spectra to be 73 to 80 dB for areas of heavy shipping traffic and high sea states, and 46 to 58 dB for light shipping and calm seas.

E.3.2.6 Shallow Water Ambient Noise

In contrast to deep water, ambient noise levels in shallow waters (i.e., coastal areas, bays, harbors, etc.) are subject to wide variations in level and frequency depending on time and location. The primary sources of noise include distant shipping and industrial activities, wind and waves, marine animals (Urick 1983). At any given time and place, the ambient noise is a mixture of all of these noise variables. In addition, sound propagation is also affected by the variable shallow water conditions, including the depth, bottom slope, and type of bottom. Where the bottom is reflective, the sounds levels tend to be higher, then when the bottom is absorptive.

E.3.2.7 Noise from Aircraft and Vessel Movement

Surface shipping is the most widespread source of anthropogenic, low frequency (0 to 1,000 Hz) noise in the oceans and may contribute to over 75% of all human sound in the sea (Simmonds and Hutchinson 1996, ICES 2005b). The Navy estimated that the 60,000 vessels of the world's merchant fleet annually emit low frequency sound into the world's oceans for the equivalent of 21.9 million days, assuming that 80 percent of the merchant ships are at sea at any one time (U.S. Navy 2001). Ross (1976) has estimated that between 1950 and 1975, shipping had caused a rise in ambient noise levels of 10 dB and predicted this would increase by another 5 dB by the beginning of the 21st century. The National Resource Council (1997) estimated that the background ocean noise level at 100 Hz has been increasing by about 1.5 dB per decade since the advent of propeller-driven ships. Michel et al. (2001) suggested an association between long-term exposure to low frequency sounds from shipping and an increased incidence of marine mammal mortalities caused by collisions with ships.

Airborne sound from a low-flying helicopter or airplane may be heard by marine mammals and turtles while at the surface or underwater. Due to the transient nature of sounds from aircraft involved in at-sea operations, such sounds would not likely cause physical effects but have the potential to affect behaviors.

Responses by mammals and turtles could include hasty dives or turns, or decreased foraging (Soto et al. 2006). Whales may also slap the water with flukes or flippers, swim away from the aircraft track.

Sound emitted from large vessels, particularly in the course of transit, is the principal source of noise in the ocean today, primarily due to the properties of sound emitted by civilian cargo vessels (Richardson et al. 1995; Arveson and Vendittis 2006). Ship propulsion and electricity generation engines, engine gearing, compressors, bilge and ballast pumps, as well as hydrodynamic flow surrounding a ship's hull and any hull protrusions contribute to a large vessels' noise emission into the marine environment. Prop-driven vessels also generate noise through cavitation, which accounts much of the noise emitted by a large vessel depending on its travel speed. Military vessels underway or involved in naval operations or exercises, also introduce anthropogenic noise into the marine environment. Noise emitted by large vessels can be characterized as low-frequency, continuous, and tonal. The sound pressure levels at the vessel will vary according to speed, burden, capacity and length (Richardson et al. 1995; Arveson and Vendittis 2006). Vessels ranging from 135 to 337 meters generate peak source sound levels from 169-200 dB between 8 Hz and 430 Hz, although Arveson and Vendittis (2006) documented components of higher frequencies (10-30 kHz) as a function of newer merchant ship engines and faster transit speeds. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with a vessel transit through an area.

Whales have variable responses to vessel presence or approaches, ranging from apparent tolerance to diving away from a vessel. Unfortunately, it is not always possible to determine whether the whales are responding to the vessel itself or the noise generated by the engine and cavitation around the propeller. Apart from some disruption of behavior, an animal may be unable to hear other sounds in the environment due to masking by the noise from the vessel. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with a vessel transit through an area.

Vessel noise primarily raises concerns for masking of environmental and conspecific cues. However, exposure to vessel noise of sufficient intensity and/or duration can also result in temporary or permanent loss of sensitivity at a given frequency range, referred to as temporary or permanent threshold shifts (TTS or PTS). Threshold shifts are assumed to be possible in marine mammal species as a result of prolonged exposure to large vessel traffic noise due to its intensity, broad geographic range of effectiveness, and constancy.

Collectively, significant cumulative exposure to individuals, groups, or populations can occur if they exhibit site fidelity to a particular area; for example, whales that seasonally travel to a regular area to forage or breed may be more vulnerable to noise from large vessels compared to transiting whales. Any permanent threshold shift in a marine animal's hearing capability, especially at particular frequencies for which it can normally hear best, can impair its ability to perceive threats, including ships. Whales have variable responses to vessel presence or approaches, ranging from apparent tolerance to diving away from a vessel. It is not possible to determine whether the whales are responding to the vessel itself or the noise generated by the engine and cavitation around the propeller. Apart from some disruption of behavior, an animal may be unable to hear other sounds in the environment due to masking by the noise from the vessel.

Most observations of behavioral responses of marine mammals to human generated sounds have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions. Nowacek et al. (2007) provide a detailed summary of cetacean response to underwater noise.

Given the sound propagation of low frequency sounds, a large vessel in this sound range can be heard 139-463 kilometers away (Ross 1976 in Polefka 2004). U.S. Navy vessels, however, have incorporated significant underwater ship quieting technology to reduce their acoustic signature (as compared to a similarly-sized vessel) in order to reduce their vulnerability to detection by enemy passive acoustics (Southall et al. 2005). Therefore, the potential for TTS or PTS from U.S. Navy vessel and aircraft movement is extremely low given that the exercises and training events are transitory in time, with vessels moving over large area of the ocean. A marine mammal or sea turtle is unlikely to be exposed long enough at high levels for TTS or PTS to occur. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with a U.S. Navy vessel transiting through an area. If behavioral disruptions result from the presence of aircraft or vessels, it is expected to be temporary. Animals are expected to resume their migration, feeding, or other behaviors without any threat to their survival or reproduction. However, if an animal is aware of a vessel and dives or swims away, it may successfully avoid being struck.

E.3.2.8 Stranding Events Associated with Navy Sonar

There are two classes of sonars employed by the U.S. Navy: active sonars and passive sonars. Most active military sonars operate in a limited number of areas, and are most likely not a significant contributor to a comprehensive global ocean noise budget (ICES 2005b).

The effects of mid-frequency active naval sonar on marine wildlife have not been studied as extensively as the effects of air-guns used in seismic surveys (Madsen et al. 2006; Stone and Tasker 2006; Wilson et al. 2006; Palka and Johnson 2007; Parente et al. 2007). Maybaum (1989, 1993) observed changes in behavior of humpbacks during playback tapes of the M-1002 system (using 203 dB re 1 µPa-m for study); specifically, a decrease in respiration, submergence, and aerial behavior rates; and an increase in speed of travel and track linearity. Direct comparison of Maybaum's results, however, with U.S Navy mid-frequency active sonar are difficult to make. Maybaum's signal source, the commercial M-1002, is not similar to how naval mid-frequency sonar operates. In addition, behavioral responses were observed during playbacks of a control tape, (i.e., a tape with no sound signal) so interpretation of Maybaum's results are inconclusive.

Research by Nowacek, et al. (2004) on North Atlantic right whales using a whale alerting signal designed to alert whales to human presence suggests that received sound levels of only 133 to 148 pressure level (decibel [dB] re 1 microPascals [µPa]) for the duration of the sound exposure may disrupt feeding behavior. The authors did note, however, that within minutes of cessation of the source, a return to normal behavior would be expected. Direct comparison of the Nowacek et al. (2004) sound source to MFA sonar, however, is not possible given the radically different nature of the two sources. Nowacek et al.'s source was a series of non-sonar like sounds designed to purposely alert the whale, lasting several minutes, and covering a broad frequency band. Direct differences between Nowacek et al. (2004) and MFA sonar is summarized below from Nowacek et al. (2004) and Nowacek et al. (2007):

(1) Signal duration: Time difference between the two signals is significant, 18-minute signal used by Nowacek et al. verses < 1-sec for MFA sonar.

(2) Frequency modulation: Nowacek et al. contained three distinct signals containing frequency modulated sounds:

- 1st - alternating 1-sec pure tone at 500 and 850 Hz
- 2nd - 2-sec logarithmic down-sweep from 4500 to 500 Hz

- 3rd - pair of low-high (1500 and 2000 Hz) sine wave tones amplitude modulated at 120 Hz

(3) Signal to noise ratio: Nowacek et al.'s signal maximized signal to noise ratio so that it would be distinct from ambient noise and resist masking.

(4) Signal acoustic characteristics: Nowacek et al.'s signal comprised of disharmonic signals spanning northern right whales' estimated hearing range.

Given these differences, therefore, the exact cause of apparent right whale behavior noted by the authors can not be attributed to any one component since the source was such a mix of signal types.

Whales

Recent beaked whale strandings have prompted inquiry into the relationship between high amplitude continuous-type sound and the cause of those strandings. For example, in the stranding in the Bahamas in 2000, the Navy MFA sonar was identified as the only contributory cause that could have lead to the stranding. The Bahamas exercise entailed multiple ships using MFA sonar during transit of a long constricted channel. The Navy participated in an extensive investigation of the stranding with the NMFS. The "Joint Interim Report, Bahamas Marine Mammal Stranding Event of 15-16 March 2000" concluded that the variables to be considered in managing future risk from tactical mid-range sonar were "sound propagation characteristics (in this case a surface duct), unusual underwater bathymetry, intensive use of multiple sonar units, a constricted channel with limited egress avenues, and the presence of beaked whales that appear to be sensitive to the frequencies produced by these sonars." (U.S. Department of Commerce and U.S. Department of the Navy, 2001).

The Navy analyzed the known range of operational, biological, and environmental factors involved in the Bahamas stranding and focused on the interplay of these factors to reduce risks to beaked whales from ASW training. Mitigation measures based on the Bahamas investigation are presented in Chapter 6.0. The confluence of these factors do not occur in the Hawaiian Islands although surface ducts may be present, there are rapid changes in bathymetry over relatively short distances, and beaked whales are present where MFA sonar is used. For example, beaked whales are present at PMRF and there are a few individual beaked whales that appear to be resident in the area off of the island of Hawaii and the Alenuihaha Channel between the island of Hawaii and Maui where ASW sonar operations occur regularly (Baird et al., 2006a; McSweeney et al., 2007). Although beaked whales are visually and acoustically detected in areas where sonar use routinely takes place, there has not been a stranding of beaked whales in the Hawaiian Islands associated with the 30-year use history of the present sonar systems.

This history would suggest that the simple exposure of beaked whales to sonar is not enough to cause beaked whales to strand. Brownell et al. (2004) have suggested that the high number of beaked whale strandings in Japan between 1980 and 2004 may be related to Navy sonar use in those waters given the presence of U.S. Naval Bases and exercises off Japan. The Center for Naval Analysis compiled the history of naval exercises taking place off Japan and found there to be no correlation in time for any of the stranding events presented in Brownell et al. (2004). Like the situation in Hawaii, there are clearly beaked whales present in the waters off Japan (as evidenced by the strandings); however, there is no correlation in time to strandings and sonar use. Sonar did not cause the strandings identified by Brownell et al. (2004), and more importantly, this suggests sonar use in the presence of beaked whales over two decades has not resulted in strandings related to sonar use.

In Hawaii, there have been no detected beaked whales strandings associated with the use of MFA sonar. While the absence of evidence does not prove there have been no affects on beaked whales, 30 years of history with no evidence of any impacts or strandings would seem to indicate that problems encountered in locations far from Hawaii involving beaked whales are location and context specific and do not apply in Hawaiian waters.

It has been suggested that there is an absence of strandings and floating dead marine mammals in Hawaii related to sonar use because (it is argued) dead marine mammals will not float, are eaten by sharks, are carried out to sea, or end up on remote shorelines in Hawaii and are never discovered. In Hawaii, floating dead marine mammals have been documented as persisting for a number of days even while being consumed by sharks, and strandings occur on a regular basis on most of the islands. Typically, dead marine mammals will initially sink, then refloat, and finally sink again after substantial deterioration (Spitz, 1993). The timeline of this process will vary depending primarily upon water temperature and water depth, as well as other factors such as gut content, amount of body fat, etc., that affect bacterial and other decomposition processes. Generally, refloating occurs within a few days while final sinking may require, for a large whale, several weeks. Considering the intense use and observation of the shorelines and waters around Hawaii given prevalent fishing and tourism, the claim that a significant number of whale carcasses have been consistently missed is unreasonable, and is contrary to the Pacific Island Region Marine Mammal Response Stranding Network's regular observations of strandings and dead floating marine mammals documented in Hawaii.

The effects of naval sonars on marine wildlife have not been studied as extensively as have the effects of airguns used in seismic surveys (Nowacek et al. 2007). In the Caribbean, sperm whales were observed to interrupt their activities by stopping echolocation and leaving the area in the presence of underwater sounds surmised to have originated from submarine sonar signals (Watkins and Schevill 1975; Watkins et al. 1985). The authors did not report receive levels from these exposures, and also got a similar reaction from artificial noise they generated by banging on their boat hull. It was unclear if the sperm whales were reacting to the sonar signal itself or to a potentially new unknown sound in general. Madsen et al. (2006) tagged and monitored eight sperm whales in the Gulf of Mexico exposed to seismic airgun surveys. Sound sources were from approximately 2 to 7 nm (4 to 13 km) away from the whales and based on multipath propagation RLs were as high as 162 dB re 1 uPa with energy content greatest between 0.3 to 3.0 kHz. Sperm whales engaged in foraging dives continued the foraging dives throughout exposures to these seismic pulses. In the Caribbean Sea, sperm whales avoided exposure to mid-frequency submarine sonar pulses, in the range 1000 Hz to 10,000 Hz (Gordon et al. 2006). In contrast, during playback experiments off the Canary Islands, André et al. (1997) reported that foraging sperm whales exposed to a 10 kHz pulsed signal did not exhibit any general avoidance reactions.

The Navy sponsored tests of the effects of low-frequency active (LFA) sonar source, between 100 Hz and 1000 Hz, on blue, fin, and humpback whales. The tests demonstrated that whales exposed to sound levels up to 155 dB did not exhibit significant disturbance reactions, though there was evidence that humpback whales altered their vocalization patterns in reaction to the noise. Given that the source level of the Navy's LFA is reported to be in excess of 215 dB, the possibility exists that animals in the wild may be exposed to sound levels much higher than 155 dB.

Acoustic exposures have been demonstrated to kill marine mammals, result in physical trauma, and injury (Ketten 2005). Animals in or near an intense noise source can die from profound injuries related to shock wave or blast effects. Acoustic exposures can also result in noise induced hearing loss that is a function of the interactions of three factors: sensitivity, intensity, and frequency. Loss of sensitivity is referred to as a threshold shift; the extent and duration of a threshold shift depends on a combination of several acoustic features and is specific to particular species (TTS or PTS, depending on how the frequency, intensity and duration of the exposure combine to produce damage). In addition to direct physiological effects, noise exposures can impair an animal's sensory abilities (masking) or result in behavioral responses such as aversion or attraction.

Acoustic exposures can also result in the death of an animal by impairing its foraging, ability to detect predators or communicate, or by increasing stress, and disrupting important physiological events. Whales have moved away from their feeding and mating grounds (Bryant *et al*. 1984; Morton and Symonds 2002; Weller et al. 2002), moved away from their migration route (Richardson et al. 1995), and have changed their calls due to noise (Miller et al. 2000). Acoustic exposures such as MFA sonar tend to be infrequent and short in duration, and therefore effects are likely indirect and to be short lived. In situations such as the alteration of gray whale migration routes in response to shipping and whale watching boats, those acoustic exposures were chronic over several years (Moore and Clarke 2002). This was also true of the effect of seismic survey airguns (daily for 39 days) on the use of feeding areas by gray whales in the western North Pacific although whales began returning to the feeding area witin one day of the end of the exposure (Weller et al. 2002).

Cetaceans and Pinnipeds

Below are evaluations of the general information available on the variety of ways in which cetaceans and pinnipeds have been reported to respond to sound, generally, and mid-frequency sonar, in particular.

The Navy is very concerned and thoroughly investigates each marine mammal stranding to better understand the events surrounding strandings. Strandings can be a single animal or several to hundreds. An event where animals are found out of their normal habitat is considered a stranding even though animals do not necessarily end up beaching (such as the July 2004 Hanalei Mass Stranding Event; Southall et al. 2006). Several hypotheses have been given for the mass strandings which include the impact of shallow beach slopes on odontocete sonar, disease or parasites, geomagnetic anomalies that affect navigation, following a food source in close to shore, avoiding predators, social interactions that cause other cetaceans to come to the aid of stranded animals, and human actions. Generally, inshore species do not strand in large numbers but generally just as a single animal. This may be due to their familiarity with the coastal area whereas pelagic species that are unfamiliar with obstructions or sea bottom tend to strand more often in larger numbers (Woodings 1995). The Navy has studied several stranding events in detail that may have occurred in association with Navy sonar activities. To better understand the causal factors in stranding events that may be associated with Navy sonar activities, the main factors, including bathymetry (i.e., steep drop offs), narrow channels (less than 35 nm), environmental conditions (e.g., surface ducting), and multiple sonar ships were compared between the different stranding events.

1. When a marine mammal swims or floats onto shore and becomes "beached" or stuck in shallow water, it is considered a "stranding" (MMPA section 410 (16 USC section 1421g;NMFS 2007a). NMFS explains that "a cetacean is considered stranded when it is on the beach, dead or alive, or in need of medical attention while free-swimming in U.S. waters. A pinniped is considered to be stranded either when dead or when in distress on the beach and not displaying normal haul-out behavior" (NMFS 2007b).

Over the past three decades, several "mass stranding" events [strandings involving two or more individuals of the same species (excluding a single cow-calf pair) and at times, individuals from different species] that have occurred over the past two decades have been associated with naval operations, seismic surveys, and other anthropogenic activities that introduce sound into the marine environment (Canary

Islands, Greece, Vieques, U.S. Virgin Islands, Madeira Islands, Haro Strait, Washington State, Alaska, Hawaii, North Carolina).

Information was collected on mass stranding events (events in which two or more cetaceans stranded) that have occurred and for which reports are available, from the past 40 years. Any causal agents that have been associated with those stranding events were also identified (Table 4-5). Major range events undergo name changes over the years, however, the equivalent of COMPTUEX and JTFEX have been conducted in southern California since 1934. Training involving sonar has been conducted since World War II and sonar systems have been used since the 1970's.

E.4 STRANDING ANALYSIS

Over the past two decades, several mass stranding events involving beaked whales have been documented. While beaked whale strandings have been reported since the 1800s (Geraci and Lounsbury 1993; Cox et al. 2006; Podesta et al. 2006), several mass strandings since have been associated with naval operations that may have included mid-frequency sonar (Simmonds and Lopez-Jurado 1991; Frantzis 1998; Jepson et al. 2003; Cox et al. 2006). As Cox et al. (2006) concludes, the state of science can not yet determine if a sound source such as mid-frequency sonar alone causes beaked whale strandings, or if other factors (acoustic, biological, or environmental) must co-occur in conjunction with a sound source.

A review of historical data (mostly anecdotal) maintained by the Marine Mammal Program in the National Museum of Natural History, Smithsonian Institution reports 49 beaked whale mass stranding events between 1838 and 1999. The largest beaked whale mass stranding occurred in the 1870s in New Zealand when 28 Gray's beaked whales (*Mesoplodon grayi*) stranded. Blainsville's beaked whale (*Mesoplodon densirostris*) strandings are rare, and records show that they were involved in one mass stranding in 1989 in the Canary Islands. Cuvier's beaked whales (*Ziphius cavirostris*) are the most frequently reported beaked whale to strand, with at least 19 stranding events from 1804 through 2000 (DOC and DoN 2001; Smithsonian Institution 2000; (U.S. Department of the Navy and Department of Commerce, 2001). By the nature of the data, much of the historic information on strandings over the years is anecdotal, which has been condensed in various reports, and some of the data have been altered or possibly misquoted.

The discussion below centers on those worldwide stranding events that may have some association with naval operations, and global strandings that the U.S. Navy feels are either inconclusive or can not be associated with naval operations.

E.4.1 Case Studies of Stranding Events Coincidental With or Implicated With Naval Sonar

In this section, specific stranding events that have been putatively linked to potential sonar operations are discussed. Of note, these events represent a small overall number of animals over an 11 year period (40 animals) and not all worldwide beaked whale strandings can be linked to naval activity (ICES 2005a; 2005b; Podesta et al. 2006). Four of the five events occurred during NATO exercises or events where U.S. Navy presence was limited (Greece, Portugal, Spain). One of the five events involved only U.S. Navy ships (Bahamas).

Beaked whale stranding events potentially associated with potential naval operations:

- 1996: Greece (NATO)
- 2000: Bahamas (US)
- 2000: Portugal, Madeira Islands (NATO/US)

- 2002: Spain, Canary Islands (NATO/US)
- 2006: Spain, Mediterranean Sea coast (NATO/US)

E.4.1.1 1996 Greece Beaked Whale Mass Stranding (May 12 – 13, 1996)

Description: Twelve Cuvier's beaked whales (*Ziphius cavirostris*) stranded along a 38.2-kilometer strand of the coast of the Kyparissiakos Gulf on May 12 and 13, 1996 (Frantzis 1998). From May 11 through May 15, the NATO research vessel Alliance was conducting sonar tests with signals of 600 Hz and 3 kHz and root-mean-squared (rms) sound pressure levels (SPL) of 228 and 226 dB re: 1µPa, respectively (D'Amico and Verboom 1998; D'Spain et al. 2006). The timing and the location of the testing encompassed the time and location of the whale strandings (Frantzis 1998).

Findings: Partial necropsies of eight of the animals were performed, including external assessments and the sampling of stomach contents. No abnormalities attributable to acoustic exposure were observed, but the stomach contents indicated that the whales were feeding on cephalods soon before the stranding event. No unusual environmental events before or during the stranding event could be identified (Frantzis 1998).

Conclusions: The timing and spatial characteristics of this stranding event were atypical of stranding in Cuvier's beaked whale, particularly in this region of the world. No natural phenomenon that might contribute to the stranding event coincided in time with the mass stranding. Because of the rarity of mass strandings in the Greek Ionian Sea, the probability that the sonar tests and stranding coincided in time and location, while being independent of each other, was estimated as being extremely low (Frantzis 1998). However, because information for the necropsies was incomplete and inconclusive, the cause of the stranding cannot be precisely determined.

E.4.1.2 2000 Bahamas Marine Mammal Mass Stranding (March 15-16, 2000)

Description: Seventeen marine mammals comprised of Cuvier's beaked whales, Blainville's beaked whales (*Mesoplodon densirostris*), minke whale (*Balaenoptera acutorostrata*), and one spotted dolphin (*Stenella frontalis*), stranded along the Northeast and Northwest Providence Channels of the Bahamas Islands on March 15-16, 2000 (Evans and England 2001; NMFS, 2001; U.S. Department of the Navy and Department of Commerce, 2001). The strandings occurred over a 36-hour period and coincided with U.S. Navy use of mid-frequency active sonar within the channel. Navy ships were involved in tactical sonar exercises for approximately 16 hours on March 15. The ships, which operated the AN/SQS-53C and AN/SQS-56, moved through the channel while emitting sonar pings approximately every 24 seconds. The timing of pings was staggered between ships and average source levels of pings varied from a nominal 235 dB SPL (AN/SQS-53C) to 223 dB SPL (AN/SQS-56). The center frequency of pings was 3.3 kHz and 6.8 to 8.2 kHz, respectively. Because of the unusual nature and situation surrounding these strandings, a comprehensive investigation into every possible cause was quickly launched (U.S. Department of the Navy and Department of Commerce, 2001).

Strandings were first reported at the southern end of the channels, and proceeded northwest throughout March 15, 2000. It is probable that all of the strandings occurred on March 15, even though some of the animals were not found or reported until March 16. Seven of the animals died, while ten animals were returned to the water alive; however, it is unknown if these animals survived or died at sea at a later time. (U.S. Department of the Navy and Department of Commerce, 2001)

The animals that are known to have died include five Cuvier's beaked whales, one Blainville's beaked whale, and the single spotted dolphin (U.S. Department of the Navy and Department of Commerce, 2001). Six necropsies were performed, but only three out of the six (one Cuvier's beaked whale, one

Blainville's beaked whale, and the spotted dolphin) were fresh enough to permit identification of pathologies by computerized tomography. Tissues from the remaining three animals were in a state of advanced decomposition at the time of inspection. Results from the spotted dolphin necropsy revealed that the animal died with systemic debilitation disease, and is considered unrelated to the rest of the mass stranding (U.S. Department of the Navy and Department of Commerce, 2001).

Seven of the animals that stranded died, while ten animals were returned to the water alive. The animals known to have died included five Cuvier's beaked whales, one Blainville's beaked whale, and the single spotted dolphin. Six necropsies were performed and three of the six necropsied whales (one Cuvier's beaked whale, one Blainville's beaked whale, and the spotted dolphin) were fresh enough to permit identification of pathologies by computerized tomography (CT). Tissues from the remaining three animals were in a state of advanced decomposition at the time of inspection.

Findings: The spotted dolphin demonstrated poor body condition and evidence of a systemic debilitating disease. In addition, since the dolphin stranding site was isolated from the acoustic activities of Navy ships, it was determined that the dolphin stranding was unrelated to the presence of Navy active sonar.

All five necropsied beaked whales were in good body condition and did not show any signs of external trauma or disease. It was preliminarily determined that they had experienced some sort of acoustic or impulse trauma which led to their stranding and ultimate demise (U.S. Department of the Navy and Department of Commerce, 2001). Detailed microscopic tissue studies followed in order to determine the source of the acoustic trauma and the mechanism by which trauma was caused.

- All five necropsied beaked whales were in good body condition, showing no signs of infection, disease, ship strike, blunt trauma, or fishery related injuries, and three still had food remains in their stomachs. (U.S. Department of the Navy and Department of Commerce, 2001).
- Auditory structural damage was discovered in four of the whales, specifically bloody effusions or hemorrhaging around the ears (U.S. Department of the Navy and Department of Commerce, 2001).
- Bilateral intracochlear and unilateral temporal region subarachnoid hemorrhage with blood clots in the lateral ventricles were found in two of the whales (U.S. Department of the Navy and Department of Commerce, 2001).
- Three of the whales had small hemorrhages in their acoustic fats (located along the jaw and in the melon) (U.S. Department of the Navy and Department of Commerce, 2001).
- Passive acoustic monitor recordings within the area during the time of the stranding showed no signs of an explosion or other geological event such as an earthquake (U.S. Department of the Navy and Department of Commerce, 2001).
- The beaked whales showed signs of overheating, physiological shock, and cardiovascular collapse, all of which commonly result in death following a stranding (U.S. Department of the Navy and Department of Commerce, 2001).

Conclusions: The post-mortem analyses of stranded beaked whales lead to the conclusion that the immediate cause of death resulted from overheating, cardiovascular collapse and stresses associated with being stranded on land. However, the presence of subarachnoid and intracochlear hemorrhages were believed to have occurred prior to stranding and were hypothesized as being related to an acoustic event. Passive acoustic monitoring records demonstrated that no large scale acoustic activity besides the Navy sonar exercise occurred in the times surrounding the stranding event. The mechanism by which sonar could have caused the observed traumas or caused the animals to strand was undetermined. The spotted dolphin was in overall poor condition for examination, but showed indications of long-term disease. No analysis of baleen whales (minke whale) was conducted. Baleen whale stranding events have not been associated with either low-frequency or mid-frequency sonar use (ICES 2005a, 2005b).

E.4.1.3 2000 Madeira Island, Portugal Beaked Whale Strandings (May 10 – 14, 2000)

Description: Three Cuvier's beaked whales stranded on two islands in the Madeira Archipelago, Portugal, from May 10 – 14, 2000 (Cox et al. 2006). A joint NATO amphibious training exercise, named "Linked Seas 2000," which involved participants from 17 countries, took place in Portugal during May 2 – 15, 2000. The timing and location of the exercises overlapped with that of the stranding incident.

Findings: Two of the three whales were necropsied. Two heads were taken to be examined. One head was intact and examined grossly and by CT; the other was only grossly examined because it was partially flensed and had been seared from an attempt to dispose of the whale by fire (Ketten 2005).

No blunt trauma was observed in any of the whales. Consistent with prior CT scans of beaked whales stranded in the Bahamas 2000 incident, one whale demonstrated subarachnoid and peribullar hemorrhage and blood within one of the brain ventricles. Post-cranially, the freshest whale demonstrated renal congestion and hemorrhage, which was also consistent with findings in the freshest specimens in the Bahamas incident.

Conclusions: The pattern of injury to the brain and auditory system were similar to those observed in the Bahamas strandings, as were the kidney lesions and hemorrhage and congestion in the lungs (Ketten 2005). The similarities in pathology and stranding patterns between these two events suggested a similar causative mechanism. Although the details about whether or how sonar was used during "Linked Seas 2000" is unknown, the presence of naval activity within the region at the time of the strandings suggested a possible relationship to Navy activity.

E.4.1.4 2002 Canary Islands Beaked Whale Mass Stranding (24 September 2002)

Description: On September 24, 2002, 14 beaked whales stranded on Fuerteventura and Lanzaote Islands in the Canary Islands (Jepson et al. 2003). Seven of the 14 whales died on the beach and the 7 were returned to the ocean. Four beaked whales were found stranded dead over the next three days either on the coast or floating offshore (Fernández et al. 2005). At the time of the strandings, an international naval exercise called Neo-Tapon, which involved numerous surface warships and several submarines, was being conducted off the coast of the Canary Islands. Tactical mid-frequency active sonar was utilized during the exercises, and strandings began within hours of the onset of the use of mid-frequency sonar (Fernández et al. 2005).

Findings: Eight Cuvier's beaked whales, one Blainville's beaked whale, and on Gervais' beaked whale were necropsied; six of them within 12 hours of stranding (Fernández et al. 2005). The stomachs of the whales contained fresh and undigested prey contents. No pathogenic bacteria were isolated from the whales, although parasites were found in the kidneys of all of the animals. The head and neck lymph nodes were congested and hemorrhages were noted in multiple tissues and organs, including the kidney, brain, ears, and jaws. Widespread fat emboli were found throughout the carcasses, but no evidence of blunt trauma was observed in the whales. In addition, the parenchyma of several organs contained macroscopic intravascular bubbles and lesions, putatively associated with nitrogen off-gassing.

Conclusions: The association of NATO mid-frequency sonar use close in space and time to the beaked whale strandings, and the similarity between this stranding event and previous beaked whale mass strandings coincident with sonar use, suggests that a similar scenario and causative mechanism of stranding may be shared between the events. Beaked whales stranded in this event demonstrated brain and auditory system injuries, hemorrhages, and congestion in multiple organs, similar to the pathological findings of the Bahamas and Madeira stranding events. In addition, the necropsy results of Canary Islands stranding event lead to the hypothesis that the presence of disseminated and widespread gas bubbles and fat emboli were indicative of nitrogen bubble formation, similar to what might be expected in decompression sickness (Jepson et al. 2003; Fernández et al. 2005). Whereas gas emboli would develop from the nitrogen gas, fat emboli would enter the blood stream from ruptured fat cells (presumably where nitrogen bubble formation occurs) or through the coalescence of lipid bodies within the blood stream.

The possibility that the gas and fat emboli found by Fernández et al. (2005) was due to nitrogen bubble formation has been hypothesized to be related to either direct activation of the bubble by sonar signals or to a behavioral response in which the beaked whales flee to the surface following sonar exposure. The first hypothesis is related to rectified diffusion (Crum and Mao 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard 1979). Deeper and longer dives of some marine mammals, such as those conducted by beaked whales, are theoretically predicted to induce greater levels of supersaturation (Houser et al. 2001). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness. It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. The second hypothesis speculates that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson et al. 2003; Fernández et al. 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Tyack et al. (2006) showed that beaked whales often make rapid ascents from deep dives suggesting that it is unlikely that beaked whales would suffer from decompression sickness. Zimmer and Tyack (2007) speculated that if repetitive shallow dives that are used by beaked whales to avoid a predator or a sound source, they could accumulate high levels of nitrogen because they would be above the depth of lung collapse (above about 210 ft) and could lead to decompression sickness. There is no evidence that beaked whales dive in this manner in response to predators or sound sources and other marine mammals such as Antarctic and Galapagos fur seals, and pantropical spotted dolphins make repetitive shallow dives with no apparent decompression sickness (Kooyman and Trillmich 1986; Kooyman et al. 1980; Baird et al. 2001).

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann 2004). Sound exposure levels predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated and are suspected as needing to be very high (Evans 2002; Crum et al. 2005). Moore and Early

(2004) reported that in analysis of sperm whale bones spanning 111 years, gas embolism symptoms were observed indicating that sperm whales may be susceptible to decompression sickness due to natural diving behavior. Further, although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson et al. 2003), there is no conclusive evidence supporting this hypothesis and there is concern that at least some of the pathological findings (e.g., bubble emboli) are artifacts of the necropsy. Currently, stranding networks in the United States have agreed to adopt a set of necropsy guidelines to determine, in part, the possibility and frequency with which bubble emboli can be introduced into marine mammals during necropsy procedures (Arruda et al. 2007).

E.4.1.5 2006 Spain, Gulf of Vera Beaked Whale Mass Stranding (26-27 January 2006)

Description: The Spanish Cetacean Society reported an atypical mass stranding of four beaked whales that occurred January 26 to 28, 2006, on the southeast coast of Spain near Mojacar (Gulf of Vera) in the Western Mediterranean Sea. According to the report, two of the whales were discovered the evening of January 26 and were found to be still alive. Two other whales were discovered during the day on January 27, but had already died. A following report stated that the first three animals were located near the town of Mojacar and were examined by a team from the University of Las Palmas de Gran Canarias, with the help of the stranding network of Ecologistas en Acción Almería-PROMAR and others from the Spanish Cetacean Society. The fourth animal was found dead on the afternoon of May 27, a few kilometers north of the first three animals.

From January 25-26, 2006, a NATO surface ship group (seven ships including one U.S. ship under NATO operational command) conducted active sonar training against a Spanish submarine within 50 nm of the stranding site.

Findings: Veterinary pathologists necropsied the two male and two female beaked whales (*Z. cavirostris*).

Conclusions: According to the pathologists, a likely cause of this type of beaked whale mass stranding event may have been anthropogenic acoustic activities. However, no detailed pathological results confirming this supposition have been published to date, and no positive acoustic link was established as a direct cause of the stranding.

Even though no causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas 2004):

- Operations were conducted in areas of at least 1000 meters in depth near a shoreline where there is a rapid change in bathymetry on the order of 1000 – 6000 meters occurring a cross a relatively short horizontal distance (Freitas 2004).

- Multiple ships, in this instance, five MFA sonar equipped vessels, were operating in the same area over extended periods of time (20 hours) in close proximity.

- Exercises took place in an area surrounded by landmasses, or in an embayment. Operations involving multiple ships employing mid-frequency active sonar near land may produce sound directed towards a channel or embayment that may cut off the lines of egress for marine mammals (Freitas 2004).

E.4.2 Discussion Of Case Studies From Other Global Strandings

In the following sections, stranding events that have been linked to U.S. Navy activity in popular press are presented. As detailed in the individual case study conclusions, the U.S. Navy believes there is enough evidence available to refute allegations of impacts from mid-frequency sonar, or at least indicate that a substantial degree of uncertainty in time and space that preclude a meaningful scientific conclusion.

E.4.2.1 2003 Washington State Harbor Porpoise Strandings (May 2 – June 2 2003)

Description: At 1040 hours on May 5, 2003, the USS SHOUP began the use of mid-frequency tactical active sonar as part of a naval exercise. At 1420, the USS SHOUP entered the Haro Strait and terminated active sonar use at 1438, thus limiting active sonar use within the strait to less than 20 minutes. Between May 2 and June 2, 2003, approximately 16 strandings involving 15 harbor porpoises (*Phocoena phocoena*) and one Dall's porpoise (*Phocoenoides dalli*) were reported to the Northwest Marine Mammal Stranding Network. A comprehensive review of all strandings and the events involving USS SHOUP on 5 May 2003 were presented in U.S. Department of Navy (2004). Given that the USS SHOUP was known to have operated sonar in the strait on May 5, and that supposed behavioral reactions of killer whales (*Orcinus orca*) had been putatively linked to these sonar operations (NMFS Office of Protected Resources, 2005), the NMFS undertook an analysis of whether sonar caused the strandings of the harbor porpoises.

Whole carcasses of ten harbor porpoises and the head of an additional porpoise were collected for analysis. Necropsies were performed on ten of the harbor porpoises and six whole carcasses and two heads were selected for CT imaging. Gross examination, histopathology, age determination, blubber analysis, and various other analyses were conducted on each of the carcasses (Norman et al. 2004a).

Findings: Post-mortem findings and analysis details are found in Norman et al. (2004a). All of the carcasses suffered from some degree of freeze-thaw artifact that hampered gross and histological evaluations. At the time of necropsy, three of the porpoises were moderately fresh, whereas the remainder of the carcasses was considered to have moderate to advanced decomposition. None of the 11 harbor porpoises demonstrated signs of acoustic trauma. In contrast, a putative cause of death was determined for 5 of the porpoises; 2 animals had blunt trauma injuries and 3 animals had indication of disease processes (fibrous peritonitis, salmonellosis, and necrotizing pneumonia). A cause of death could not be determined in the remaining animals, which is consistent with expected percentage of marine mammal necropsies conducted within the northwest region. It is important to note, however, that these determinations were based only on the evidence from the necropsy so as not to be biased with regard to determinations of the potential presence or absence of acoustic trauma. The result was that other potential causal factors, such as one animal (Specimen 33NWR05005) found tangled in a fishing net, was unknown to the investigators in their determination regarding the likely cause of death.

Conclusions: The NMFS concluded from a retrospective analysis of stranding events that the number of harbor porpoise stranding events in the approximate month surrounding the USS SHOUP use of sonar was higher than expected based on annual strandings of harbor porpoises (Norman et al. 2004a). In this regard, it is important to note that the number of strandings in the May-June timeframe in 2003 was also higher for the outer coast indicating a much wider phenemona than use of sonar by USS SHOUP in Puget Sound for one day in May. The conclusion by NMFS that the number of strandings in 2003 was higher is also different from that of The Whale Museum, which has documented and responded to harbor porpoise strandings since 1980 (Osborne 2003). According to The Whale Museum, the number of strandings as of May 15, 2003, was consistent with what was expected based on historical stranding records and was less than that occurring in certain years. For example, since 1992 the San Juan Stranding Network has documented an average of 5.8 porpoise strandings per year. In 1997 there were 12 strandings in the San Juan Islands with more than 30 strandings throughout the general Puget Sound area. Disregarding the discrepancy in the historical rate of porpoise strandings and its relation to the USS SHOUP, NMFS acknowledged that the intense level of media attention focused on the strandings likely resulted in an increased reporting effort by the public over that which is normally observed (Norman et al. 2004a). NMFS also noted in its report that the "sample size is too small and biased to infer a specific relationship with respect to sonar usage and subsequent strandings."

Seven of the porpoises collected and analyzed died prior to SHOUP departing to sea on May 5, 2003. Of these seven, one, discovered on May 5, 2003, was in a state of moderate decomposition, indicating it died before May 5; the cause of death was determined to be due, most likely, to salmonella septicemia. Another porpoise, discovered at Port Angeles on May 6, 2003, was in a state of moderate decomposition, indicating that this porpoise also died prior to May 5. One stranded harbor porpoise discovered fresh on May 6 is the only animal that could potentially be linked in time to the USS SHOUP's May 5 active sonar use. Necropsy results for this porpoise found no evidence of acoustic trauma. The remaining eight strandings were discovered one to three weeks after the USS SHOUP's May 5 transit of the Haro Strait, making it difficult to causally link the sonar activities of the USS SHOUP to the timing of the strandings. Two of the eight porpoises died from blunt trauma injury and a third suffered from parasitic infestation, which possibly contributed to its death (Norman et al. 2004a). For the remaining five porpoises, NMFS was unable to identify the causes of death.

The speculative association of the harbor porpoise strandings to the use of sonar by the USS SHOUP is inconsistent with prior stranding events linked to the use of mid-frequency sonar. Specifically, in prior events, the stranding of whales occurred over a short period of time (less than 36 hours), stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Although mid-frequency active sonar was used by the USS SHOUP, the distribution of harbor porpoise strandings by location and with respect to time surrounding the event do not support the suggestion that mid-frequency active sonar was a cause of harbor porpoise strandings. Rather, a complete lack of evidence of any acoustic trauma within the harbor porpoises, and the identification of probable causes of stranding or death in several animals, further supports the conclusion that harbor porpoise strandings were unrelated to the sonar activities of the USS SHOUP.

Additional allegations regarding USS SHOUP use of sonar having caused behavioral effects to Dall's porpoise, orca, and a minke whale also arose in association with this event (see U.S. Department of Navy 2004 for a complete discussion).

Dall's porpoise: Information regarding the observation of Dall's porpoise on 5 May 2003 came from the operator of a whale watch boat at an unspecified location. This operator reported the Dall's porpose were seen "going north" when the SHOUP was estimated by him to be 10 miles away. Potential reasons for the Dall's movement include the pursuit of prey, the presence of harassing resident orca or predatory transient orca, vessel disturbance from one of many whale watch vessels, or multiple other unknowable reasons including the use of sonar by USS SHOUP. In short, there was nothing unusual in the observed behavior of the Dall's porpoise on 5 May 2003 and no way to assess if the otherwise normal behavior was in reaction to the use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

Orca: Observer opinions regarding orca J-Pod behaviors on 5 May 2003 were inconsistent, ranging from the orca being "at ease with the sound" or "resting" to their being "annoyed." One witness reported observing "low rates of surface active behavior" on behalf of the orca J-Pod, which is in conflict with that of another observer who reported variable surface activity, tail slapping and spyhopping. Witnesses also expressed the opinion that the behaviors displayed by the orca on 5 May 2003 were "extremely unusual," although those same behaviors are observed and reported regularly on the Orca Network Website, are behaviors listed in general references as being part of the normal repertoire of orca behaviors. Given the contradictory nature of the reports on the observed behavior of the J-Pod orca, it is impossible to determine if any unusual behaviors were present. In short, there is no way to assess if any unusual behaviors were present or if present they were in reaction to vessel disturbance from one of many nearby whale watch vessels, use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

Minke whale: A minke whale was reported porpoising in Haro Strait on 5 May 2003, which is a rarely observed behavior. The cause of this behavior is indeterminate given multiple potential causal factors including but not limited to the presence of predatory Transient orca, possible interaction with whale watch boats, other vessels, or SHOUP's use of sonar. The behavior of the minke whale was the only unusual behavior clearly present on 5 May 2003, however, no way to given the existing information if the unusual behavior observed was in reaction to the use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

E.4.2.2 2004 Hawai'i Melon-Headed Whale Mass Stranding (July 3-4 2004)

Description: The majority of the following information is taken from the NMFS report on the stranding event (Southall et al. 2006) but is inclusive of additional and new information not presented in the NMFS report. On the morning of July 3, 2004, between 150-200 melon-headed whales (*Peponocephala electra*) entered Hanalei Bay, Kauai. Individuals attending a canoe blessing ceremony observed the animals entering the bay at approximately 7:00 a.m. The whales were reported entering the bay in a "wave as if they were chasing fish" (Braun 2005). At 6:45 a.m. on July 3, 2004, approximately 25 nm north of Hanalei Bay, active sonar was tested briefly prior to the start of an anti-submarine warfare exercise.

The whales stopped in the southwest portion of the bay, grouping tightly, and displayed spy-hopping and tail-slapping behavior. As people went into the water among the whales, the pod separated into as many as four groups, with individual animals moving among the clusters. This continued through most of the day, with the animals slowly moving south and then southeast within the bay. By about 3 p.m., police arrived and kept people from interacting with the animals. The Navy believes that the abnormal behavior by the whales during this time is likely the result of people and boats in the water with the whales rather than the result of sonar activities taking place 25 or more miles off the coast. At 4:45 p.m. on July 3, 2004, the RIMPAC Battle Watch Captain received a call from a National Marine Fisheries representative in Honolulu, Hawaii, reporting the sighting of as many as 200 melon-headed whales in Hanalei Bay. At 4:47 p.m. the Battle Watch Captain directed all ships in the area to cease active sonar transmissions.

At 7:20 p.m. on July 3, 2004, the whales were observed in a tight single pod 75 yards from the southeast side of the bay. The pod was circling in a group and displayed frequent tail slapping and whistle vocalizations and some spy hopping. No predators were observed in the bay and no animals were reported as having fresh injuries. The pod stayed in the bay through the night of July 3, 2004. On the morning of July 4, 2004, the whales were observed to still be in the bay and collected in a tight group. A decision was made at that time to attempt to herd the animals out of the bay. A 700-to-800-foot rope was constructed by weaving together beach morning glory vines. This vine rope was tied between two canoes and with the assistance of 30 to 40 kayaks, was used to herd the animals out of the bay. By approximately 11:30 a.m. on July 4, 2004, the pod was coaxed out of the bay.

A single neonate melon-headed whale was observed in the bay on the afternoon of July 4, after the whale pod had left the bay. The following morning on July 5, 2004, the neonate was found stranded on

Lumahai Beach. It was pushed back into the water but was found stranded dead between 9 and 10 a.m. near the Hanalei pier. NMFS collected the carcass and had it shipped to California for necropsy, tissue collection, and diagnostic imaging.

Following the stranding event, NMFS undertook an investigation of possible causative factors of the stranding. This analysis included available information on environmental factors, biological factors, and an analysis of the potential for sonar involvement. The latter analysis included vessels that utilized mid-frequency active sonar on the afternoon and evening of July 2. These vessels were to the southeast of Kauai, on the opposite side of the island from Hanalei Bay.

Findings: NMFS concluded from the acoustic analysis that the melon-headed whales would have had to have been on the southeast side of Kauai on July 2 to have been exposed to sonar from naval vessels on that day (Southall et al. 2006). There was no indication whether the animals were in that region or whether they were elsewhere on July 2. NMFS concluded that the animals would have had to swim from 1.4-4.0 m/s for 6.5 to 17.5 hours after sonar transmissions ceased to reach Hanalei Bay by 7:00 a.m. on July 3. Sound transmissions by ships to the north of Hanalei Bay on July 3 were produced as part of exercises between 6:45 a.m. and 4:47 p.m. Propagation analysis conducted by the 3rd Fleet estimated that the level of sound from these transmissions at the mouth of Hanalei Bay could have ranged from 138-149 dB re: 1 μPa.

NMFS was unable to determine any environmental factors (e.g., harmful algal blooms, weather conditions) that may have contributed to the stranding. However, additional analysis by Navy investigators found that a full moon occurred the evening before the stranding and was coupled with a squid run (Mobley et al. 2007). One of the first observations of the whales entering the bay reported the pod came into the bay in a line "as if chasing fish" (Braun 2005). In addition, a group of 500-700 melon-headed whales were observed to come close to shore and interact with humans in Sasanhaya Bay, Rota, on the same morning as the whales entered Hanalei Bay (Jefferson et al. 2006). Previous records further indicated that, though the entrance of melon-headed whales into the shallows is rare, it is not unprecedented. A pod of melon-headed whales entered Hilo Bay in the 1870s in a manner similar to that which occurred at Hanalei Bay in 2004.

The necropsy of the melon-headed whale calf suggested that the animal died from a lack of nutrition, possibly following separation from its mother. The calf was estimated to be approximately one week old. Although the calf appeared not to have eaten for some time, it was not possible to determine whether the calf had ever nursed after it was born. The calf showed no signs of blunt trauma or viral disease and had no indications of acoustic injury.

Conclusions: It is unlikely that the sound level from the sonar caused the melon-headed whales to enter Hanalei Bay, however, the investigation of this even concluded that there was insufficient evidence to determine causality. This conclusion is based on a number of factors:

1. The speculation that the whales may have been exposed to sonar the day before and then fled to the Hanalei Bay is not supported by reasonable expectation of animal behavior and swim speeds. The flight response of the animals would have had to persist for many hours following the cessation of sonar transmissions. Such responses have not been observed in marine mammals and no documentation of such persistent flight response after the cessation of a frightening stimulus has been observed in other mammals. The swim speeds, though feasible for the species, are highly unlikely to be maintained for the durations proposed, particularly since the pod was a mixed group containing both adults and neonates. Whereas adults may maintain a swim speed of

4.0 m/s for some time, it is improbable that a neonate could achieve the same for a period of many hours.

2. The area between the islands of Oahu and Kauai and the PMRF training range have been used in RIMPAC exercises for more than 20 years, and are used year-round for ASW training using mid frequency active sonar. Melon-headed whales inhabiting the waters around Kauai are likely not naive to the sound of sonar and there has never been another stranding event associated in time with ASW training at Kauai or in the Hawaiian Islands. Similarly, the waters surrounding Hawaii contain an abundance of marine mammals, many of which would have been exposed to the same sonar operations that were speculated to have affected the melon-headed whales. No other strandings were reported coincident with the RIMPAC exercises. This leaves it uncertain as to why melon-headed whales, and no other species of marine mammal, would respond to the sonar exposure by stranding.

3. At the nominal swim speed for melon-headed whales, the whales had to be within 1.5 to 2 nm of Hanalei Bay before sonar was activated on July 3. The whales were not in their open ocean habitat but had to be close to shore at 6:45 a.m. when the sonar was activated to have been observed inside Hanalei Bay from the beach by 7:00 a.m (Hanalei Bay is very large area). This observation suggests that other potential factors could be causative of the stranding event (see below).

4. The simultaneous movement of 500-700 melon-headed whales and Risso's dolphins into Sasanhaya Bay, Rota, in the Northern Marianas Islands on the same morning as the 2004 Hanalei stranding (Jefferson et al. 2006) suggests that there may be a common factor which prompted the melon-headed whales to approach the shoreline. A full moon occurred the evening before the stranding and a run of squid was reported concomitant with the lunar activity (Mobley et al. 2007). Thus, it is possible that the melon-headed whales were capitalizing on a lunar event that provided an opportunity for relatively easy prey capture (Mobley et al. 2007). A report of a pod entering Hilo Bay in the 1870s indicates that on at least one other occasion, melon-headed whales entered a bay in a manner similar to the occurrence at Hanalei Bay in July 2004. Thus, although melon-headed whales entering shallow embayments may be an infrequent event, and every such event might be considered anomalous, there is precedent for the occurrence.

5. The received noise sound levels at the bay were estimated to range from roughly 95 – 149 dB re: 1 μPa. Received levels as a function of time of day have not been reported, so it is not possible to determine when the presumed highest levels would have occurred and for how long. However, received levels in the upper range would have been audible by human participants in the bay. The statement by one interviewee that he heard "pings" that lasted an hour and that they were loud enough to hurt his ears is unreliable. Received levels necessary to cause pain over the duration stated would have been observed by most individuals in the water with the animals. No other such reports were obtained from people interacting with the animals in the water.

Although NMFS concluded that sonar use was a "plausible, if not likely, contributing factor in what may have been a confluence of events (Southall et al. 2006)," this conclusion was based primarily on the basis that there was an absence of any other compelling explanation. The authors of the NMFS report on the incident were unaware, at the time of publication, of the simultaneous event in Rota. In light of the simultaneous Rota event, the Hanalei stranding does not appear as anomalous as initially presented and the speculation that sonar was a causative factor is weakened. The Hanalei Bay incident does not share the characteristics observed with other mass strandings of whales coincident with sonar activity (e.g., specific traumas, species composition, etc.). In addition, the inability to conclusively link or exclude the impact of other environmental factors makes a causal link between sonar and the melon-headed whale strandings highly speculative at best.

E.4.2.3 1980- 2004 Beaked Whale Strandings in Japan (Brownell et al. 2004)

Description: Brownell et al. (2004) compare the historical occurrence of beaked whale strandings in Japan (where there are U.S. Naval bases), with strandings in New Zealand (which lacks a U.S. Naval base) and concluded the higher number of strandings in Japan may be related to the presence of the U.S. Navy vessels using mid-frequency sonar. While the dates for the strandings were well documented, the authors of the study did not attempt to correlate the dates of any navy activities or exercises with the dates of the strandings.

To fully investigate the allegation made by Brownell et al. (2004), the Center for Naval Analysis (CNA) in an internal Navy report, looked at the past U.S. Naval exercise schedules from 1980 to 2004 for the water around Japan in comparison to the dates for the strandings provided by Brownell et al. (2004). None of the strandings occurred during or soon (within weeks) after any U.S. Navy exercises. While the CNA analysis began by investigating the probabilistic nature of any co-occurrences, the strandings and sonar use were not correlated by time. Given there there there was no instance of co-occurrence in over 20 years of stranding data, it can be reasonably postulated that sonar use in Japan waters by U.S. Navy vessels did not lead to any of the strandings documented by Brownell et al. (2004).

E.4.2.4 2004 Alaska Beaked Whale Strandings (7-16 June 2004)

Description: In the timeframe between 17 June and 19 July 2004, five beaked whales were discovered at various locations along 1,600 miles of the Alaskan coastline and one was found floating (dead) at sea. Because the Navy exercise Alaska Shield/Northern Edge 2004 occurred within the approximate timeframe of these strandings, it has been alleged that sonar may have been the probable cause of these strandings.

The Alaska Shield/Northern Edge 2004 exercise consisted of a vessel tracking event followed by a vessel boarding search and seizure event. There was no ASW component to the exercise, no use of mid-frequency sonar, and no use of explosives in the water. There were no events in the Alaska Shield/Northern Edge exercise that could have caused in any of the strandings over this 33 day period covering 1,600 miles of coastline.

E.4.2.5 2005 North Carolina Marine Mammal Mass Stranding Event (January 15-16, 2005)

Description: On January 15 and 16, 2005, 36 marine mammals consisting of 33 short-finned pilot whales, 1 minke whale, and 2 dwarf sperm whales stranded alive on the beaches of North Carolina (Hohn et al. 2006a). The animals were scattered across a 111-km area from Cape Hatteras northward. Because of the live stranding of multiple species, the event was classified as a UME. It is the only stranding on record for the region in which multiple offshore species were observed to strand within a two- to three-day period

The U.S. Navy indicated that from January 12-14 some unit level training with mid-frequency active sonar was conducted by vessels that were 93 to 185 km from Oregon Inlet. An expeditionary strike group was also conducting exercises to the southeast, but the closest point of active sonar transmission to the inlet was 650 km away. The unit level operations were not unusual for the area or time of year and the vessels were not involved in antisubmarine warfare exercises. Marine mammal observers on board the vessels did not detect any marine mammals during the period of unit level training. No sonar transmissions were made on January 15-16.

The National Weather Service reported that a severe weather event moved through North Carolina on January 13 and 14. The event was caused by an intense cold front that moved into an unusually warm and moist air mass that had been persisting across the eastern United States for about a week. The weather caused flooding in the western part of the state, considerable wind damage in central regions of the state, and at least three tornadoes that were reported in the north central part of the state. Severe, sustained (one to four days) winter storms are common for this region.

Over a two-day period (January 16-17), two dwarf sperm whales, 27 pilot whales, and the minke whale were necropsied and tissue samples collected. Twenty-five of the stranded cetacean heads were examined; two pilot whale heads and the heads of the dwarf sperm whales were analyzed by CT.

Findings: The pilot whales and dwarf sperm whale were not emaciated, but the minke whale, which was believed to be a dependent calf, was emaciated. Many of the animals were on the beach for an extended period of time prior to necropsy and sampling, and many of the biochemical abnormalities noted in the animals were suspected of being related to the stranding and prolonged time on land. Lesions were observed in all of the organs, but there was no consistency across species (National Oceanic and Atmospheric Administration, 2006; Hohn et al., 2006). Musculoskeletal disease was observed in two pilot whales and cardiovascular disease was observed in one dwarf sperm whale and one pilot whale. Parasites were a common finding in the pilot whales and dwarf sperm whales but were considered consistent with the expected parasite load for wild odontocetes. None of the animals exhibited traumas similar to those observed in prior stranding events associated with mid-frequency sonar activity. Specifically, there was an absence of auditory system trauma and no evidence of distributed and widespread bubble lesions or fat emboli, as was previously observed (Fernández et al. 2005).

Sonar transmissions prior to the strandings were limited in nature and did not share the concentration identified in previous events associated with mid-frequency active sonar use (Evans and England 2001). The operational/environmental conditions were also dissimilar (e.g., no constrictive channel and a limited number of ships and sonar transmissions). NMFS noted that environmental conditions were favorable for a shift from up-welling to down-welling conditions, which could have contributed to the event. However, other severe storm conditions existed in the days surrounding the strandings and the impact of these weather conditions on at-sea conditions is unknown. No harmful algal blooms were noted along the coastline.

Conclusions: All of the species involved in this stranding event are known to occasionally strand in this region. Although the cause of the stranding could not be determined, several whales had preexisting conditions that could have contributed to the stranding (National Oceanic and Atmospheric Administration, 2006; NMFS, 2008). Cause of death for many of the whales was likely due to the physiological stresses associated with being stranded. A consistent suite of injuries across species, which was consistent with prior strandings where sonar exposure is expected to be a causative mechanism, was not observed.

NMFS was unable to determine any causative role that sonar may have played in the stranding event. The acoustic modeling performed, as in the Hanalei Bay incident, was hampered by uncertainty regarding the location of the animals at the time of sonar transmissions. However, as in the Hanalei Bay incident, the response of the animals following the cessation of transmissions would imply a flight response that persisted for many hours after the sound source was no longer operational. In contrast, the presence of a severe weather event passing through North Carolina during January 13 and 14 is a possible, if not likely, contributing factor to the North Carolina UME of January 15. Hurricanes may have been responsible for mass strandings of pygmy killer whales in the British Virgin Islands and Gervais' beaked whales in North Carolina (Mignucci-Giannoni et al. 2000; Norman and Mead 2001).

E.4.3 Causal Associations for Stranding Events

As discussed previously, several stranding events have been associated with Navy sonar activities but relatively few of the total stranding events that have been recorded occurred spatially or temporally with Navy sonar activities. While sonar may be a contributing factor under certain rare conditions, the presence of sonar it is not a necessary condition for stranding events to occur.

A review of past stranding events associated with sonar suggest that the potential factors that may contribute to a stranding event are steep bathymetry changes, narrow channels, multiple sonar ships, surface ducting and the presence of beaked whales that may be more susceptible to sonar exposures. The most important factors appear to be the presence of a narrow channel (e.g., Bahamas and Madeira Island, Portugal) that may prevent animals from avoiding sonar exposure and multiple sonar ships within that channel. These factors are not present during RDT&E activities in the NAVSEA NUWC Keyport Range Complex.

There have been no mass strandings in Pacific Northwest waters that have been attributed to Navy sonar. Given the large military presence and private and commercial vessel traffic in the Southern California waters, it is likely that a mass stranding event would be detected. Therefore, it is unlikely that the conditions that may have contributed to past stranding events involving Navy sonar would be present in the NAVSEA NUWC Keyport Range Complex.

E.5 CONCLUSIONS

Marine mammal strandings have been a historic and ongoing occurrence attributed to a variety of causes. Over the last fifty years, increased awareness and reporting has lead to more information about species effected and raised concerns about anthropogenic sources of stranding. While there has been some marine mammal mortalities potentially associated with mid-frequency sonar effects to a small number of species (primarily limited numbers of certain species of beaked whales), the significance and actual causative reason for any impacts is still subject to continued investigation.

By comparison and as described previously, potential impacts to all species of cetaceans worldwide from fishery related mortality can be orders of magnitude more significant (100,000s of animals vice 10s of animals) (Culik 2002; ICES 2005b; Read et al. 2006). This does not negate the influence of any mortality or additional stressor to small, regionalized sub-populations which may be at greater risk from human related mortalities (fishing, vessel strike, sound) than populations with larger oceanic level distribution or migrations. ICES (2005a) noted, however, that taken in context of marine mammal populations in general, sonar is not major threat, or significant portion of the overall ocean noise budget.

In conclusion, a constructive framework and continued research based on sound scientific principles is needed in order to avoid speculation as to stranding causes, and to further our understanding of potential effects or lack of effects from military mid-frequency sonar (Bradshaw et al. 2006; ICES 2005b; Barlow and Gisiner 2006; Cox et al. 2006).

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APPENDIX F:
SCIENTIFIC NAMES FOR BIOLOGICAL RESOURCES

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Table F-1. Scientific Names of Faunal Species Discussed in the Text

Common Name	*Scientific Name*
INVERTEBRATES	
Brittle star	*Ophiothrix purpurea*
Butter clam	*Saxidomus giganteus*
Cockles	*Clinocardium nuttallii*
Copepod	*Pseudocalanus newmani*
Copepod	*Euchaeta elongata*
Dungeness crab	*Cancer magister*
Eastern soft shell clam	*Mya arenaria*
Fiddler crab	*Uca pugilator*
Giant Pacific octopus	*Enteroctopus dofleini*
Horse clam	*Tresus capax*
Horse mussel	*Midiolus rectus*
Littleneck clam	*Protothaca staminea*
Macomas clam	*Macoma irus*
Manila clam	*Venerupis philippinarum*
Market squid	*Loligo opalescens*
North Sea shrimp	*Crangon crangon*
Pacific geoduck	*Panopea abrubta*
Pacific krill	*Euphausia pacifica*
Pacific oyster	*Crassostrea gigas*
Pacific squid	*Loligo opalescens*
Pandalid shrimp	*Pandalidae*
Piddocks	*Zirfaea pilsbryii*
Razor clam	*Siliqua patula*
Red rock crab	*Plagusia chabrus*
Sand dollars	*Clypeasteroida*
Sea cucumber	*Holothuroidea*
Sun star	*Pycnopodia helianthoides*
White-plumed anemone	*Metridium giganteum*
FISH	
American shad	*Alosa sapidissima*
Arrowtooth flounder	*Atheresthes stomias*
Atlantic cod	*Gadus morhua*
Atlantic salmon	*Salmo salar*
Aurora rockfish	*Sebastes aurora*
Bay anchovy	*Anchoa mitchilli*
Big skate	*Raja binoculata*
Blackbelly eelpout	*Lycodopsis pacifica*
Black rockfish	*Sebastes melanops*
Blue rockfish	*Sebastes mystinus*
Bocaccio rockfish	*Sebastes paucispinis*
Brown rockfish	*Sebastes auriculatus*
Bull shark	*Carcharhinus leucas*
Bull trout	*Salvelinus confluentus*
Butter sole	*Isopsetta isolepis*
Cabezon	*Scorpaenichthys marmoratus*
California skate	*Raja inornata*
Canary rockfish	*Sebastes pinniger*
Chillipepper rockfish	*Sebastes goodei*
China rockfish	*Sebastes nebulosus*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*
Coho salmon	*Oncorhynchus kisutch*
Copper rockfish	*Sebastes caurinus*
Cowcod rockfish	*Sebastes levis*

Table F-1. Scientific Names of Faunal Species Discussed in the Text

Common Name	*Scientific Name*
Curlfin sole	*Pleuronichthys decurrens*
Cutthroat trout	*Salmo clarki clarki*
Dab	*Limonda limanda*
Darkblotched rockfish	*Sebastes crameri*
Deepsea sole	*Embassichthys bathybius*
Dogfish	*Squalus acanthias*
Dover sole	*Microstomus pacificus*
Eelpouts	*Zoarcidae*
English sole	*Parophrys vetulus*
Eulachon	*Thaleichthys pacificus*
Finescale codling	*Antimora microlepis*
Flathead sole	*Hippoglossoides elassodon*
Goby	*Padogobius martensii, Gobius nigricans*
Greenlings	*Hexagrammidae*
Greenspotted rockfish	*Sebastes chlorostictus*
Greenstriped rockfish	*Sebastes elongates*
Gulf menhaden	*Brevoortia patronus*
Gunnels	*Pholidae*
Jack mackerel	*Trachurus symmetricus*
Kelp Greenling	*Hexagrammos decagrammus*
Lemon shark	*Negaprion brevirostris*
Lingcod	*Ophiodon elongatus*
Longnose skate	*Raja rhina*
Longspine thornyhead	*Sebastolobus altivelis*
Northern anchovy	*Engraulis mordax*
Northern rockfish	*Sebastes polyspinis*
Oyster toadfish	*Opsanus tau*
Pacific cod	*Gadus macrocephalus*
Pacific halibut	*Hippoglossus stenolepis*
Pacific herring	*Clupea pallasii*
Pacific (chub) mackerel	*Scomber japonicus*
Pacific ocean perch	*Sebastes alutus*
Pacific rattail	*Coryphaenoides acrolepis*
Pacific sand lance	*Ammodytes hexapterus*
Pacific sanddab	*Citharichthys sordidus*
Pacific sardine	*Sardinops sagax*
Pacific whiting (hake)	*Merluccius productus*
Petrale sole	*Eopsetta jordani*
Pink salmon	*Oncorhynchus gorbuscha*
Plaice	*Pleuronectes platessa*
Quillback rockfish	*Sebastes maliger*
Redbanded rockfish	*Sebastes babcocki*
Redstripe rockfish	*Sebastes proriger*
Rex sole	*Glyptocephalus zachirus*
Rockfish	*Sebastes spp.*
Rock sole	*Lepidopsetta bilineata*
Rosethorn rockfish	*Sebastes helvomaculatus*
Rosy rockfish	*Sebastes rosaceus*
Rougheye rockfish	*Sebastes aleutianus*
Sablefish	*Anoplopoma fimbria*
Sand sole	*Psettichthys melanostictus*
Scaled sardine	*Harengula jaguana*
Sharpchin rockfish	*Sebastes zacentrus*
Shortbelly rockfish	*Sebastes jordani*
Shortraker rockfish	*Sebastes borealis*

Table F-1. Scientific Names of Faunal Species Discussed in the Text

Common Name	*Scientific Name*
Shortspine thornyhead	*Sebastolobus alascanus*
Slender sea robin	*Prionotus scitulus*
Sockeye salmon	*Oncorhynchus nerka*
Soupfin shark	*Galeorhinus galeus*
Spiny dogfish	*Squalus acanthias*
Splitnose rockfish	*Sebastes diploproa*
Spotlined sardine	*Sardinops melanostictus*
Spotted ratfish	*Hydrolagus colliei*
Squirrelfish	*Holocentrus adscensionis*
Starry flounder	*Platichthys stellatus*
Steelhead trout	*Oncorhynchus mykiss*
Striped seaperch	*Embiotoca lateralis*
Stripetail rockfish	*Sebastes saxicola*
Surf perch	*Embiotocidae*
Surf smelt	*Hypomesus pretious*
Tiger rockfish	*Sebastes nigrocinctus*
Vermilion rockfish	*Sebastes miniatus*
Walleye pollock	*Theragra chalcogramma*
White sturgeon	*Acipenser transmontanus*
Whitespotted greenling	*Hexagrammos stelleri*
Widow rockfish	*Sebastes entomelas*
Wolf eel	*Lycenchelys paxillus*
Yelloweye rockfish	*Sebastes ruberrimus*
Yellowmouth rockfish	*Sebastes reedi*
Yellowtail rockfish	*Sebastes flavidus*
SEA TURTLES	
Green sea turtle	*Chelonia mydas*
Kemp's Ridleys turtle	*Lepidochelys kempii*
Leatherback turtle	*Dermochyles coriacea*
BIRDS	
American wigeon	*Anas americana*
Bald eagle	*Haliaeetus leucocephalus*
Barrow's goldeneye	*Bucephala islandica*
Belted kingfisher	*Ceryle alcyon*
Black scoter	*Melanitta nigra*
Brandt's cormorant	*Phalacrocorax penicillatus*
Brant	*Branta bernicla*
Brown pelican	*Pelecanus occidentalis*
Bufflehead	*Bucephala albeola*
California gull	*Larus californicus*
Common goldeneye	*Bucephala clangula*
Common loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common murre	*Uria aalge*
Double-crested cormorant	*Phalacrocorax auritus*
Glaucous-winged gull	*Larus glaucescens*
Great blue heron	*Ardea herodias*
Harlequin duck	*Histrionicus histrionicus*
Heermann's gull	*Larus heermanni*
Hooded merganser	*Lophodytes cucullatus*
Mallard	*Anas platyrhynchos*
Marbled murrelet	*Brachyramphus marmoratus*
Northern pintail	*Anas acuta*
Osprey	*Pandion haliaetus*
Pacific loon	*Gavia pacifica*

Table F-1. Scientific Names of Faunal Species Discussed in the Text

Common Name	*Scientific Name*
Parasitic jaeger	*Stercorarius parasiticus*
Pelagic cormorant	*Phalacrocorax pelagicus*
Peregrine falcon	*Falco peregrinus*
Pied-billed grebe	*Podilymbus podiceps*
Pigeon guillemot	*Cepphus columba*
Red-breasted merganser	*Mergus serrator*
Rhinoceros auklet	*Cerorhinca monocerata*
Ring-billed gull	*Larus delawarensis*
Ruddy duck	*Oxyura jamaicensis*
Semipalmated plover	*Charadrius semipalmatus*
Snowy plover	*Charadrius alexandrinus*
Sooty shearwater	*Puffinus griseus*
Surf scoter	*Melanitta perspicillata*
Trumpeter swan	*Cygnus buccinator*
Tufted puffin	*Fratercula cirrhata*
Western grebe	*Aechmophorus occidentalis*
Western gull	*Larus occidentalis*
Western sandpiper	*Calidris mauri*
White-winged scoter	*Melanitta fusca*
MAMMALS	
Baird's beaked whale	*Berardius bairdii*
Beluga whale	*Delphinapterus leucus*
Blue whale	*Balaenoptera musculus*
Bottlenose dolphin	*Tursiops truncatus*
California sea lion	*Zalophus californianus*
Cuvier's beaked whale	*Ziphius cavirostris*
Dall's porpoise	*Phocoenoides dalli*
Dwarf sperm whale	*Kogia sima*
False killer whale	*Pseudorca crassidens*
Fin whale	*Balaenoptera physalus*
Gray whale	*Eschrichtius robustus*
Harbor porpoise	*Phocoena phocoena*
Harbor seal	*Phoca vitulina*
Hubb's beaked whale	*Mesoplodon carlhubbsi*
Humpback whale	*Megaptera novaeangiliae*
Killer whale	*Orcinus orca*
Minke whale	*Balaenoptera acutorostrata*
Northern elephant seal	*Mirounga angustirostris*
Northern fur seal	*Callorhinus ursinus*
Northern right whale dolphin	*Lissodelphis borealis*
North Pacific right whale	*Eubalaena japonica*
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
River otter	*Lutra canadensis*
Sea otter	*Enhydra lutris*
Sei whale	*Balaenoptera borealis*
Short-beaked common dolphin	*Delphinus delphis*
Short-finned pilot whale	*Globicephala macrorhynchus*
Sperm whale	*Physeter macrocephalus*
Stejneger's beaked whale	*Mesoplodon stejnegeri*
Steller's sea lion	*Eumetopias jubatus*
Striped dolphin	*Stenella coeruleoalba*

Sources: PFMC 1998, 2005, 2006, 2006b; NMFS 2006; FishBase 2006.

APPENDIX G:
PUBLIC COMMENTS

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Directory of Comments on the Draft EIS

Organization/Commentor	Comment Tracking Code	Page Number
Tribes		
Hoh Indian Tribe (Joseph Gilbertson)	T1	G-3
Makah Tribe (McCarty, Micah)	T2	G-5
Port Gamble S'Klallam Tribe (Daubenberger, Hans)	T3	G-7
Quinault Indian Nation (Fawn Sharp)	T4	G-16
Suquamish Tribe (O'Sullivan, Alison)	T5	G-19
Federal Agencies		
Marine Mammal Commission (Ragen, Tim)	F1	G-23
Olympic Coast National Marine Sanctuary (Bernthal, Carol)	F2	G-27
U.S. Army Corps of Engineers, Seattle District (Walker, Michelle)	F3	G-30
U.S. Department of the Interior, National Park Service (Gustin, Karen)	F4	G-31
U.S. Environmental Protection Agency, Region 10 (Reichgott, Christine)	F5	G-34
State Agencies		
Department of Ecology, State of Washington (Butorac, Diane & Figueroa-Kaminsky, Christiana)	S1	G-37
Washington Department of Fish and Wildlife (Thiesfeld, Steve)	S2	G-39
Local Agencies		
Port of Port Townsend (Thompson, David, et al.)	L1	G-40
Organizations		
Natural Resources Defense Council (Jasny, Michael)	O1	G-42
Olympic Coast National Marine Sanctuary Advisory Council (Klinger, Terrie)	O2	G-84
Private Entities/Individuals		
Aker, William (verbal comment at public hearing)	P1	G-97
Bailey, Jack (verbal comment at public hearing)	P2	G-99
Beck, Herb (verbal comment at public hearing)	P3	G-104
Boldt, Jim	P4	G-109
Caldwell, John	P5	G-111
Carle, Renee	P6	G-113
Coleman, Don (verbal comment at public hearing)	P7	G-115
Hager, John (verbal comment at public hearing)	P8	G-117
Hogan, Ralph (verbal comment at public hearing)	P9	G-119
MacIntyre, James (verbal comment at public hearing)	P10	G-123
Milner, Glen	P11	G-125
Nixon, Shirley	P12	G-129
Public, Jean	P13	G-130
Rowland, Jerry	P14	G-132
Ryan, Matt	P15	G-133
Schwab, David and Greb, Ruth	P16	G-134
Sword, Carol	P17	G-135
Veatch, John	P18	G-136
Veatch, John (verbal comment at public hearing)	P19	G-139

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T1 – Hoh Indian Tribe *(page 1 of 2)*

HOH INDIAN TRIBE
PO BOX 2196 • FORKS, WASHINGTON 98331
TELEPHONE (360) 374-6582 • FAX (360) 374-6549

January 6, 2008
To: United States Navy, c/o Shaari Unger
From: Hoh Tribe Department of Natural Resources

Re: Hoh Tribal Comments Regarding NAVSEA NUWC Keyport Range Complex Extension, Environmental Impact Statement, Specifically Operations in the QUTR Range Site

The following is a list of Hoh Tribal concerns which we want considered prior to any Government consultation and prior to conducting any exercises in the QUTR:

- U.S. Navy should consult with the Hoh Tribe and avoid operations in or near the QUTR site when Tribal vessels are fishing in or near the QUTR. Navy operations must avoid and not disturb fishing gear encountered during operations including pots and long-lines. 1
- U.S. Navy will avoid exercises in areas restricted to ocean fishing for ESA or conservation concerns including all present or future rockfish conservation areas. If conservation concerns prohibit Tribal fishing, these conservation concerns must also be respected by the Navy and prohibit undersea warfare exercises. 2
- The Hoh Tribe expects absolutely zero use of munitions in the QUTR. Any use munitions must be considered independent of this EIS. Use of white phosphorus, depleted uranium or any other known toxic or radioactive substances will not be tolerated. 3
- Every possible effort must be made to retrieve debris generated by exercises in the QUTR. The Hoh Tribe must be notified if debris removal fails, and the location of the debris provided to the Tribe. 4
- Underwater anchors used in mobile tracking arrays or for any other equipment must be comprised of a biologically inert material and removed upon completion of exercises in order to minimize the potential to fowl ocean bottom fishing gear. 5
- Report all accidents including those which result in the release of petrochemicals or any other potentially toxic spills or contamination resulting from Navy exercises in the QUTR. The Navy will assume ALL responsibility for clean up and mitigation in the event of any accident resulting in environmental damage. 6

Response:

1. NUWC Keyport will continue ongoing collaboration and consultation with the Hoh Tribe to facilitate cooperative use of marine areas.
2. NUWC Keyport's ongoing consultation with the Hoh Tribe will include discussion of sensitive habitat.

   Any restrictions on Navy activities in federal or state-designated conservation areas are outside the scope of the EIS/OEIS.
3. Use of munitions is not a component of current or proposed NUWC Keyport activities in any of the three range sites.
4. It is NUWC Keyport practice to retrieve/recover all major test components and minimize expended materials.

   NUWC Keyport's ongoing consultation with the Hoh Tribe will include discussion of unrecovered or expended materials.

   A description of expended materials has been added to Section 1.3 of the EIS/OEIS, and additional analysis of the potential effects of expended materials has been added to the appropriate impact sections of the EIS/OEIS.
5. Larger anchoring components are typically retrieved; smaller, low-profile anchors and inert anchoring devices (such as sandbags or concrete clumps) may not be recovered. Such items are unlikely to foul fishing gear.

   As technological advances yield more environmentally-friendly test components, the Navy would consider use of these components to further minimize impacts.
6. NUWC Keyport follows regulatory reporting requirements as required by law and Navy policy.

   The existing regulatory framework provides for assignment of responsibility for clean up and mitigation of environmental damage according to the circumstances of the event.

T1 – Hoh Indian Tribe ***(page 2 of 2)***

- The Navy will notify Tribal staff if exercises are found to harm or kill any marine wildlife including birds, shellfish, fish and marine mammals. Upon observation of wildlife mortality caused by the exercises all activity must cease. The Navy will then work with Tribal staff to determine the cause and extent of the damage, The Navy will assume responsibility for the damage and modify the procedures in the future to reduce the risk of mortality recurrence. 7
- The Navy will conduct surveys of operation area in the QUTR for presence of cetaceans prior to operations. A record or this surveillance must be maintained and made available to Tribal staff. 8
- The Navy will cease or delay all operations if Orca, Grey whales or Humpback whales are observed within the QUTR, the area of planned exercises or within 1000 meters of any vessel during surveillance or conduct of the operation. 9
- The Navy will consult with Tribal biologists and will avoid operations during periods of known Grey whale migration in or around the QUTR. 10
- The Navy will abide by all regulations contained in the MMPA (marine mammal protection act) 11
- The Navy will update the Hoh Tribe upon successful completion of operations, even accident-free operations, the assure the Tribe that impacts remain minimal. 12
- The Navy will consider and respond to all Hoh Tribal requests and concerns in a timely fashion regarding operations in and around the QUTR. 13
- The Navy will respond to all future data which may modify or improve our understanding of the environmental impacts of exercises within the QUTR. 14
- The Navy and Hoh Tribe will continue to communicate to ensure Tribal concerns are addressed and also to satisfy the Hoh Tribe that exercises are conducted in a safe and ecologically responsible fashion. 15

Prepared by Joseph Gilbertson,
Fisheries Management Biologist,
Hoh Tribe

Response:

7. NUWC Keyport's ongoing consultation with the Hoh Tribe will include discussion of reporting and response requirements in the unlikely event of wildlife harm/mortality associated with NUWC Keyport activities.

   NUWC Keyport is currently in consultation with regulatory agencies (USFWS and NMFS) and will implement any required reporting, monitoring, or mitigation programs. Such information would be shared with the Hoh Tribe.
8. Per NUWC Keyport's Range Operating Procedures, surveillance is performed prior to and during NUWC Keyport activities. Additional mitigation measures to reduce any potential impact to marine mammals are described in Section 3.5 of the EIS/OEIS.

   NUWC Keyport is currently in consultation with NMFS and will implement any required reporting, monitoring, or mitigation programs.
9. As described in Table 2-8 of the EIS/OEIS, "in accordance with the MMPA and ESA, … an 'exclusion zone' shall be established and surveillance will be conducted to ensure that there are no marine mammals within this exclusion zone prior to the commencement of each in-water exercise. For cetaceans (whales, dolphins, and porpoises), the exclusion zone must be at least as large as the entire area within which the test unit may operate, and must extend at least 1,000 yards (914.4 m) from the intended track of the test unit."

   In addition, the mitigations in Section 3.5 of the EIS/OEIS identify "Safety Zones – When cetaceans are detected by any means within 1,000 yards of the intended track of the test vehicle, the transmissions will be terminated. For all range sites the sources are either on or off; there is no capability to reduce source levels."
10. NUWC Keyport will continue ongoing collaboration and consultation with the Hoh Tribe to facilitate cooperative use of marine areas.
11. Concur.
12. NUWC Keyport's ongoing consultation with the Hoh Tribe will include discussion of communication protocols.
13. NUWC Keyport's ongoing consultation with the Hoh Tribe will include discussion of communication protocols.
14. NUWC Keyport will evaluate new data and update environmental documentation as a function of the 5-year reauthorization process for the Letter of Authorization under the MMPA.
15. Concur.

T2 – Makah Tribe ***(page 1 of 2)***

MAKAH TRIBAL COUNCIL

P.O. BOX 115 • NEAH BAY, WA 98357 • 360-645-2201

IN REPLY REFER TO:

October 22, 2008

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Re: Request for extension of time to comment on NAVSEA NUWC Keyport Range Draft EIS/OEIS

Dear Mrs. Kler,

The Makah Tribal Council (MTC) respectfully requests an extension of time to submit formal written comments on the draft EIS/OEIS noted above. The draft EIS has not been readily available for the public to review. For this and the reasons explained below, we request at least three-week extension so that comments would be due November 17th. 1

The Makah Indian Tribe did not engage in formal government-to-government consultation with the Navy at the initiation of this process because we wanted to understand the context and details of the Navy's proposal. Now that the draft EIS has been released, we would like to engage in government-to-government consultation to discuss our concerns. In addition, given the importance and potential impact of the Navy's proposal, we would like to discuss the draft EIS at the upcoming Navy Tribal Charter meeting which is just beyond the October 27th comment period. 2

The Makah Tribal Council has serious concerns about the potential for increased oil spills due to the increase in Navy activity proposed by the draft EIS. The MTC would like the opportunity for its Office of Marine Affairs to review the Navy's contingency plan that presumably addresses mitigation for the increased risk of oil spills. Until the MTC is afforded an opportunity to review that document, it is unable to provide the type of thoughtful analysis and comment that is necessary to full and fair public comment. 3

For the reasons outlined above, we respectfully request that the public comment period for the draft EIS/OEIS be extended for the general public from October 27, 2008 to November 17, 2008.

Response:

1. No extension is needed. Tribes are not limited to providing comments only during the 45-day public comment period. The Navy has engaged in direct Government-to-Government discussion with the Makah Tribe to address concerns.
2. The Navy discussed this concern with Tribal members at the Region Navy/Tribal Council meeting on November 4th, 2008. Makah Tribal members understand that they are not limited to providing comments only during the 45-day public comment period. They have requested ongoing Government-to-Government consultation. Representatives from the Navy and the Makah Tribe will continue coordinating to arrange Government-to-Government meetings. No further comments on the Draft EIS/OEIS were provided.
3. The Navy provided to the Makah Tribe the Commander, Navy Region Northwest Integrated Contingency Plan.

T2 – Makah Tribe *(page 2 of 2)*	
Thank you for your courtesy in considering this extension request. Sincerely, Micah McCarty, Chairman Makah Tribal Council cc: Congressman Norm Dicks via Judith Morris, Port Angeles constituent office Ms. Shaari Unger (via e-mail to shaari.unger@navy.mil)	**Response:**

T3 – Port Gamble S'Klallam Tribe ***(page 1 of 9)***

PORT GAMBLE S'KLALLAM TRIBE
31912 Little Boston Road NE • Kingston, WA 98346

Shaari Unger
Naval Undersea Warfare Center Div, Keyport
610 Dowell St
Keyport, WA 98345

October 27, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

The Port Gamble S'Klallam Tribe appreciates the opportunity to comment on the Draft NAVSEA NUWC Keyport Range Complex Extension Environmental Impact Statement/ Overseas Environmental Impact Statement.

As you know, the marine waters of the Hood Canal are within the Port Gamble S'Klallam Tribe's usual and accustomed (U and A) fishing grounds and stations As such these areas play a significant cultural and practical role in the Tribes continued viability. The shellfish, finfish, and marine mammals occupying these waters provide economic, subsistence and cultural opportunities to our tribal members, making them vital to the Tribes well being. 1

Do to the size and scope of the Draft EIS, the Port Gamble S'Klallam Tribe would like to set up a technical meeting with the Navy to discuss the practical implications of the proposed expanded naval activities within the Hood Canal area.

Do to the size of the Draft EIS the Tribe has not had the capacity / time to conduct a complete and thorough review of the document. That said, we have noticed the omission of at least one critical detail. On page 3-156 Table 3.5-11 titled Marine Mammals Known to Occur or Potentially Occurring within the DBRC Action Area. Harbor Porpoise are not included in the table. Harbor porpoise are known by the Port Gamble S'Kallam Tribe to occur regularly within the Hood Canal, including areas within the proposed DBRC action area. To that end, we have attached field notes taken by the Hood Canal Salmon Enhancement Group and the Port Gamble S'Klallam Tribe Natural Resources Department documenting their presences over several months this calendar year. 2

We suggest that the Navy contact Cascadia Research Collective at http://www.cascadiaresearch.org/, as they may have information regarding Harbor Porpoise usage within the Hood Canal. If Cascadia Research Collective does not have data regarding Harbor Porpoise usage within the Hood Canal, the Port Gamble S'Klallam Tribe would like to work with the Navy to develop that data set.

(360) 297-2646 Kingston | (360) 478-4583 Bremerton | (206) 464-7281 Seattle | (360) 297-7097 Fax

Response:

1. Two meetings have been held with the Tribe. One was hosted at the Point No Point Treaty Council location on November 3, 2008, and the other at the Undersea Museum near Keyport on November 13, 2008. Follow up to these will include a tour of the Dabob Bay range computer site and a Government-to-Government meeting in early 2009.
2. As suggested in the comment, NUWC Keyport sought additional information from NMFS as well as Cascadia Research on harbor porpoise sightings in Hood Canal. Cascadia's biologists confirmed that they had received several reports of harbor porpoises in the same areas described in the notes attached to the Tribe's comment letter, in the northern part of Hood Canal during 2008. This is a recent phenomenon, and NMFS concluded that the data should not be incorporated into the EIS/OEIS or LOA request because of insufficient detail on abundance and seasonal presence. As indicated in the Draft EIS/OEIS, previous NMFS stock assessments did not identify the presence of harbor porpoise in Hood Canal.

   Per NUWC Keyport's Range Operating Procedures (Table 2-8 of the EIS/OEIS), surveillance is performed for all marine mammals prior to and during range activities. Additional mitigation measures to reduce any potential impact to marine mammals are described in Section 3.5 of the EIS/OEIS.

   Future surveys are outside the scope of this EIS/OEIS.

T3 – Port Gamble S'Klallam Tribe *(page 2of 9)*

PORT GAMBLE S'KLALLAM TRIBE
31912 Little Boston Road NE • Kingston, WA 98346

Description of attached documents: The document titled (*Hood Canal Salmon Enhancement Group Marine Water Quality Sampling)* is a copy of the Port Gamble S'Klallam Tribe Natural Resources Departments Field notes. The document titled (Regarding: Porpoise sightings in field notes HCDOP program) is a fax containing field datasheets and a short summary of there content.

Sincerely,

Hans Daubenberger
Habitat Biologist
360-297-6289
hans@pgst.nsn.us

(360) 297-2646 Kingston (360) 478-4583 Bremerton (206) 464-7281 Seattle (360) 297-7097 Fax

Response:

T3 – Port Gamble S'Klallam Tribe ***(page 3 of 9)***

Oct. 23. 2008 1:10PM HOOD CANAL SALMON ENHANC. GROUP No. 2646 P. 1

To: Hans Daubenberger
S'Klallam Tribe
Natural Resources Department

Fax number: 360-297-4791

Date: 10/23/2008

# of Pages (including cover): 3

A FACSIMILE FROM:

Hood Canal Salmon Enhancement Group

22881 NE State Route 3
Belfair, WA 98528
(360) 275-9722 ph
(360) 275-0648 fax

Regarding: Porpoise sightings in field notes HCDOP program

Comments:

Hans,

This was the only datasheet on which I had recorded porpoise sightings. Since we saw them just about every time we were out sampling, I didn't bother to record their whereabouts in our field notes on a weekly basis.

However, on the 6th of May 2008, we saw huge numbers of them between Port Ludlow and BridgeHaven (south of the Hood Canal bridge). That's the reason I had recorded that info.

At Hood Head we were estimating at least 30-50 fins out of the water at once (and that was a very conservative estimate) and then at BridgeHaven we saw about 10 different fins out of the water at once. (My notes on the datasheet were cut off with the 3-hole punch- sorry about that.)

Colin Smith maintains the northern University of Washington ORCA buoy North of the Hood Canal Bridge and Hood Head transect. He's noticed porpoises while out on the buoy as well. Would you like a written statement from him?

Thank you,

Renee Rose

Hood Canal Salmon Enhancement Group

Renee@hcseg.org

Response:

T3 – Port Gamble S'Klallam Tribe ***(page 4 of 9)***

Oct. 23. 2008 1:10PM HOOD CANAL SALMON ENHANC. GROUP No. 2646 P. 2

[redacted]

Names of Volunteers Ronae Pene, Hans [illegible], Ted Smith

Hours of Service: Start time: End time:

HOOD CANAL SURVEYS DATE: 5-6-08

[redacted] Bangor West

Marine Secchi (ft/m) 5.5

Lake Secchi (ft/m) ______

CTD cast # 1 Time On/Off: 10:42 / Notes: hit bottom

CTD cast # ______ Time On/Off: ______ / Notes: ______

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. ☐Y ☐N		1038	7m	192			7
2. ☐Y ☐N 1		~~:45~~	~~10m~~	~~230~~			
3. ☐Y ☐N							
4. ☐Y ☐N							

Notes:

Weather: ☐ storm ☐ rain ☐ showers ☐ overcast ☐ part cloudy ☐ clear/sunny

Wind: ☐ strong ☐ moderate ☐ steady ☐ light ☐ calm

Direction: ___

Waves: ☐ strong ☐ medium ☐ light ☐ small ripple ☐ calm

[redacted] Bangor Center

Marine Secchi (ft/m) 5.5

Lake Secchi (ft/m) ______

CTD cast # 2 Time On/Off: 10 53 / Notes:

CTD cast # ______ Time On/Off: ______ / Notes:

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. ☐Y ☐N 2		11:00	~109m	230			6.5
2. ☐Y ☐N		10:53	1m	258			7
3. ☐Y ☐N							
4. ☐Y ☐N							

Notes:

Weather: ☐ storm ☐ rain ☐ showers ☐ overcast ☐ part cloudy ☐ clear/sunny

Wind: ☐ strong ☐ moderate ☐ steady ☐ light ☐ calm

Direction: ___

Waves: ☐ strong ☐ medium ☐ light ☐ small ripple ☐ calm

[redacted] Bang E

Marine Secchi (ft/m) 6m

Lake Secchi (ft/m) ______

CTD cast # 3 Time On/Off: ______ / Notes:

CTD cast # ______ Time On/Off: ______ / Notes:

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. ☐Y ☐N		1:34	~1m	212			7
2. ☐Y ☐N 3		11:40	11m	249			
3. ☐Y ☐N							
4. ☐Y ☐N							

Notes:

Weather: ☐ storm ☐ rain ☐ showers ☐ overcast ☐ part cloudy ☐ clear/sunny

Wind: ☐ strong ☐ moderate ☐ steady ☐ light ☐ calm

Direction: ___

Waves: ☐ strong ☐ medium ☐ light ☐ small ripple ☐ calm

Take multiple field replicates Chlorophyll Max from Data CTD Name: Osprey

Response:

T3 – Port Gamble S'Klallam Tribe *(page 5 of 9)*

Oct. 23. 2008 1:10PM HOOD CANAL SALMON ENHANC. GROUP No. 2646 P. 3

Names of Volunteers
Hours of Service: Start time: End time:

HOOD CANAL SURVEYS DATE:

[redacted] Hood Head E

Marine Secchi (ft/m) 6m
Lake Secchi (ft/m)

CTD cast # 4 Time On/Off: / Notes:
CTD cast # Time On/Off: / Notes:

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. Y			~18m	182			7
2. N		1222	1m	245			
3.							
4.							

Notes:

Weather: storm, rain, showers, overcast, part cloudy, clear/sunny
Wind: strong, moderate, steady, light, calm
Direction:
Waves: strong, medium, light, small ripple, calm

[redacted] HH Center

Marine Secchi (ft/m) 6.5
Lake Secchi (ft/m)

CTD cast # 5 Time On/Off: / Notes:
CTD cast # Time On/Off: / Notes:

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. N			1	204			7
2. Y/N	line at ~140m; bottom - NO FIRE			176 + 179a			
3.							
4.							

Notes:

Weather: storm, rain, showers, overcast, part cloudy, clear/sunny
Wind: strong, moderate, steady, light, calm
Direction:
Waves: strong, medium, light, small ripple, calm

[redacted] Hood Head West

Marine Secchi (ft/m) 6
Lake Secchi (ft/m)

CTD cast # 6 Time On/Off: ~12:57 / Notes:
CTD cast # Time On/Off: / Notes:

Niskin fired w/CTD (Cast #)	Niskin #	Time	Depth (ft/m)	DO Bottle #	Plankton	Nutrient Bottle #	Water Temp
1. Y 6			~1m	176 & 179a			7
2.				nearly rain on the water, not much of a ripple			
3.							
4. Y			1m	181a			

Notes:

Weather: storm, rain, showers, overcast, part cloudy, clear/sunny
Wind: strong, moderate, steady, light, calm
Direction:
Waves: strong, medium, light, small ripple, calm

CTD Name:

Response:

T3 – Port Gamble S'Klallam Tribe *(page 6of 9)*	
Hood Canal Salmon Enhancement Group *Marine Water Quality Sampling* January 17th, 2008 • Renee, Nicole, Heather, and Mike. • Sampled Hamma Hamma & Bangor. • Renee trained Heather Fuller and Nicole Kaiser. • Sampled for dissolved oxygen and nutrients (with Niskin). • Hours: 9:15 to 4:00 • Weather: calm & sunny January 24th, 2008 • Mike, Nicole, and Renee • Sampled Hamma Hamma & Bangor. • Sampled Hood Head Point. • Did not sample Tala point due to a broken winch. • Sampled for dissolved oxygen (with Niskin & Hydrolab). • Hours: 9:15 to 3:00 • Weather: calm & slightly cloudy February 7th, 2008 • Mike, Nicole, and Renee • Sampled Hood Head & Tala Point. • Sampled for dissolved oxygen (with Niskin & Hydrolab). • Hours: 9:30 to 1:00 • Weather: calm & slightly cloudy February 14th, 2008 • Mike, Nicole, and Renee • Sampled Hamma Hamma & Bangor (with Niskin and CTD). • Hours: 9:30 to 2:00 • Weather: calm & sunny March 6th, 2008 • Nicole, Renee, and Scott • Nicole sampled with HCSEG at inventory sites. • Hours: 8:00 to 2:30 • Weather: cloudy & light wind March 18, 2008 • Sampling did not occur with HCSEG due to lack of supplies (messengers) and due to HCSEG needed all the supplies for other sampling. • Nicole, Heather, Mike sampled PGST sites (PG Bay, Tala Point & Hoods Head) with Hydrolab	**Response:**

T3 – Port Gamble S'Klallam Tribe ***(page 7 of 9)***

March 20, 2008
- Sampling did not occur at Hamma Hamma and Bangor due to weather conditions.

*Boat not available week of 2/18/08 thru 3/10/08 due to maintenance.

March 26, 2008
- Heather, Hans, Renee
- Sampled Hamma Hamma & Bangor.
- Sampled DO and Nutrients with Niskins
- Hours: 10:00 to 3:30
- Weather: Cloudy, wind around 10 knots, mildly choppy

April 1, 2008
- Heather, Hans, Renee
- Sampled Bangor, Hoods Head, and Tala Point
- Sampled DO at Bangor, DO and Nutrients at Hoods Head and Tala Point
- Hours: 10:00-3:30
- Weather: Sunny, breezy, fairly calm

April 8, 2008
- Heather, Renee, Rob (from PG law enforcement)
- Sampled Hamma Hamma and Bangor for DO
- Hours: 9:30-1:30
- Weather: Cloudy, breezy/slightly choppy and strong current at Hamma Hamma, calm at Bangor
- Wildlife: Spotted large flock of seagulls near East Bangor site (herring???)

April 15, 2008
- Heather, Ted Switz, Renee and Rob (PG law enforcement)
- Renee and Heather trained Ted on HCSEG methods and the hydrolab
- Sampled Bangor, Hood Head, and Tala Point for DO
- Hours: 9:30-2
- Weather: cloudy, calm
- Wildlife: Spotted juvenile herring jumping out of water at East Bangor site.

May 1, 2008
- Hans Daubenberger, Ted Switz
- Sampled Bangor, Hood Head and Tala Point
- Hours 9-3pm
- Weather- Clear and Calm
- Wildlife- Water birds, harbor seals

Response:

T3 – Port Gamble S'Klallam Tribe ***(page 8 of 9)***	
May 6, 2008 • Ted Switz, Hans Daubenberger, Renee • Sampled Bangor, Hood Head, Tala Point • Hours 9-3pm • Weather- Overcast, calm • Wild life- two pods of porpoise seen, Tala point and south of HCB, sea lions& seals seen on rock outcroppings south of Bridge. May 13, 2008 • Ted Switz, Hans Daubenberger, Renee • Sampled Bangor, Hood Head,- DO and Nutrients • Hours 9-2pm • Weather- Overcast, rain, light wind, some white caps • Porpoise seen at Hood Head May 27, 2008 • Ted Switz, Hans Daubenberger, • Sampled Bangor, PGB, Hood Head, Tala point- DO sampling • Hours 11-330pm • Weather- calm, prt. Cloudy, flat water • Juvenile salmonid seen, harbor seals June 10, 2008 • Ted Switz, Hans Daubenberger, Renee • Sampled Bangor, Hood Head, Tala point- DO sampling • Hours 1030-330pm • Weather- calm, Cloudy, flat water Juvenile salmonid seen, harbor seals, porpoise pods-south of bridge and at hood head June 17, 2008 • Ted, Gus, Renee • Sampled Bangor, Hood Head, DO sampling • Hours 930-330pm • Weather- calm, Cloudy, flat water Juvenile salmonid seen, harbor seals	**Response:**

T3 – Port Gamble S'Klallam Tribe ***(page 9 of 9)***

June 24, 2008
- Ted, Hans, Renee
- Sampled Bangor, Hood Head, DO sampling
- Hours 930-330pm
- Weather- calm, flat water

Juvenile salmonid seen, harbor seals

July 8, 2008
- Ted, Hans, Renee
- Sampled Bangor, Hama Hama, DO sampling
- Hours 930-400pm
- Weather- calm, Cloudy, flat water

Juvenile salmonid seen, harbor seals

July 15, 2008
- Ted, Mike Jr, Renee
- Sampled Bangor, Hood Head, Tala point, DO sampling
- Hours 930-330pm
- Weather- Cloudy, low wind
- Juvenile salmonid seen, harbor seals

July22, 2008
- Ted, Hans, Renee
- Sampled Bangor, Hood Head
- Hours 930-300pm
- Weather- Clear, low wind in AM, 10+ wind, swells by PM

August 5, 2008
- Ted, Gus, Renee
- Sampled Bangor, Gamble Bay
- Hours 930-200pm
- Weather- Clear, low wind

Response:

T4 – Quinault Indian Nation *(page 1 of 3)*

QUINAULT INDIAN NATION

Quinault Indian Nation

POST OFFICE BOX 189 • TAHOLAH, WASHINGTON 98587 • TELEPHONE (360) 276-8211

Commander, NUWC Division
610 Dowell Street
Keyport, WA 98345
Attn: Shaari Unger

December 21, 2008

Re: DEIS Comments for Proposed Expansion of Quinault Undersea Naval Testing Range.

Commander,

At the recent meeting between the U.S. Navy and the Quinault Indian Nation (QIN), held in Taholah on November 21, 2008, representatives from the Naval Undersea Warfare Center Division Keyport presented the Draft Environmental Impact Statement for the Proposed Range Expansion, including the Quinault Undersea Training Area in the ocean areas adjacent to the QIN reservation. Quinault representatives present at the meeting included the Director of the Quinault Division of Natural Resources Dave Bingaman, Fisheries staff including Larry Gilbertson, Joe Schumacker and Scott Mazzone; Cultural Archaeologist Justine James, Fisheries Policy Spokesperson Ed Johnstone and myself President Fawn Sharp.

Quinault Indian Nation staff had previously reviewed your document and had comments to that effect at our meeting. Additional comments were voiced by myself and Spokesperson Johnstone regarding cultural, educational and natural resource concerns. This letter will serve to formalize those comments for your scoping process.

The proposed range expansion area encompasses a large portion of the Quinault's adjudicated Usual and Accustomed Harvest Area (U&A). It is our utmost concern that the Navy not interfere with any QIN fisheries that occur in our U&A. The Quinault Nation has fought long and hard for these rights and they must not be jeopardized in any way by testing in the W-237-A South area. To that end we insisted on a formalized process for notification and coordination of our respective activities in that area. We believe that these details can be dealt with in a Memorandum of Understanding (MOU) that would meet both our needs. We request that this MOU be agreed to before any expansion of testing occurs.

Though we had requested in a previous letter that the Navy not have a shore-based site within our U&A we appreciate that the proposed expansion is completely bracketed within our U&A and limits your choices. We have discussed your preferred alternative at the Pacific Beach site and find it acceptable with the caveat of having the aforementioned MOU in effect.
I would like to reiterate that the proposed expansion area includes some the QIN's most productive fishing grounds. This area is harvested by the Nation for Dungeness crab, salmon, halibut, blackcod (sablefish), razor clams, mussels and numerous intertidal organisms that are culturally important to the Quinault people.

I would also like to thank you personally for bringing your staff and yourself to Taholah for this government to government consultation. We appreciate the Navy's respect for our sovereign rights and government. We felt it was productive meeting and hope that more can come of our

Response:

T4 – Quinault Indian Nation *(page 2 of 3)*

discussions especially regarding educational opportunities for our Quinault children, sharing of Navy bottom mapping (bathymetric) data from our U&A and the potential of working with QIN fishers to clear lost gear from our crabbing areas.

Quinault Comments to the DEIS:

- After review of the DEIS we do not have specific comments regarding potential impacts to fish, birds or mammals in the open waters of the offshore areas. You have addressed them to our satisfaction in the DEIS. Quinault's concerns are primarily with impacts to the ocean bottom, both offshore and nearshore. We believe that any bottom disturbance, lost equipment or crawler activities represent potential impacts to flora and fauna though the DEIS claims no or minimal impacts for the most part. We would expect the Navy to hold to their commitment to use more environmentally friendly techniques and substances as they become available. 1
- From our discussions and from the DEIS, it is apparent that the Navy is unaware of the large amount of lost crab gear that exists on the sea-floor, especially in the shore-based operating area. It would seem apparent that this gear has potential to disrupt the Navy's testing if they are seeking metal objects and may entangle Navy equipment. 2
- As a co-manager of all the resources and habitats within our Usual and Accustomed area (the majority of W-237-A) Quinault is concerned about your level of interaction with one of our co-managers, the Washington Dept. of Fish and Wildlife. They are seldom mentioned as managers of the resources within the QUTR sections of the DEIS, though federal managers such as OCNMS, ONP and USFWS are acknowledged. Was WDFW consulted for this DEIS? 3
- Corrections are needed for the map in Figure 3.2-6 regarding habitat areas of both razor clams and Dungeness crab. 4
    - Razor clams, *Siliqua patula*, exist or have suitable habitat on most of the coast from Destruction Island south. The map should label all of the beaches north of Pt. Brown (46°55.7'N Lat.) including the length of Kalaloch Beach in the north as containing razor clams. Additionally, razor clams exist sub-tidally along this range offshore for up to one-half mile (WDFW webpage http://wdfw.wa.gov/fish/shelfish/razorclm/razorclm.htm) . A second species, *Siliqua sloati*, also exists in substrates deeper than 30 feet.
    - Dungeness crab are found abundantly throughout Area W-237A to depths of 100 fathoms. They are commercially fished from that depth into shore within the Operating Area. There are no gaps for crab along the coast as indicated in Figure 3.2-6.
- Wave-heights stated on page 3-213 are stated to reach 26 ft maximum from October through December at the Grays Harbor buoy. This maximum has been exceeded during the last two winters. The central coast was subjected to near 40 foot waves during the winter of 2006-07. 5
- The statement on page 3-216 (Traditional Cultural Resources) that "the "Boldt Decision" allocated 50 percent of the annual catch to treaty tribes…" is misstated. The Boldt Decision reaffirmed the fishing rights stated in the treaties with the U.S. Government in the 1850's. There was no "allocation" it was a reassertion of the rights of the tribes to "fish in common with" non-native people. This and similar statements should be clarified throughout the DEIS. 6
- Section 3.9 "Land and Shoreline Use" does not adequately state the management authority of the tribes that co-manage the resources found within W-237. Section 3.9.4.1 "Existing Conditions" (pg. 3-250) notes that the OCNMS, Olympic National Park, and 7

Response:

1. We agree that these types of ocean bottom disturbances constitute potential impacts. As described in Section 3.2.4.2 of the EIS/OEIS, these activities have been evaluated and found to have temporary effects on relatively small areas of habitat and, therefore, the overall impacts are considered minimal. As technological advances yield more environmentally-friendly test components, the Navy will consider use of these components to further minimize impacts.
2. NUWC Keyport's ongoing consultation with the Quinault Indian Nation will include discussion of lost fishing gear.
3. Washington Department of Fish and Wildlife is a state agency and was given opportunity to review and comment on the Draft EIS/OEIS (see comment S2).
4. Figure 3.2-6 has been revised as suggested.
5. The Final EIS/OEIS will include more recent data as appropriate.
6. Text has been revised accordingly.
7. Text has been revised to include the information provided about Tribal co-management.

T4 – Quinault Indian Nation *(page 3 of 3)*

USFWS as resource managers along the coastal areas. This is not correct. The coastal tribes co-manage the resources of the Olympic coast north of Grays Harbor with Washington Dept. of Fish and Wildlife (WDFW) and the agencies noted above. Tribal co-management jurisdiction extends to habitat as well as fisheries related resources. 7 (cont.)

- The Ocean-Related Industries section on Page 3-270 refers only to the non-tribal Coastal Commercial Dungeness Crab industry. The Quinault Nation is a commercial harvester of crab, salmon, sablefish, halibut, lingcod, rockfish and other species within the W-237-A area. Quinault currently fishes with 28 vessels based in Westport WA. The QIN harvested over 2 million pounds of crab for each of the last four crab seasons. Hundreds of thousands of pounds of sablefish and halibut are also harvested annually by Quinault. Naval activities in this area will have impact on these and other fisheries unless proper coordination of exercises and fisheries are maintained. 8
    - Quinault also commercially harvests razor clams on the beaches south of Pt. Grenville to Pt. Brown. These digs are conducted during low tides from August to mid-June each year. Subsistence digs for razor clams also occur during this time.
- Section 3.11.3.2 "Environmental Consequences" states for each alternative shore-based site that "proposed activities under Alternative(s) would not disrupt Tribal usual and accustomed fishing patterns at or around the QUTR Site." These statements are based on coordinating exercises and Quinault fishing openings. We remind the Navy that we are "place-based" and have nowhere else to go for our livelihoods and to exercise our treaty rights. Additionally our fisheries are seasonal and have discreet periods open for harvest. Careful coordination with Quinault is the only way that the DEIS statement noted above can be held true. Again we expect this to be carefully detailed in an MOU with Quinault so that any potential conflicts can be avoided. 9
- Quinault's concerns regarding implementation of an MOU to avoid conflicts should be noted in Chapter 4, "Cumulative Impacts" for Cultural Resources (pg 4-19) and Socioeconomics and Environmental Justice (pg 4-20) as well as any other applicable areas regarding the QUTR Site and cumulative impacts. 10

Sincerely,

Fawn Sharp
President, Quinault Indian Nation

Response:

8. NUWC Keyport will continue ongoing collaboration and consultation with the Quinault Indian Nation to facilitate cooperative use of marine areas.

9. NUWC Keyport will continue ongoing collaboration and consultation with the Quinault Indian Nation to facilitate cooperative use of marine areas.

10. NUWC Keyport will continue ongoing collaboration and consultation with the Quinault Indian Nation to discuss the development of a formal agreement.

    In lieu of an MOU, NUWC Keyport has added text to the mitigation sections for Cultural Resources to reflect communication protocol between the Nation and Tribes and NUWC Keyport.

T5 – Suquamish Tribe *(page 1 of 4)*

FISHERIES DEPARTMENT
360/598-3311
Fax 360/598-4666

THE SUQUAMISH TRIBE

P.O. Box 498, Suquamish, Washington 98392

November 14, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Ste 203
Silverdale, WA 98315-1101

Shaari Unger
Naval Undersea Warfare Engineering Center Keyport
610 Dowell Street
Keyport, WA 98345

Re: NAVSEA NUWC Keyport Range Complex Extension
Draft Environmental Impact Statement – September 2008

Dear Ms. Kler and Unger:

The Suquamish Tribe appreciates the U.S. Navy's efforts to provide the Tribe an overview of the above-referenced project during our meeting on October 22, 2008. This letter transmits the Suquamish Tribe's comments pertaining to the proposed Keyport Range Expansion project, which is located within the Tribe's Usual and Accustomed ("U & A") fishing grounds and stations. Please note that the only portion of the document reviewed was that which pertains to the Keyport Range site and not the DBRC or the QUTR sites.

Ethnographic and archaeological evidence demonstrates that the Suquamish people have lived, gathered food stuffs, ceremonial and spiritual items, and hunted and fished for thousands of years in the range expansion area (personal communication, Dennis Lewarch, 2008). The 1855 Treaty of Point Elliot outlined articles of agreement between the United States and the Suquamish Tribe. Under the articles of the treaty the Tribe ceded certain areas of its aboriginal lands to the United States and reserved for its use and occupation certain lands, rights and privileges and the United States assumed fiduciary obligations, including, but not limited to, legal and fiscal responsibilities to the Tribe.

An aboriginal right retained under the Treaty includes the immemorial custom and practice to hunt, fish, and gather within the usual and accustomed grounds and stations, which was the basis of the Tribe's source of food and culture. Treaty-reserved resources situated on and off the Port

Response:

T5 – Suquamish Tribe ***(page 2 of 4)***

Madison Indian Reservation include, but are not limited to, fishery resources situated within the Suquamish Tribe's adjudicated usual and accustomed (U and A) fishing area. The Suquamish Tribe U and A extends well beyond Reservation boundaries. The U and A fishing places of the Suquamish Tribe include marine waters of Puget Sound from the northern tip of Vashon Island to the Fraser River in Canada, including Haro and Rosario Straits, the streams draining into the western side of Puget Sound and also Hood Canal. The U and A of the Suquamish Tribe also extends west into Jefferson County, and south into Mason County. Kitsap County is within the Suquamish Tribe's U and A.

On February 12, 1974, U.S. District Court Judge Boldt ruled that treaty rights entitled Indian Tribes to half of the harvestable fish running in their traditional waters, a right which was later affirmed to include shellfish and other natural resources. The ruling established Washington State's federally recognized Indian Tribes as co-managers (with Washington Department of Fish and Wildlife) of fisheries resources within their usual and accustomed fishing areas. The Tribe currently enhances the Puget Sound fisheries for all—tribal, non-Indian commercial, and sports fishing—and has had strong support from groups enabling a quality enhancement fisheries program. The Tribe releases in excess of 5 million fish per year into the Puget Sound system. Beaches are also of critical cultural significance to the Tribe as many Tribal Members continue commercial, ceremonial and subsistence digging for shellfish. As a resource co-manager, the Suquamish Tribe is active in participating in the environmental review process for development within its U and A. The Tribe not only has the right to fish but also the right to preserve and maintain the resource. Thus, our standard for review is based on the protection and maintenance of resources as well as the Tribes right to fish and harvest.

The Tribe is pleased that the Navy is willing to engage in dialogue with the Tribe to discuss potential treaty fishing issues. As discussed at our October 22, 2008 meeting, the Tribe requires additional language in the DEIS that addresses the Navy's intention and process by which it will address treaty fishing access and avoid impacts to treaty fishing rights as well as cultural resources. This language, under separate heading other than cultural resources (Tribal Fishing and Uses for example), should include satisfactory measures for coordination/communication to avoid impacts to treaty fishing areas and/or activities. Items requiring coordination/communication include but are not limited to schedule/location of activities and location of any structures or potential hazards. An established process (including establishment of contact persons) for coordination/communication will minimize future conflicts and possible disputes between the Tribe and the Navy concerning conflicting uses within the area. 1

Additional general and specific comments on the DEIS are provided below.

General Comments

The Tribe would like to request a baseline environmental assessment/population survey be done in the area, so that any problems that are unforeseen can be addressed later if needed. The DEIS provides a list of potential species that may occur but this does not provide specific information that will show potential adverse affects to different populations. Some information is available in the Liberty Bay Nearshore Habitat Evaluation and Enhancement Project. This report has 2

Response:

1. NUWC Keyport has added text to the mitigation sections for Cultural Resources to reflect communication protocol between the Tribe and NUWC Keyport.
2. A new baseline survey is outside the scope of the EIS/OEIS and is not required because the data used in the Draft EIS/OEIS are sufficient to enable consideration of the impacts of the Navy's Proposed Action under NEPA and EO 12114. No site-specific construction or discharges are associated with the Proposed Action, and the proposed increase in activity is relatively small and spread over a large area, with only temporary effects at any given place and time. Based on consideration in the Draft EIS/OEIS, the Navy's effects, if any, would be essentially undetectable against the background of local and regional circumstances affecting water quality, habitats, and biotic communities. These other circumstances include fishing, other surrounding land and water uses, point and non-point source discharges, and regional climatic and oceanographic changes, all of which have strong effects on water quality and species' populations.

   The study referenced in the comment was reviewed and found to have site-specific sample data for many locations in Liberty Bay but to have little overlap with areas associated with the Proposed Action. Hence a detailed presentation of results from the study would not be appropriate.

T5 – Suquamish Tribe *(page 3 of 4)*

information regarding benthic invertebrates, beach seine data (fish species), and water quality (http://www.libertybayfoundation.com/content/final_report/finalreport.htm). The Tribe recommends the collection of CPUE (catch per unit effort) data on crab and shrimp as well as some additional beach seine data to supplement existing data. The Tribe and the Navy could partner on these efforts. 3

Will any type of explosives be tested within the Keyport range? 4

Specific Comments

Section 3.1.1 – Migratory Bird Treaty Act

All three range expansion sites lie within an area defined as the Pacific Flyway. The Pacific Flyway is an important migration corridor for a variety of bird species.

3.1.2.1

Great blue herons are omitted in the list of birds that utilize the site and need to be added. The stand of trees next to the lagoon, the lagoon itself as well as the Keyport shoreline is heavily utilized by great blue herons. 5

Section 3.2.1 – Acoustic Capabilities of Marine Invertebrates

The Navy identifies a data gap regarding the impacts/affects of acoustics on invertebrates. The Navy and the Tribe should look at potential partnering opportunities prior to testing to further investigate the response (or lack of) on marine invertebrates (shrimp and/or crab). 6

Section 3.2.2 – Keyport Range Site Existing Conditions (Marina Flora and Invertebrates)

The Liberty Bay Nearshore Habitat Evaluation provides an extensive list of benthic species that exist in Liberty Bay. The list is included in Table 16: Cumulative Benthic Invertebrate Species List for Liberty Bay.

Subtidal Benthic Invertebrates:
The last sentence of 2nd paragraph is not accurate. Dungeness crab occur south of Point Bolin as well as north and probably throughout the existing and proposed extended range area. Tribal fisherman have fished in the vicinity of the proposed range expansion. 7

Intertidal Benthic Invertebrates:
The species listed here are also found in subtidal areas (sea cucumber are found in intertidal areas but are mostly subtidal). 8

Response:

3. Since the Proposed Action is not anticipated to affect catch per unit effort or crab and shrimp populations, this study would be outside of the scope of the EIS/OEIS and would be more appropriately discussed in the context of fisheries management with the WDFW.
4. No explosive warheads are currently tested or planned for testing within the Keyport Range, DBRC, and QUTR sites.
5. Agree, great blue herons added to the list of common species in Section 3.1.2.1.
6. As discussed in the Draft EIS/OEIS, the best available scientific data support the conclusion that the Proposed Action would have insignificant acoustic impacts on invertebrates.

   NUWC Keyport will continue ongoing collaboration and consultation with the Suquamish Tribe to discuss future partnering opportunities.
7. Agree. Text and figure modified.
8. Agree. Description in text modified.

T5 – Suquamish Tribe *(page 4 of 4)*

Section 3.4.2.1 Keyport Range Site Existing Conditions (Fish)

Liberty Bay Nearshore Habitat Evaluation and Enhancement Project lists various fish species found in Liberty Bay beach seine activities. Chinook and chum are primarily seen in the spring with some coho, cutthroat and shiner perch dominating during summer. Other species captured include: pile perch, starry flounder, English sole and sculpin (mainly staghorn). Northern anchovies are observed in late fall and are a primary food source for Chinook.
Other sources of data regarding timing of juvenile fish migration include both the Sinclair Inlet juvenile salmon use beach seine data (WDFW) http://wdfw.wa.gov/fish/papers/ps_salmon/juv_sinclair01-02.pdf and the Bainbridge Island beach seine data http://www.engr.washington.edu/epp/psgb/2005psgb/2005proceedings/papers/B9_DORN.pdf. Sinclair shows largest numbers of chum March through July and largest numbers of coho and Chinook April through August. Bainbridge data indicates largest number of juvenile coho May through September (and again briefly in Nov) and largest numbers of Chinook April through October (and again briefly in December). As discussed during the meeting on October 22, 2008 the Tribe would like to review a copy of the BA when it is completed. Subsequent to our review we will provide additional comments on the potential effects of the proposal and may request additional consultation. Additional consultation may also be requested if the use or intensity of use changes within the Keyport range area. We appreciate the Navy taking the time to meet with us to go over project specifics and address initial concerns. 9

The Suquamish Tribe welcomes the opportunity to work with the Navy to develop a project that satisfies your goals as well as protects Tribal resources and harvest activities. I look forward to providing additional comments as this project progresses and more information is available. If you have questions regarding the comments above please don't hesitate to call 360-394-8447.

Sincerely,

Alison O'Sullivan
Biologist, Environmental Program

Response:

9. Information has been reviewed, and any relevant new or different information has been incorporated as applicable into the Final EIS/OEIS. In compliance with the ESA, the Biological Evaluation (BE) is strictly for Endangered Species Act consultation with cognizant regulatory agencies. Accordingly, the BE was only provided to USFWS and NMFS. NUWC Keyport will continue ongoing collaboration and consultation with the Suquamish Tribe to discuss natural resources.

F1 – MMC *(page 1 of 4)*

10/29/2008 16:49 FAX 301 504 0099 MARINE MAMMAL COMM. 002

MARINE MAMMAL COMMISSION
4340 EAST-WEST HIGHWAY, ROOM 700
BETHESDA, MD 20814-4447

29 October 2008

Navy Facilities Engineering Command, Northwest
Attn.: Mrs. Kimberly Kler (EIS/OEIS PM)
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Mrs. Kler:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS) for the Keyport Range Complex submitted by the U.S. Navy. The applicant is seeking comments on the potential environmental consequences of extending the operational areas of the Keyport Range Complex and increasing the average annual number of tests and testing days at two of the three range sites that make up the complex (Keyport Range site and Quinault Undersea Test Range).

The Commission also has reviewed the National Marine Fisheries Service's 8 July 2008 *Federal Register* notice announcing receipt of the Navy's application for an incidental harassment authorization under the Marine Mammal Protection Act for activities in the Keyport Range Complex. The Commission's 4 August 2008 letter to the Service (appended and thereby incorporated here) commented on the Navy's application, expressed a number of concerns regarding risks to marine mammals, and made a number of recommendations. Here, we highlight several key concerns and recommendations.

RECOMMENDATIONS

<u>The Marine Mammal Commission recommends</u> that the Navy—

- provide a comprehensive description of the risk estimation process used for the Keyport Range Complex, subject that process to independent review, explain any differences between the processes used at Keyport versus those used at other sites, and assess and report the significance of those differences with respect to estimating risks to marine mammals;
- work with the National Marine Fisheries Service to plan and conduct an independent assessment of the Navy's proposed monitoring and mitigation methods;
- incorporate in the DEIS a requirement to submit to the Service annual reports providing full documentation of methods, results, and interpretation pertaining to all monitoring and mitigation efforts, including dates and locations of operations and marine mammal sightings, and estimates of the amount and nature of potential takes of marine mammals; and 1
- modify the DEIS to include the need to halt activities that result in the serious injury or death of a marine mammal, determine the cause of the injury or death, assess the number of animals involved, and determine how the activity should be modified to avoid future injuries or deaths.

PRINTED ON RECYCLED PAPER

PHONE: (301) 504-0087
FAX: (301) 504-0099

Response:

1. See detailed responses below.

F1 – MMC *(page 2 of 4)*

Naval Facilities Engineering Command, Northwest
29 October 2008
Page 2

RATIONALE

Risk Estimation

With regard to marine mammals, the fundamental problem for the Navy is that its various operations pose unintentional but potentially significant risks. To provide a basis for judging the level and significance of those risks, the Navy has been attempting to develop risk estimation procedures. The Navy also has conducted or supported extensive research to collect data needed for the risk estimation process. All of these efforts are commendable, and the data collected will likely prove valuable for a number of purposes. Nonetheless, risk estimation is confounded by great uncertainty, particularly regarding marine mammals, their distribution and movement patterns, and their vulnerability to noise generated by the Navy's operations.

In its comments on previous DEISs, the Commission has pointed out that the risk estimation process is not adequately described. The Commission has requested and received a briefing on the Navy's risk estimation processes, but a great deal of uncertainty remains. Resolving this uncertainty is crucial if these processes are to be considered scientifically credible. Doing so will be particularly challenging because it appears to us that the Navy may be using different risk estimation procedures at different sites. We would expect that certain elements of risk estimation would change to take into account different operations, as well as changes in the local environment and the suite of marine mammals that may be affected. However, we also would expect the basics of the process to be the same or at least consistent. For the Keyport DEIS it is not clear that that is the case. For the risk estimation process to be considered scientifically credible, it must be repeatable, which means it must be described in sufficient detail that someone could undertake the same process and get the same results, and it must be peer-reviewed to ensure, to the extent possible, that the process is conceptually sound.

The Navy's explanation of risk estimation methods used for the Keyport Range Complex is the most detailed and complete to date. Still, uncertainty remains about those methods, and it is not clear, for example, if the Keyport methods are the same as those used for all other range complexes (e.g., Hawaii Range Complex) or whether they were only used for the Keyport Range Complex. For all of these reasons, the Marine Mammal Commission recommends that the Navy provide a comprehensive description of the risk estimation process used for the Keyport Range Complex, subject that process to independent review, explain any differences between the processes used at Keyport versus those used at other sites, and assess and report the significance of those differences with respect to estimating risks to marine mammals. 2

Monitoring and Mitigation

As in its previous DEISs, the Navy estimates the risks to marine mammals and then indicates that it can reduce those risks by implementing various monitoring and mitigation measures. The lowering of risk is based on the assumption that monitoring and mitigation measures are effective to a degree, and in some cases the effectiveness is apparent (e.g., scheduling activities during seasons when no marine mammals are present). However, the utility of most monitoring and

Response:

2. A description of the risk estimation process is provided in Draft EIS/OEIS Appendix C. The process is consistent with other Navy sea range EIS/OEIS documents and has been extensively reviewed by NMFS.

F1 – MMC *(page 3 of 4)*

10/29/2008 16:50 FAX 301 504 0099 MARINE MAMMAL COMM. 004

Naval Facilities Engineering Command, Northwest
29 October 2008
Page 3

mitigation measures used to reduce or eliminate risk to marine mammals is not known with certainty but is expected to be low—sometimes exceedingly so (e.g., visual surveys for beaked whales). Despite the uncertainty regarding their utility, the Navy continues to implement its measures as though they are sufficient to address the underlying concerns about risks to marine mammals. In the Commission's view, reliance on untested monitoring and mitigation measures is both misleading and unjustified. The Navy is capable of testing the effectiveness of these measures but to date has chosen not to do so. Failure to assess monitoring and mitigation measures is inconsistent with the Navy's stewardship responsibilities. To address this persistent problem, the Marine Mammal Commission recommends that the Navy work with the National Marine Fisheries Service to plan and conduct an independent assessment of the Navy's proposed monitoring and mitigation methods. Such an assessment will require considerable work, as the efficacy of these measures is likely to vary by species, oceanographic conditions, and a number of other variables. However, until such tests are conducted, the Commission does not believe that the Navy has a legitimate basis for making assumptions about the reliability of its monitoring and mitigation measures. 3

Reporting

The DEIS, like the letter of authorization application that preceded it, stated that "[p]rocedures for reporting marine mammal sightings on the Keyport Range complex shall be promulgated, and sightings shall be entered into the Range Operating System and forwarded to NOAA/NMML Platforms of Opportunity Program." However, we were not able to find in the DEIS the specific reporting protocol described in the IHA request. Post-event reports have great potential value to the Navy, the Service, and all interested parties. Those reports help describe whether and what kind of marine mammals were detected during exercises, what measures the Navy took to avoid significant adverse effects, and whether those measures were effective. Therefore, the Marine Mammal Commission recommends that the Navy incorporate in the DEIS a requirement to submit to the Service annual reports providing full documentation of methods, results, and interpretation pertaining to all monitoring and mitigation efforts, including dates and locations of operations and marine mammal sightings, and estimates of the amount and nature of potential takes of marine mammals. 4

Lethal Taking/Serious Injury

Based on its analyses in the DEIS, the Navy has chosen not to request authorization to take animals by Level A harassment. In the absence of such a request, the incidental take authorization, if issued, should require suspension of the associated Navy activity if a marine mammal is seriously injured or killed and the injury or death could be associated with the activity. Therefore, the Marine Mammal Commission recommends that the Navy modify the DEIS to include the need to halt activities that result in the serious injury or death of a marine mammal, determine the cause of the injury or death, assess the number of animals involved, and determine how the activity should be modified to avoid future injuries or deaths. It should be clear to all interested parties that more information is required to understand the potential effects of sound on marine mammals, and full investigation of such incidents is essential to provide more complete information on potential effects. 5

Response:

3. NMFS is a cooperating agency on this Draft EIS/OEIS. The mitigation and monitoring process is being developed pending completion of the LOA process.
4. Annual reporting of this type is a requirement for the MMPA and ESA consultation process. Results of those consultations will be released to the public.
5. As a matter of standard practice and Navy policy, NUWC Keyport would immediately curtail any activity implicated in a previously unauthorized harm to a marine mammal.

F1 – MMC *(page 4 of 4)*

Naval Facilities Engineering Command, Northwest
29 October 2008
Page 4

Please contact me if you have questions about the Commission's recommendations.

Sincerely,

for

Timothy J. Ragen, Ph.D.
Executive Director

Enclosure

Response:

F2 – Olympic Coast National Marine Sanctuary *(page 1 of 3)*

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Olympic Coast National Marine Sanctuary
115 East Railroad Avenue, Suite 301
Port Angeles, WA 98362-2925

October 27, 2008

Ms. Kimberly Kler
Naval Facilities Command
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Ms. Kler:

Thank you for the opportunity to review the Draft NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS dated September 2008 (Keyport DEIS). The NOAA Office of National Marine Sanctuaries (ONMS) acknowledges and appreciates the substantial effort the Navy has made with this DEIS to articulate the proposed activities, identify alternatives, and analyze potential environmental impacts. We have identified some areas of deficiency in the analysis which are being transmitted to the Navy via NOAA Fisheries. In addition, because the proposed expansion of the Quinault Underwater Testing Range (QUTR), and Navy activities therein, would cover a significantly greater area within the Olympic Coast National Marine Sanctuary (OCNMS or sanctuary) than is presently the case, the ONMS has some particular concerns about the relationship between the proposed QUTR expansion and OCNMS regulations and the National Marine Sanctuaries Act.

As noted on page 1-30 of the Keyport DEIS, the QUTR instrumented area, special use airspace W-237A and activities therein were described in NOAA's 1993 Environmental Impact Statement (EIS) for the OCNMS. The NOAA EIS was the foundation for a management plan, regulations, and the establishment of the OCNMS in 1993-1994.

OCNMS regulations at 15 CFR §922.152 (d)(1) specify that "All Department of Defense military activities shall be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources and qualities." Furthermore, §922.152(d)(1)(i) notes that prohibitions in §922.152(a)(2) through (7) do not apply to activities associated with the Quinault Range, including the in-water testing of non-explosive torpedoes.

1

It is our view that the exemptions in OCNMS regulations for Department of Defense activities would not apply to the expanded QUTR, including the proposed surf zone, as the present OCNMS regulations were based on Department of Defense operations areas and activities as described in NOAA's 1993 EIS. The regulations, specifically 15 CFR §922.152 (d)(ii), allow that new activities may be exempted by the Director of the Office

Response:

1. The Navy does not agree that consultation is required for the Proposed Action. The Proposed Action is consistent with the existing military exemptions as designated in the Federal Register notice that promulgated the establishment of the sanctuary. This includes anti-submarine warfare activities.

F2 – Olympic Coast National Marine Sanctuary *(page 2 of 3)*

of National Marine Sanctuaries only after consultation between the Director and the Department of Defense.

In addition to this regulatory requirement to consult, section 304(d) of the National Marine Sanctuaries Act (16 U.S.C. 1434(d)) requires Federal agencies to consult with the Secretary of Commerce (delegated to the ONMS) prior to taking any action that is likely to destroy, cause the loss of, or injure any sanctuary resource. We believe that further consultations on the proposed QUTR expansion, activities to be conducted therein, and the manner in which they will be conducted will also satisfy the 304(d) requirement, thereby allowing both consultation requirements to be met in a single process. 1 (cont.)

Our primary concern is that, under all alternatives in the Keyport DEIS, the QUTR would be increased from 48.3 square nautical miles to approximately 1,840 square nautical miles and would include an extension through the surf zone. This represents an expansion to an area approximately 40 times the size of the existing area used by the Navy for testing operations within the sanctuary. This expansion incorporates a variety of habitat types and creates the potential for impacts to habitats and resources that do not occur in the current QUTR. The rationale for expansion of the QUTR to coincide with the entire W-237A area is not well developed in the DEIS; because of this, the ONMS believes that the Navy's objectives could be achieved with a smaller expansion of the QUTR that better considers the size necessary to fulfill the objective of different habitat types, particularly if the southern portion of W-237A is considered. 2

In addition, three action alternatives are outlined for the QUTR, two with surf zones in the sanctuary (Alternatives 1 and 2) and one outside the sanctuary (Alternative 3). The ONMS has concerns about the accidental loss and abandonment of equipment, potential contaminant impacts (from fuels or batteries, for example), and potential disturbance or loss of both living and non-living OCNMS benthic resources that could result from testing in these high energy environments. Therefore, we would like to discuss with the Navy the possibility of pursuing an alternative that includes both a smaller expansion of the QUTR and a surf zone located outside OCNMS boundaries, in order to eliminate adverse impacts on sanctuary resources in the intertidal area. 3

I believe that these issues can be addressed in a manner that meets the goals and objectives of both the Navy and the ONMS. I recommend that, at the earliest opportunity, the Navy initiate consultation with us to discuss ways the Navy can address these concerns, including improvements that can be made to the Navy's alternatives and the development of measures necessary to protect sanctuary resources to the maximum extent practicable. Please contact me at your convenience to set up further discussions and continue the consultation process.

2

Response:

2. See response to comment F2-3.
3. A smaller alternative would not meet the purpose and need for the Proposed Action, nor would it decrease the potential for impact from expended materials (because the concentration of such materials would be greater).

   The EIS/OEIS concluded that the disturbance to surf zone habitats and species would be temporary and of limited extent. These impacts are minimal and essentially the same at all three alternative surf zone sites. As the comment states, the surf zone is a high energy environment where natural disturbances greatly exceed those of the proposed activities.

F2 – Olympic Coast National Marine Sanctuary *(page 3 of 3)*	
I can be reached by phone at 360-457-6622 ext. 11 or by email at carol.bernthal@noaa.gov. Sincerely, Carol Bernthal Carol Bernthal Superintendent 3	**Response:**

F3 – USACE, Seattle District *(page 1 of 1)*

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Regulatory Branch

OCT 10 2008

Ms. Kimberly Kler
Naval Facilities Engineering Command Northwest
Code EVI.KK
1101 Tautog Circle Suite 203
Silverdale, Washington 98315-1101

Reference: NWS-2008-1278-NO
September 2008 DEIS
Keyport Firing Range Complex

Dear Ms. Kler:

We recently received a copy of the September 2008 Draft Environmental Impact Statement (DEIS) for the NAVSEA NUWC Keyport Range Complex Extension. The Keyport Range Complex consists of the Keyport Range Site, Dabob Bay Range Complex, and Quinault Underwater Tracking Range Site. It is our understanding this proposal is only an increase in the size of the testing ranges at Keyport Range Complex and no structures, restrictions to navigation, fill, or placement of permanent scientific instruments will occur. The proposed action as stated above does not require a Department of the Army (DA) permit. However, if the proposed work changes and a permit is required for any work the Navy eventually proposes to do, Ms. Vicky Didenhover will be the project manager assigned to the action. 1

Please contact me at (206)764-6915 or Ms. Didenhover at (206) 764-3311 or email vicky.i.didenhover@usace.army.mil) if you have any questions regarding the DA permitting authorities and processes.

Sincerely,

Michelle Walker, Chief
Regulatory Branch

Response:

1. No action proposed or required.

F4 – USDI-NPS *(page 1 of 3)*

United States Department of the Interior
NATIONAL PARK SERVICE
Olympic National Park
600 East Park Avenue
Port Angeles, Washington 98362-6798

IN REPLY REFER TO:

L7615 (OLYM-S)

October 28, 2008

Ms. Kimberly Kler
Environmental Planner,
Naval Facilities Engineering Command
1101 Tautogg Circle, Suite 203
Silverdale, Washington 98315-1101

Dear Ms. Kler:

This letter follows the phone call you received from Dr. Steve Fradkin, requesting an extension for Olympic National Park to provide comments on the NAVSEA NUWC Keyport Range Complex Extension draft environmental impact statement (DEIS). We request an extension of two weeks until November 17 to provide comments. In order to provide fully considered comments on the DEIS – particularly the sections related to the Quinault Underwater Tracking Range that affect Olympic National Park – we need this brief extension of the deadline. 1

I appreciate your consideration in this matter.

Sincerely,

Dupank McBride
for Karen Gustin
Superintendent

Response:

1. In order for the Navy to meet the required permit timelines with NMFS to continue activities in the NAVSEA NUWC Keyport Range Complex, the public comment period must remain at 45 days.

   The 45-day public comment period provided sufficient time for all commenters to review and comment on the Draft EIS/OEIS.

F4 – USDI-NPS *(page 2 of 3)*

11/12/2008 WED 11:33 FAX 360 565 3015 Olympic National Park HQ ☑002/003

United States Department of the Interior

NATIONAL PARK SERVICE
Olympic National Park
600 East Park Avenue
Port Angeles, Washington 98362-6798

IN REPLY REFER TO:
L7615 (OLYM-NRM)

November 10, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, Washington 98315-1101

Dear Kimberly:

The purpose of this letter is to provide comment from Olympic National Park on the U.S. Navy's NAVSEA Keyport Range Complex Extension DEIS (DEIS), specifically the portion of the DEIS that pertains to the proposed expansion of the Quinault Underwater Tracking Range (QUTR).

Most of the QUTR portion of the DEIS addresses areas inside the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS) and outside of Olympic National Park. The integrity of these areas are of great interest to the park due to the tight ecological linkage between nearshore and intertidal ecosystems. The park and the OCNMS have an overlapping boundary in the intertidal zone. We support the DEIS comments provided by the OCNMS Advisory Council in their comment letter of October 22, 2008, especially the support for the "No Action" alternative. 2

One area of particular concern to Olympic National Park is the proposed expansion of the QUTR site in Alternative 1 into the Kalaloch surf zone and intertidal area. The Kalaloch shoreline is within the national park where the park's seaward boundary is the extreme low water mark, an area that includes both the intertidal surf zone and the upland beach area. The Kalaloch surf zone area identified in Figure 3.2-6 of the DEIS is adjacent to the Kalaloch campground. Kalaloch beach is the most accessible part of the park shoreline and receives heavy year-round visitation by the public on the shoreline and at the campground. Kalaloch beach is rich with natural resources, including important razor clam beds that support both recreational and tribal subsistence harvest. As the manager of these natural resources, the National Park Service has special trust responsibilities to the treaty tribes to ensure their integrity. The Kalaloch shoreline is also used extensively by sea otters, river otters, and a host of migrant bird species. 3

Response:

2. The No-Action Alternative does not meet the purpose and need and support NUWC Keyport mission requirements.
3. The No-Action Alternative would allow for continued cabling maintenance and minimal surf zone activity at Kalaloch.

F4 – USDI-NPS *(page 3 of 3)*

11/12/2008 WED 11:33 FAX 360 565 3015 Olympic National Park HQ 003/003

The activities listed within Table 2-6 for the QUTR surf zone include, amongst others, unmanned undersea vessel activities (up to 40 per year), electro/chemical propulsion system tests (30/year), mine detection activities (10/year), deployment of acoustic and non-acoustic sensors, and aircraft activities (20/year). These activities are incompatible with the natural resource and recreational values managed for by the National Park Service. As such, Olympic National Park advocates a location of the QUTR surf-zone site outside of the park, and preferably outside of the OCNMS, as proposed in Alternative 3. Given the tight ecological linkage between the nearshore OCNMS and the park shoreline, Olympic National Park endorses the No-Action Alternative of the DEIS. 4

In addition, Figure 3.2-6 of the DEIS is inaccurate and minimizes the importance of park natural resources in its depiction of the distribution of dungeness crab and razor clams along the Kalaloch shoreline. Dungeness crab and razor clams occur and are abundant *throughout* the Kalaloch region, especially in the proposed QUTR Alternative 1 area of the Kalaloch shoreline. Figure 3.2-6 depicts the absence of both organisms in this area and is incorrect. 5

We thank you for the opportunity to comment on the DEIS and look forward to tracking the QUTR range extension process.

Sincerely,

Karen Gustin
Superintendent

Response:

4. Potential impacts on recreation were considered in Draft EIS/OEIS Section 3.8. Minimal, if any, conflicts with recreation are anticipated due to the temporary localized nature of RDT&E activities.

5. This figure has been modified.

F5 – USEPA *(page 1 of 3)*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

OCT 27 2008

Reply To: EPTA - 088 Ref: 03-062-DOD

Ms. Kimberly Kler
EIS/OEIS Project Manager
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Ms. Kler:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (EIS) for the proposed **Naval Sea Systems Command (NAVSEA), Naval Undersea Warfare Center (NUWC), and Keyport Complex Extension (CEQ no.** 20080346) in Gray Harbor, Jefferson, Kitsap and Mason Counties, WA. Our review was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309 directs EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Under our policies and procedures, we evaluate the document's adequacy in meeting NEPA requirements.

The draft EIS evaluates the potential environmental impacts associated with current and proposed research, development, testing, and evaluation (RDT&E) activities scheduled and coordinated by Naval Undersea Warfare Center (NUWC) Keyport at the Naval Sea Systems Command (NAVSEA) NUWC Keyport Range Complex in WA. The proposed action includes an extension of the operational areas and an increase in the average annual number of tests and days of testing at three range sites that comprise the Range Complex. The three range sites include two in Puget Sound (Keyport and Dabob Bay Range Complex (DBRC)) and one off the west coast of the Olympic Penninsula (Quinault Underwater Tracking (QUTR)). The Navy developed and analyzed independent sets of alternatives for each range site. In addition to the No Action Alternative, they include one alternative at the Keyport range site, two at DBRC, and three at QUTR. A Preferred Alternative was also identified for each range site.

EPA is concerned about potential adverse impacts of an expanded QUTR range on protected resources in the Olympic Coast National Marine Sanctuary. The proposed expansion would be 38 times larger than the existing range area and the preferred alternative would include a surf zone landing area inside the sanctuary. Proposed activities in this area may disturb benthic habitat and biota, but the DEIS does not give enough information to evaluate the extent or magnitude of this disturbance. We recommend that the final EIS include more information about the anticipated disturbance to benthic organisms and how impacts will be avoided and mitigated. We also recommend consideration of an alternative smaller in area with a surf zone landing area outside the sanctuary. 1

Response:

1. It should be recognized that Navy vessels and aircraft operate in W-237A/PACNW OPAREA, and that NUWC Keyport activities represent a small portion of Navy activities in these waters and airspace. These activities have been and will continue to be subject to NEPA and EO 12114 as applicable. The proposed extension actually represents a small increase in the number of certain types of activities (Draft EIS/OEIS Table 2-6), but allows these activities to be conducted in more varied, realistic environments. Having a smaller area designated for surf zone activities would not reduce the area of disturbance, which is very small in any case, but it would reduce the flexibility to avoid conflicts or other concerns that may exist on a particular stretch of the beach. Disturbance footprints would be very small, e.g. Figure 1-7 in the Draft EIS/OEIS. Also refer to response to comment F2-3.

F5 – USEPA *(page 2 of 3)*

2

EPA is also concerned about potential adverse impacts to water quality and critical habitat in Puget Sound, particularly near the mouths of the Duckabush and Hamma Hamma Rivers. The proposed boundaries of the DBRC range extend southwest into Hood Canal close to shore in these sensitive areas. As an active member of the Puget Sound Partnership, EPA strongly supports the strategic priorities that have been established to protect and restore this important resource. Ecosystem processes in sensitive areas are key areas to protect and restore. We recommend consideration of an alternative that avoids more of the critical habitat areas, particularly near the mouths of the Duckabush and Hamma Hamma Rivers. 2

Based on our review, we have assigned an EC-2 (Environmental Concerns, insufficient information) rating to the draft EIS. This rating and a summary of our comments will be published in the *Federal Register*. For your reference, a copy of our rating system used in conducting our review is enclosed.

If you have questions or would like to discuss these comments, please contact me at (206) 553-1601. Thank you for the opportunity to provide these comments.

Sincerely,

Christine B. Reichgott

Christine B. Reichgott, Manager
NEPA Review Unit

Enclosures

Response:

2. As the EIS/OEIS indicates, the Proposed Action would not interfere with ecosystem processes or adversely affect water quality and critical habitat. Hence reducing the areas available would not be justified as mitigation.

F5 – USEPA ***(page 3 of 3)***

U.S. Environmental Protection Agency Rating System for
Draft Environmental Impact Statements
Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Response:

S1 – DOE *(page 1 of 2)*

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 27, 2008

Ms. Kimberly Kler, Environmental Planner
Naval Facilities Engineering
Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Ms. Kler:

Thank you for the opportunity to comment on the draft environmental impact statement for the Navsea NUWC Keyport Range Complex Extension project, located in Grays Harbor County, Jefferson County, Kitsap County and Mason County. The Department of Ecology (Ecology) reviewed the information provided and has the following comment(s):

HAZARDOUS WASTE & TOXICS REDUCTION: Christiana Figueroa-Kaminsky (360) 407-6342)

The submitted DEIS does not cover issues pertaining to the management of dangerous wastes generated at the facility or in the test areas. Dangerous wastes may include oil-contaminated wastewaters (such as bilge water), spent materials and unusable equipment containing hazardous substances, universal wastes such as lead acid batteries, and any other potential wastes from the weapon systems, vessels or testing instrumentation entering the water column. All dangerous wastes must be managed in accordance with WAC 173-303. 1

SPILLS PREVENTION PREPAREDNESS RESPONSE: Diane Butorac (360) 407-6238

The DEIS says the Oil and Hazardous Substance Release Contingency and Response Plan (NUWC Keyport 2002) will be used to ensure oil and hazardous material spills and accidental discharges are kept to a minimum, however, this plan is designed to respond to a spill, not prevent one. A prevention plan specific to operations in each area should be developed to fully plan for spills. It should include specific prevention measures that will be put in place to prevent any oil or hazardous materials from entering the water. (Sections 3.6.1.1, 3.6.2.1 and 3.6.3.1) 2

The DEIS States occasional accidental discharges of materials (e.g., leak of oils, fuel from test components) do occur; however, such discharges are minimal and disperse over large areas due to ocean mixing. This does not adhere to the Navy policy noted. Navy OPNAVINST 5090.1C Section 12-3.5 states discharge "Includes any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil or an actual or substantial threat of any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil." Section 12-3.31 defines release as "Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing, including an actual or substantial threat of any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing, into the environment, of any hazardous substance (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any HS or pollutant or contaminant)." Section 12-3.37 defines a Spill to "include both releases of hazardous substances and discharges of oil." 3

OPNAVINST 5090.1C, Section 22-5.3 further states ships "will comply with applicable oil discharge regulations and the operational requirements contained in this chapter. Compliance will ensure that Navy ships operate with due regard to all recognized standards for environmental protection, while not detracting unreasonably from the Navy's mission to protect the national security interests of the United States. Commanding officers will make every effort to minimize oil spill risks across all navy operations through application of aggressive spill prevention measures. All ships should strive

Response:

1. The existing and proposed RDT&E activities are not a source of dangerous waste as defined in the applicable statute. Accidental and unavoidable losses of expendable materials do not constitute dangerous waste. Shipboard or shore-based dangerous and universal waste generated during ranging activities are managed in accordance with the waste program at the associated WAC 173-303 permitted facility to which the waste is pier-side transferred. The primary facilities for the NAVSEA NUWC Keyport Range Complex include NUWC Keyport and Naval Base Kitsap Bangor. Bilge and sanitary wastewater are only transferred pier side.
2. Preventative measures are part of the plan.
3. Spills and leaks are not allowed, and must be addressed immediately upon discovery. The Draft EIS/OEIS only recognized the possibility of accidental releases. As the comment notes, such occurrences and their consequences must be, and are, minimized.

S1 – DOE *(page 2 of 2)*

October 27, 2008
Page 2

to continuously reduce oil spills through proper preparation, rigid adherence to published procedures, and application of the full measure of command attention to any operation involving movement of oil and oily waste. Preventing oil spills is one of the Navy's top priorities." Oil spills, hazardous material releases of materials such as Otto II fuel must be handled as a spill, with the appropriate planning and training. Operations must have defined procedures to prevent oil spills of any amount. (Sections 3.6.1.2, 3.6.2.2 and 3.6.3.1) 3 (cont.)

The COMNAVREG NW Oil and Hazardous Substance Integrated Contingency Plan (CNRNW ICP) includes NUWC Keyport. The ICP is only applicable to incidents that occur within 12 nm of the assigned shorelines and the NRNW area of operations. The QUTR is not included in this area. A separate plan or annex must be developed to include this area. (Section 3.6.3.1)

The vast majority of the Navy response assets identified in the CNRNW ICP are located within Puget Sound, not on the outer coast. For this reason, response equipment and personnel would be greatly delayed in the case of a spill in the QUTR area. Resources to respond to a spill or release must be identified, pre-positioned, and training conducted to cover this gap. (Section 3.6.3.1) 4

For a spill, the DEIS states "impacts are minimal because the spills are small, ocean currents dilute hazardous constituent concentrations, and it is extremely unlikely that the same volume of water is affected by more than one occurrence. Even if two accidental discharges were to occur simultaneously, it is unlikely that the two events affect the same volume of water." The CNRNW ICP states environmental sensitivities must be used to determine characterization of a spill. Sensitive areas are one of the factors to be considered for this. The DEIS incorrectly states that impacts are minimal due to the small size and will be diluted, without considering the environmental sensitivities. In addition, the DEIS does not provide any capacities of oil or hazardous substances that would be involved in the operations which makes it impossible to determine a spill as "small" beforehand. (Section 3.6.3.1)

The ICP sets the goal of preventing pollution incidents "through effective planning, training, and operational risk management. The DEIS does not address this goal or propose any additional planning, training, or resource deployment for the operations for QUTR. No mitigation measures are included in the DEIS.

The ICP also sets a goal of conducting "thorough contingency planning efforts through a focused program of preparation and cooperation." There are no new efforts identified to address planning for operations in the QUTR. (Section 3.6.3.3)

Ecology's comments are based upon information provided by the lead agency. As such, they do not constitute an exhaustive list of the various authorizations that must be obtained or legal requirements that must be fulfilled in order to carry out the proposed action.

If you have any questions or would like to respond to these comments please contact the appropriate reviewing staff listed above.

Department of Ecology
Southwest Regional Office

(SM: 08-6951)

cc: Diane Butorac, SPPR
Christiana Figueroa-Kaminsky, HWTRS

Response:

4. Spills on the open ocean are addressed in OPNAVINST 5090.1C Ch. 22. New measures are not warranted. The Draft EIS/OEIS correctly stated the relatively low risk of a spill that would have significant consequences. The proposed and alternative actions do not include vessels carrying large quantities of oil; these are small to mid-size naval vessels. Under naval regulations, each vessel carries spill response equipment and has a shipboard spill contingency plan including protocols for contacting and obtaining assistance from Navy, Coast Guard, or State organizations as may be warranted. For spills outside 12 nm that exceed the craft crew's response capability, the Supervisor of Salvage and Diving (SUPSALV) and/or a national response organization provides oil spill response. SUPSALV are technical experts providing a complete spill response capability including spill management, equipment operations, on-site training of local labor, recovered oil storage and full logistics support.

S2 – Washington Department of Fish and Wildlife *(page 1 of 1)*

From: Steve Thiesfeld [mailto:thiesslt@DFW.WA.GOV]
Sent: Monday, October 27, 2008 16:41
To: KYPT_WA_Public Affairs Office
Cc: Jeromy Jording; John Long; Teresa Scott
Subject: EIS Comments Form Submission

Comments: Thank you for the opportunity to provide comments. The Washington Department of Fish and Wildlife (WDFW) manages both recreational and commercial salmon fisheries in Hood Canal. These fisheries are occasionally constrained by activities at the Dabob Range Complex Site. Commercial salmon seasons are conducted in a very short time frame during mid-October through late November. Given the short nature of this season, we view all of this time frame as key days for the commercial sector. Recreational fisheries in this area are conducted 1 from mid-August through early April. Additional recreational fisheries may be scheduled during the summer in the future. Weekends and holidays are key days for recreational fisheries. While the proposed expansion would have little impact on salmon fisheries most of the time, the range expansion does have a potential to increase those impacts. WDFW requests that the Navy examine ways to minimize additional impacts to those seasons through closer coordination with WDFW regarding our fishing schedules, and increased planning and preparation by the Navy to avoid key fishing times.Additional comments may be forthcoming from other WDFW staff.Steve ThiesfeldPuget Sound Salmon Manager

Name: Steve Thiesfeld

Address: 600 Capitol Way North, Olympia WA 98501

Please include me on your mailing list.

Please send me a CD Copy of the final EIS/OEIS.Thank you.

1

Response:

1. A description of NUWC Keyport activities is currently provided via e-mail to WDFW staff. WDFW also informs NUWC Keyport of fisheries seasons and associated key fishing times.

L1 – Port of Port Townsend *(page 1 of 2)*	
(letter below)	**Response:**

PORT OF PORT TOWNSEND
P.O. Box 1180 • Port Townsend, Washington 98368-4624
Administration: (360) 385-0656 Operations: (360) 385-2355 Fax: (360) 385-3988

November 4, 2008

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Subject: NAVSEA NUWC Keyport Range Extension EIS/OEIS

Dear Mrs. Kler,

We are aware that the deadline has come and gone for comments on the above referenced EIS, however, we would still like to submit comments from the Port of Port Townsend Commissioners which were signed on October 23, 2008. This was signed at the Port Commission meeting and afterwards was accidentally placed in a folder where it was just discovered today. So for what it's worth, we appreciate your taking the time to read these comments.

Sincerely,

Sue Nelson
Administrative Assistant

e-mail: info@portofpt.com website: www.portofpt.com

L1 – Port of Port Townsend ***(page 2 of 2)***

PORT OF PORT TOWNSEND

P.O. Box 1180 • Port Townsend, Washington 98368-4624

Administration: (360) 385-0656 Operations: (360) 385-2355 Fax: (360) 385-3988

October 23, 2008

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Subject: NAVSEA NUWC Keyport Range Extension EIS/OEIS

Dear Mrs. Kler,

Thank you for the opportunity to provide comments on the above referenced Range Extension EIS. The Port of Port Townsend is a county-wide municipal government providing marina, boat launch, shipyard and airport facilities though out Jefferson County, Washington. As the Port Commission we have attended one of your public hearings and have studied the written material concerning the range extension.

While we do support the Navy's mission, we also have concerns about the extension in the Hood Canal. We operate a full service marina within Quilcene Bay. We understand that during your operations, surface vessel traffic will be restricted for various lengths of time with little notice. The local economics of commercial businesses, fishermen, and recreational boaters are negatively impacted by such operations. We have also heard the extension to the south will have similar impacts on the private marina, Pleasant Harbor, located in Brinnon, Washington. 1

We would like to discuss the ability to have sufficient prior notice or be assured the days of operation would be restricted to certain days of the week so our local boating interest would be able to adjust and carry on their business with minimal impact. 2

We want to thank you again for this opportunity to provide comments. Our Executive Director, Larry Crockett, will be contacting you to discuss this topic further. If you any questions, please contact him directly at (360) 385-0656.

Sincerely,

David H. Thompson, President

John N. Collins, Secretary

Herbert F. Beck, Vice President

e-mail: info@portofpt.com website: www.portofpt.com

Response:

1. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

2. Access would remain open and no economic impacts are anticipated. See response to L1-1 above and Section 3.11 (Socioeconomics and Environmental Justice) of the EIS/OEIS.

O1 – NRDC ***(page 1 of 42)***

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Regular Mail

October 27, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101
Phone: (360) 396-0927

Re: Draft Overseas Environmental Impact Statement/ Environmental Impact Statement for the NAVSEA NUWC Keyport Range Complex Extension

Dear Ms. Kler:

On behalf of the Natural Resources Defense Council ("NRDC"), Friends of the Earth, the International Fund for Animal Welfare, People for Puget Sound, Beam Reach Marine Science and Sustainability School, Cetacean Society International, League for Coastal Protection, Ocean Futures Society, Jean-Michel Cousteau, Val Veirs (President of the Board, The Whale Museum) and Dr. David Bain, and our millions of members and activists, we are writing to submit comments on the Navy's Draft Overseas Environmental Impact Statement / Environmental Impact Statement ("DEIS") for the proposed NAVSEA NUWC Keyport Range Complex Extension.[1]

At the outset we must note that the Navy afforded the public *only 45 days* to submit comments on the over 700 page DEIS. Notice of the comment period was published in the Federal Register on September 12, 2008. See 73 Fed. Reg. 53002 (Sept. 12, 2008). On the same day, the Navy released the latest DEIS for its planned development of an Undersea Warfare Training Range off the southeast coast of the United States, as well as a DEIS for sonar and other naval training exercises in the Cherry Point Operating Area off the coast of North Carolina. See 73 Fed. Reg. 52972, 52969 (Sept. 12, 2008). Although the DEISs were over 1,000 and 700 pages long respectively, the Navy once again limited its comment period to only 45 days. In light of the simultaneous issuance 1

[1] NRDC is aware that comments are being submitted independently by a substantial number of government agencies, individual scientists, environmental organizations, and the public. All of these comments are hereby incorporated by reference. The comments that follow do not constitute a waiver of any factual or legal issue raised by any of these organizations or individuals and not specifically discussed herein.

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Response:

1. The Navy met the legal requirement for 45 day public review.

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of related documents, the dense information provided by the Navy in justifying its plans, and the extensive range of activity proposed, NRDC requested an extension of at least 45 days to submit written comments. See enclosed NRDC extension request letter dated Oct. 22, 2008. The Navy never responded to our Keyport Range Complx extension request, and arbitrarily and capriciously denied our other extension requests via a phone message on October 23, 2008. Given the extraordinarily short time the Navy has allowed us to respond, this letter reflects our best effort to meaningfully comment. 1 (cont.)

We must also object to the Navy's piecemealing of expansion projects in the Pacific Northwest. On July 31, 2007, the U.S. Navy announced its intent to prepare an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for expansion of its Northwest Training Range Complex ("NWTRC"). See 72 Fed. Reg. 41712 (July 31, 2007). Several organizations, including NRDC, objected to the Navy's attempt to improperly segment the NWTRC expansion project and Keyport Range Complex Extension project because these two projects are connected to one another both geographically and operationally. Indeed, both of the action alternatives briefly previewed in the Federal Register for the NWTRC EIS/OEIS involve utilizing, upgrading, or expanding existing ranges, including those covered by the Keyport Range Complex Extension. The National Environmental Policy Act, 42 U.S.C. 4321 et seq., prohibits the Navy from segmenting these types of connected actions in different analyses and requires consideration of the impacts of such connected actions together in one EIS that comprehensively considers environmental effects. 40 C.F.R. § 1508.25(a)(1) (ii), (iii); id. § 1502.4(a). 2

For the reasons above and as discussed in detail below, we believe that the DEIS fails to meet the environmental review standards prescribed by the National Environmental Policy Act ("NEPA"), 42 U.S.C. 4321 et seq. Accordingly, if the Navy intends to pursue this extension project, we believe that the document must be thoroughly revised and reissued.

The Keyport Range Complex is composed of three distinct ranges: (1) the Keyport Range site, (2) the Dabob Bay Range Complex ("DBRC") site, and (3) the Quinault Underwater Tracking Range ("QUTR") site. The proposed extension would expand each of the three range sites, including a 1791.5 square nautical expansion of the QUTR site. The QUTR site lies within the Olympic Coast National Marine Sanctuary, a region of extraordinary biological diversity that provides habitat or migratory area for 29 species of marine mammals, including eight threatened or endangered species of whales, otters and pinnipeds. Of particular concern is the overlap of the proposed Keyport Range Complex Extension with habitat for three ecotypes of killer whales, including the highly endangered Southern Resident population of killer whales. DEIS at 1-9, 3-147.[2] Despite extensive public comments for inclusion of the Olympic Coast

[2] See also Oleson, E.M., J.A. Hildebrand, J, Calambokidis, G, Schorr, and E. Falcone, 2006 Progress Report on Acoustic and Visual Monitoring for Cetaceans along the Outer Washington Coast, Report

Response:

2. We disagree. The two actions, although overlapping, involve very different activities, Fleet training on the NWTRC and RDT&E on the NAVSEA NUWC Keyport Range Complex, respectively. Neither action depends on the other. The Navy is ensuring NEPA and EO 12114 compliance for both actions. NUWC Keyport activities will be evaluated in the cumulative impacts section of the NWTRC EIS/OEIS.

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National Marine Sanctuary in the designation of critical habitat of the Southern Resident Community, NMFS chose to just list the internal waters of Puget Sound notwithstanding regular sitings off the Olympic Coast during winter months. See 71 Fed. Reg. 69054, 69057 (Nov. 29, 2006). The protection of the whales' winter habitat is particularly important in that abundance of their salmonid prey is lowest when calves are most commonly born and females are incurring the caloric stress of lactation.

The proposed Keyport Range Complex Extension ("Extension") poses significant risks to wildlife and coastal resources without economic or environmental benefit to local communities. The Extension would adversely impact whales, fish, and other wildlife that depend on sound for breeding, feeding, navigating, and avoiding predators—in short, for their survival. Many of the exercises proposed would employ sonar, which has been implicated in mass injuries and mortalities of whales around the globe. The same technology is known to affect marine mammals in countless other ways, inducing panic responses, displacing animals, and disrupting crucial behavior such as foraging. The Extension would also affect fisheries and essential fish habitat, damage hard-bottom habitat, and release a variety of hazardous materials into coastal waters.

NEPA requires the Navy to employ rigorous standards of environmental review, including a fair and objective description of potential impacts of the range, a comprehensive analysis of all reasonable alternatives, and a thorough delineation of measures to mitigate harm. Unfortunately, the DEIS released by the Navy falls far short of these standards. To cite just a few examples:

- The Navy disregards nearly the entire literature on behavioral impacts on marine mammals, in support of an abstract standard that contradicts the actual evidence of harm. 3
- It fails to acknowledge risks posed to a wide range of marine species – including the critically endangered Southern Resident killer whale – and impacts to the Olympic Coast National Marine Sanctuary. 4
- It adopts mitigation that a federal court found to be "woefully inadequate and ineffectual," and fails to prescribe measures that have been used repeatedly by the Navy in the past, used by other navies, or required by the courts. 5
- It claims, against generations of field experience, that marine mammals—even cryptic, deep-diving marine mammals like beaked whales—can effectively be spotted from fast-moving ships and avoided. 6

The picture that the Navy paints with such an analysis belies common sense. If one is to believe the DEIS—and ignore the overwhelming weight of scientific evidence—then

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NPS-OC-07-003 to Naval Postgraduate School, Monterey, CA (2007), available at www.cascadiaresearch.org.

Response:

3. Behavioral impacts were considered in the Draft EIS/OEIS, e.g. Section 3.5.2.5. NMFS is a cooperating agency for this EIS/OEIS. The Navy is currently consulting with NMFS and has applied for an LOA.

4. The Draft EIS/OEIS analyzed potential impacts to killer whales and other marine species, as well as to the OCNMS.

5. The Navy has consistently adopted mitigation measures that are effective at reducing risk without detrimental effects on training and testing activities. The Navy has historically not implemented mitigation measures that are not effective at reducing risk to marine species, yet cause an undue burden on training. The referenced case in the California courts does not apply to NUWC Keyport activities. NUWC Keyport implements measures that have proven effective on NUWC Keyport ranges, and is not required to adopt measures developed for other purposes and locations.

6. We believe the mitigation measures implemented as part of the ROP are effective for NUWC Keyport activities under the conditions in which we operate. These activities typically involve slow-moving or stationary vessels on the surface which afford relatively good conditions for observation and maximize the likelihood of detecting marine mammals in the vicinity. The Navy is currently consulting with NMFS on these measures as part of the application for an LOA, the results of which will be reflected in the ROD.

   Because continuous visual monitoring by Navy ships is critical to ship safety and operational effectiveness, training and execution in spotting techniques is, and long has been, integral to ship handling and operation. The Navy is better positioned, trained, and equipped to spot marine mammals and other sea life than most marine vessels operated by other entities. While visual detection of marine mammals is not 100-percent effective, Navy lookouts and bridge personnel (5 in total on surface ships) are highly qualified and experienced marine observers. Compared to commercial vessels, Navy ships' bridges are positioned forward to allow more optimal scanning of the ocean area from the bridge and bow area. Navy lookouts undergo extensive training to include on-the job instruction under supervision of an experienced lookout followed by completion of Personnel Qualification Standard Program. Navy lookouts use both hand held and "Big Eye" (20X110) binoculars. In addition to visual monitoring, passive acoustic systems may be used to monitor for marine mammal vocalizations, which are then reported to the appropriate watch station for dissemination to observers. Navy ships also monitor their surroundings using all appropriate sensors at night and with night vision goggles as appropriate for activities conducted at night. The Navy believes visual spotting provides effective avoidance of marine mammals.

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the high-intensity acoustic activities contemplated by the Navy would unfold without any significant environmental effect. To reach such a conclusion the Navy simply ignores the literature on behavioral impacts on marine mammals and fails to properly analyze cumulative impacts, such as the impacts of repeated use of sonar on marine wildlife. Nor is the Navy's analysis of alternatives or mitigation measures any more credible. For example, the Navy fails to consider a variety of other options – some employed by other navies – that would reduce the impacts of the project. What the Navy presents instead is an analysis so narrowly defined – and so predominated by factors of operational convenience – that the marine environment and those who depend on it are left out of the equation.

In sum, the DEIS is fatally flawed by its inconsistency with the weight of scientific evidence and with the standards of environmental review embodied in NEPA. We urge the Navy to revise its analysis consistent with federal law and to produce a mitigation plan that truly maximizes environmental protection given the Navy's actual operational needs. We also urge the Navy to make available to the public the data and modeling on which its analysis is based.

I. THE DEADLY IMPACTS OF SONAR

Scientists agree, and the publicly available scientific literature confirms, that the intense sound generated by active sonar can induce a range of adverse effects in whales and other species, from significant behavioral changes to stranding and death. By far the most widely-reported and dramatic of these effects are the mass strandings of beaked whales and other marine mammals that have been associated with military sonar use.

A. Strandings and Mortalities Associated with Active Sonar

Over the last decade, the association between military active sonar and whale mortalities has become a subject of considerable scientific interest and concern. That interest is reflected in the publication of numerous papers in peer-reviewed journals, in reports by inter-governmental bodies such as the IWC's Scientific Committee, and in evidence compiled from a growing number of mortalities associated with sonar. Yet the DEIS only glosses over these stranding incidents. 7

In March 2000, for example, sixteen whales from at least three species— including two minke whales—stranded over 150 miles of shoreline along the northern channels of the Bahamas. The beachings occurred within 24 hours of Navy ships using mid-frequency sonar in those same channels.[3] Post-mortem examinations found, in all whales examined, hemorrhaging in and around the ears and other tissues related to sound conduction or production, such as the larynx and auditory fats, some of which was debilitative and potentially severe.[4] It is now accepted that these mortalities were caused, through an unknown mechanism, by the Navy's use of mid-frequency sonar.

[3] Commerce and Navy, Joint Interim Report at iii, 16.

[4] Id.

Response:

7. An in-depth discussion of stranding events was presented in the Draft EIS/OEIS in Appendix E. Section E.4 contains an objective analysis of the causes of mass strandings and potential links to mid-frequency sonar use. The analysis does not support the link suggested by the comment between the use of sonar by the U.S.S. Shoup and harbor porpoise strandings that occurred along the Washington coast during May-June 2003.

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The Bahamas event is one of numerous mortality events coincident with military activities and active sonar that have now been documented, only some of which the Navy discusses:[5]

(1) Canary Islands 1985-1991 – Between 1985 and 1989, at least three separate mass strandings of beaked whales occurred in the Canary Islands, as reported in Nature.[6] Thirteen beaked whales of two species were killed in the February 1985 strandings, six whales of three species stranded in November 1988, and some twenty-four whales of three species stranded in October 1989—all while naval vessels were conducting exercises off shore.[7] An additional stranding of Cuvier's beaked whales, also coinciding with a naval exercise, occurred in 1991.[8] It was reported that mass live strandings occurred each time exercises took place in the area.[9] 7 (cont.)

(2) Greece 1996, 1997 – In 1996, twelve Cuvier's beaked whales stranded along 35 kilometers on the west coast of Greece. The strandings were correlated, by an analysis published in Nature, with the test of a low- and mid-frequency active sonar system operated by NATO.[10] A subsequent NATO investigation found the strandings to be closely timed with the movements of the sonar vessel, and ruled out all other physical environmental factors as a cause.[11] The following year saw nine additional Cuvier's beaked whales strand off Greece, again coinciding with naval activity.[12]

(3) Virgin Islands 1999 – In October 1999, four beaked whales stranded in the U.S. Virgin Islands as the Navy began an offshore exercise. A wildlife

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[5] The following is not a complete list, as other relevant events have been reported in Bonaire, Japan, Taiwan, and other locations. See, e.g., R.L. Brownell, Jr., T. Yamada, J.G. Mead, and A.L. van Helden, Mass Strandings of Cuvier's Beaked Whales in Japan: U.S. Naval Acoustic Link? (2004) (IWC SC/56E37); J.Y. Wang and S.-C. Yang, Unusual Cetacean Stranding Events of Taiwan in 2004 and 2005, 8 Journal of Cetacean Research and Management 283-292 (2006); P.J.H. van Bree and I. Kristensen, On the Intriguing Stranding of Four Cuvier's Beaked Whales, Ziphius cavirostris, G. Cuvier, 1823, on the Lesser Antillean Island of Bonaire, 44 Bijdragen tot de Dierkunde 235-238 (1974).

[6] M. Simmonds and L.F. Lopez-Jurado, Whales and the Military, 337 Nature 448 (1991).

[7] Id.

[8] V. Martín, A. Servidio, and S. Garcia, Mass Strandings of Beaked Whales in the Canary Islands, in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 33-36 (2004).

[9] Simmonds and Lopez-Jurado, Whales and the Military, 337 Nature at 448.

[10] A. Frantzis, Does Acoustic Testing Strand Whales? 392 Nature 29 (1998).

[11] See SACLANT Undersea Research Center, Summary Record, La Spezia, Italy, 15-17 June 1998, SACLANTCEN Bioacoustics Panel, SACLANTCEN M-133 (1998).

[12] Id.; A. Frantzis, The First Mass Stranding That Was Associated with the Use of Active Sonar (Kyparissiakos Gulf, Greece, 1996), in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 14-20 (2004).

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official from the Islands reported the presence of "loud naval sonar."[13] When NMFS asked the Navy for more information about its exercise, the Department's response was to end the consultation that it had begun for the exercise under the Endangered Species Act.[14] In January 1998, according to a NMFS biologist, a beaked whale "stranded suspiciously" at Vieques as naval exercises were set to commence offshore.[15]

(4) Bahamas 2000 – As described above. 7 (cont.)

(5) Madeira 2000 -- In May 2000, four beaked whales stranded on the beaches of Madeira while several NATO ships were conducting an exercise near shore. Scientists investigating the stranding found that the whales' injuries—including "blood in and around the eyes, kidney lesions, pleural hemorrhage"—and the pattern of their stranding suggest "that a similar pressure event [*i.e.*, similar to that at work in the Bahamas] precipitated or contributed to strandings in both sites."[16]

(6) Canary Islands 2002 – In September 2002, at least fourteen beaked whales from three different species stranded in the Canary Islands. Four additional beaked whales stranded over the next several days.[17] The strandings occurred while a Spanish-led naval exercise that included U.S. Navy vessels and at least one ship equipped with mid-frequency sonar was conducting anti-submarine warfare exercises in the vicinity.[18] The subsequent investigation, as reported in the journals Nature and Veterinary Pathology, revealed a variety of traumas, including emboli and lesions suggestive of decompression sickness.[19]

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[13] Personal communication of Dr. David Nellis, U.S. Virgin Island Department of Fish and Game, to Eric Hawk, NMFS (Oct. 1999); personal communication from Ken Hollingshead, NMFS, to John Mayer, Marine Acoustics Inc. (March 19, 2002).

[14] Letter from William T. Hogarth, Regional Administrator, NMFS Southeast Regional Office, to RADM J. Kevin Moran, Navy Region Southeast (undated); personal communication from Ken Hollingshead, NMFS, to John Mayer, Marine Acoustics Inc. (March 19, 2002).

[15] Personal communication from Eric Hawk, NMFS, to Ken Hollingshead, NMFS (Feb. 12, 2002).

[16] D.R. Ketten, Beaked Whale Necropsy Findings 22 (2002) (paper submitted to NMFS); L. Freitas, The Stranding of Three Cuvier's Beaked Whales Ziphius Cavirostris in Madeira Archipelago—May 2000, in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 28-32 (2004).

[17] Vidal Martin et al., Mass Strandings of Beaked Whales in the Canary Islands, in Proceedings of the Workshop on Active Sonar and Cetaceans 33 (P.G.H. Evans & L.A. Miller eds., 2004); Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446-57.

[18] Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446; K.R. Weiss, Whale Deaths Linked to Navy Sonar Tests, L.A. Times, Oct. 1, 2002, at A3.

[19] Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446-57; Jepson et al., Gas-Bubble Lesions, 425 Nature at 575-76.

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(7) Washington 2003 – In May 2003, the U.S. Navy vessel USS Shoup was conducting a mid-frequency sonar exercise while passing through Haro Strait, off the coast of Washington. According to one contemporaneous account, "[d]ozens of porpoises and killer whales seemed to stampede all at once . . . in response to a loud electronic noise echoing through" the Strait.[20] Several field biologists present at the scene reported observing a pod of endangered orcas bunching near shore and engaging in very abnormal behavior consistent with avoidance, a minke whale "porpoising" away from the sonar ship, and Dall's porpoises fleeing the vessel in large numbers.[21] Eleven harbor porpoises—an abnormally high number given the average stranding rate of six per year—were found beached in the area of the exercise.[22]

(8) Kauai 2004 – During the Navy's conduct of a major training exercise off Hawaii, called RIMPAC 2004, some 150-200 whales from a species that is rarely seen near shore and had never naturally mass-stranded in Hawaii came into Hanalei Bay, on the island of Kaua'i. The whales crowded into the shallow bay waters and milled there for over 28 hours. Though the whales were ultimately assisted into deeper waters by members of a local stranding network, one whale calf was left behind and found dead the next day. NMFS undertook an investigation of the incident and concluded that the Navy's nearby use of sonar in RIMPAC 2004 was the "plausible, if not likely" cause of the stranding.[23]

(9) Canary Islands 2004 – In July 2004, four dead beaked whales were found around the coasts of the Canary Islands, within one week of an NATO exercise. The exercise, Majestic Eagle 2004, was conducted approximately 100 kilometers north of the Canaries. Although the three whale bodies that were necropsied were too decomposed to allow detection of gas embolisms (see below), systematic fat embolisms were found in these animals.[24] The probability that the whales died at sea is extremely high.[25]

7 (cont.)

[20] Christopher Dunagan, Navy Sonar Incident Alarms Experts, Bremerton Sun, May 8, 2003.

[21] NMFS, Assessment of Acoustic Exposures at 6, 9.

[22] NMFS, Preliminary Report: Multidisciplinary Investigation of Harbor Porpoises (Phocoena phocoena) Stranded in Washington State from 2 May – 2 June 2003 Coinciding with the Mid-Range Sonar Exercises of the USS Shoup 53-55 (2004) (conclusions unchanged in final report). Unfortunately, according to the report, freezer artifacts and other problems incidental to the preservation of tissue samples made the cause of death in most specimens difficult to determine; but the role of acoustic trauma could not be ruled out. Id.

[23] B.L. Southall, R. Braun, F.M.D. Gulland, A.D. Heard, R.W. Baird, S.M. Wilkin, and T.K. Rowles, Hawaiian Melon-Headed Whale (Peponacephala electra) Mass Stranding Event of July 3-4, 2004 (2006) (NOAA Tech. Memo. NMFS-OPR-31).

[24] A. Espinosa, M. Arbelo, P. Castro, V. Martín, T. Gallardo, and A. Fernández, New Beaked Whale Mass Stranding in Canary Islands Associated with Naval Military Exercises (Majestic Eagle 2004) (2005) (poster presented at the European Cetacean Society Conference, La Rochelle, France, April 2005); A. Fernández, M. Méndez, E. Sierra, A. Godinho, P. Herráez, A. Espinosa de los Monteros, F. Rodríguez, F., and M. Arbelo, M., New Gas and Fat Embolic Pathology in Beaked Whales Stranded in

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(10) North Carolina 2005 – During and just after a U.S. training exercise off North Carolina, at least thirty-seven whales of three different species stranded and died along the Outer Banks, including numerous pilot whales (six of which were pregnant), one newborn minke whale, and two dwarf sperm whales. NMFS investigated the incident and found that the event was highly unusual, being the only mass stranding of offshore species ever to have been reported in the region, and that it shared 'a number of features' with other sonar-related mass stranding events (involving offshore species which stranded alive and were atypically distributed along the shore). NMFS concluded that sonar was a possible cause of the strandings and also ruled out the most common other potential causes, including viral, bacterial, and protozoal infection, direct blunt trauma, and fishery interactions.[26] 7 (cont.)

(11) Spain 2006 – Four Cuvier's beaked whales stranded on the Almerian coast of southern Spain, with the same suite of bends-like pathologies seen in the whales that stranded in the Canary Islands in 2002 and 2004.[27] A NATO response force was performing exercises within 50 miles at the time of the strandings.

Some preliminary observations can be drawn from these incidents. For example, beaked whales, a group of deep-water species that are seldom seen and may in some cases be extremely rare, seem to be particularly vulnerable to the effects of active sonar. A 2000 review undertaken by the Smithsonian Institution, and reported and expanded by the IWC's Scientific Committee and other bodies, supports this conclusion, finding that every mass stranding on record involving multiple species of beaked whales has occurred with naval activities in the vicinity.[28] Indeed, it is not even certain that some beaked whale species naturally strand in numbers.

But the full magnitude of sonar's effects on these species—or on other marine mammals—is not known. Most of the world lacks networks to identify and investigate stranding events, particularly those that involve individual animals spread out over long stretches of coastline, and therefore the mortalities that have been identified thus far are

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the Canary Islands (2005) (poster presented at the European Cetaecan Society Conference, La Rochelle, France, April 2005).

[25] Id.

[26] A.A. Hohn, D.S. Rotstein, C.A. Harms, and B.L. Southall, Multispecies Mass Stranding of Pilot Whales (Globicephala macrorhynchus), Minke Whale (Balaenoptera acutorostrata), and Dwarf Sperm Whales (Kogia sima) in North Carolina on 15-16 January 2005 (2006) (NOAA Tech. Memo. NMFS-SEFSC-53).

[27] International Whaling Commission, Report of the Scientific Committee, Annex K at 28 (2006) (IWC/58/Rep1).

[28] Marine Mammal Program of the National Museum of Natural History, Historical Mass Mortalities of Ziphiids 2-4 (Apr. 6, 2000); see also 2 J. Cetacean Res. & Mgmt., Supp., Annex J at § 13.8 (2000) (report of the IWC Scientific Committee, Standing Working Group on Environmental Concerns).

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likely to represent only a subset of a substantially larger problem. For example, most beaked whale casualties (according to NMFS) are bound to go undocumented because of the remote siting of sonar exercises and the small chance that a dead or injured animal would actually strand.[29] It is well understood in terrestrial ecology that dead and dying animals tend to be grossly undercounted given their rapid assimilation into the environment, and one would of course expect profound difficulty where offshore marine species are concerned.[30] Along the eastern seaboard and in the Gulf of Mexico, all beaked whale sightings during NMFS shipboard surveys have occurred at considerable distances from shore.[31]

7 (cont.)

Furthermore, although the physical process linking sonar to strandings is not perfectly understood, the record indicates that debilitating and very possibly lethal injuries are occurring in whales exposed to sonar at sea—only some of which may then strand. As first reported in the journal *Nature*, animals that came ashore during sonar exercises off the Canary Islands, in September 2002, had developed large emboli in their organ tissue and suffered from symptoms resembling those of severe decompression sickness, or "the bends."[32] It has been proposed that the panic led them to surface too rapidly or because it pushed them to dive before they could eliminate the nitrogen accumulated on previous descents, or because the sound itself precipitated the growth of nitrogen bubbles in the blood, which expanded to devastating effect. This finding has since been supported by follow-on papers, by published work in other fields, and by expert reviews.[33] In any case, the evidence is considered "compelling" that acoustic trauma, or injuries resulting from behavioral responses, has in some way led to the deaths of many of these animals.[34]

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[29] J.V. Carretta, K.A. Forney, M.M. Muto, J. Barlow, J. Baker, and M. Lowry, U.S. Pacific Marine Mammal Stock Assessments: 2006 (2007).

[30] See, e.g., G. Wobeser, Investigation and Management of Disease in Wild Animals 13-15 (1994); P.A. Alison, C.R. Smith, H. Kukert, J.W. Deming, B.A. Bennett, Deep-Water Taphonomy of Vertebrate Carcasses: A Whale Skeleton in the Bathyal Santa Catalina Basin, 17 Paleobiology 78-89 (1991).

[31] G.T. Waring, E. Josephson, C.P. Fairfield, and K. Maze-Foley, eds., U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2006 at 232-33, 238, 288, 292, 296 (2007) (NOAA Tech. Memo. NMFS NE 201) (data from NMFS surveys, showing all beaked whales sightings at significant distances from shore).

[32] See P.D. Jepson, M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martín, A.A. Cunningham, A. Fernández, Gas-Bubble Lesions in Stranded Cetaceans, 425 Nature 575-576 (2003); Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 415.

[33] Cox et al., Understanding the Impacts. For additional papers, see also the studies referenced at section III.A. ("Thresholds of Injury, Hearing Loss and Behavioral Change"). Of course it would be a mistake to assume that an animal must suffer bends-like injury or some other sort of acoustic trauma in order to strand. Some may die simply because the noise disorients them, for instance. See, e.g., NMFS, Assessment of Acoustic Exposures at 9-10.

[34] Cox et al., Understanding the Impacts; see also P.G.H. Evans and L.A. Miller, Concluding Remarks, in Proceedings of the Workshop on Active Sonar and Cetaceans 74 (2004); K.C. Balcomb and D.E. Claridge, A Mass Stranding of Cetaceans Caused by Naval Sonar in the Bahamas, 8(2) Bahamas Journal

Response:

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In this light, the Navy's assessment of the risk of marine mammal injury and mortality is astonishingly poor. The Navy stubbornly refuses to account for the research linking military active sonar and whale mortalities. Citing some of the stranding events discussed above (DEIS at E-23-35), the Navy blithely concludes that "the simple exposure of beaked whales to sonar is not enough to cause beaked whales to strand." DEIS E-20. The Navy further concludes that "while sonar may be a contributing factor under certain rare conditions, the presence of sonar is not a necessary condition for stranding events to occur." DEIS at 3-129. Such conclusions simply ignore numerous published, peer-reviewed papers. While it is true that cetaceans have stranded naturally for millions of years, the issue here is whether sonar use causes mortalities above and beyond natural mortality. Events correlated with sonar use and mechanisms for how low levels of noise exposure could lead to stranding suggest sonar does in fact increase strandings and mortalities.[35] The Navy must properly analyze these impacts. 7 (cont.)

There are other problems with the Navy's analysis as well. For instance, the Navy capriciously (1) denies that any injury to ESA-listed species would occur during the myriad activities proposed for the Extension (DEIS at 3-149, 167. 168, 189, 197); (2) dismisses the potential for sonar to injure whales at sea, grossly mischaracterizing the literature (DEIS E-36); (3) fails to consider the potential for strandings and mortalities in other species of cetaceans; and (4) assumes that the Navy's failure to observe mortalities during past sonar training is probative of a lack of mortalities, despite the lack of any remotely adequate monitoring system.

B. Other Harmful Effects of Active Sonar

Strandings and mass mortalities, though an obvious focus of much reporting and concern, are likely only the tip of the iceberg of sonar's harmful effects. Marine mammals are believed to depend on sound to navigate, find food, locate mates, avoid predators, and communicate with each other. Flooding their habitat with man-made, high-intensity noise interferes with these and other functions. In addition to strandings and non-auditory injuries, the harmful effects of high-intensity sonar include: 8

- temporary or permanent loss of hearing, which impairs an animal's ability to communicate, avoid predators, detect and capture prey, and avoid ship strikes;
- avoidance behavior, which can lead to abandonment of habitat or migratory pathways;
- disruption of biologically important behaviors such as mating, feeding, nursing, or migration, or loss of efficiency in conducting those behaviors;
- aggressive (or agonistic) behavior, which can result in injury;

of Science 1 (2001); D.E. Claridge, Fine-Scale Distribution and Habitat Selection of Beaked Whales (2006) (M.Sc. thesis).

[35] See footnotes 3 through 27.

Response:

8. The risk-function analysis of sub-TTS behavioral effects in the Draft EIS/OEIS directly addressed the potential for a variety of behavioral effects, and behavioral effects were also recognized to accompany temporary or permanent threshold shifts. The Draft EIS/OEIS considered potential acoustic effects on invertebrates, sea turtles, and fish in Sections 3.2, 3.3, and 3.4, respectively (see also Appendix B). The analysis of acoustic effects on fish and invertebrates does not suggest any potential impacts on distribution or abundance that could lead to indirect effects on marine mammals that prey on these species.

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- masking of biologically meaningful sounds, such as the call of predators or potential mates;
- chronic stress, which can compromise viability, suppress the immune system, and lower the rate of reproduction;
- habituation, causing animals to remain near damaging levels of sound, or sensitization, exacerbating other behavioral effects; and
- declines in the availability and viability of prey species, such as fish and shrimp. 8 (cont.)

Over the past 20 years, a substantial literature has emerged documenting the range of effects of ocean noise on marine mammals.[36]

Marine mammals are not the only species affected by undersea noise. Impacts on fish are of increasing concern due to several recent studies demonstrating hearing loss and widespread behavioral disruption in commercial species of fish and to reports, both experimental and anecdotal, of catch rates plummeting in the vicinity of noise sources.[37] Further, the death of species not protected by federal law reduces prey available to listed species. Sea turtles, most of which are considered threatened or endangered under federal law, have been shown to engage in escape behavior and to experience heightened stress in response to noise. And noise has been shown in several cases to kill, disable, or disrupt the behavior of invertebrates, many of which possess ear-like structures or other sensory mechanisms that could leave them vulnerable. It is clear that intense sources of noise are capable of affecting a wide class of ocean life.

II. THE NAVY'S COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act of 1969 ("NEPA") "declares a broad national commitment to protecting and promoting environmental quality." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 348 (1989). To achieve this critical goal, NEPA requires that each federal agency consider the potential environmental impacts of any "major Federal actions significantly affecting the quality of the human environment" through the preparation of an environmental impact statement ("EIS"). Id.; 42 U.S.C. § 4332. This directive is known as a "set of action-forcing procedures that require that agencies take a 'hard look' at environmental consequences." Robertson, 490 U.S. at 349 (quoting Kleppe v. Sierra Club, 427 U.S. 390, 410, n.21 (1976)). 9

[36] For a review of research on behavioral and auditory impacts of undersea noise, see, e.g., L.S. Weilgart, The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management, 85 Canadian Journal of Zoology 1091-1116 (2007); W.J. Richardson, C.R. Greene, Jr., C.I. Malme, and D.H. Thomson, Marine Mammals and Noise (1995); National Research Council, Ocean Noise and Marine Mammals (2003); Whale and Dolphin Conservation Society, Oceans of Noise (2004).

[37] See the discussion below, at section V ("Impacts on Fish and Fisheries").

Response:

9. The Navy's statement of the purpose and need for the Proposed Action is detailed and specific, the scope of the Proposed Action is described in exhaustive detail after careful assessment of RDT&E requirements, and the development of alternatives has been conducted according to the highest standards and requirements of NEPA. The EIS/OEIS is the product of extensive analysis applying best available science, including methodologies for analyzing impacts of MFA sonar on marine mammals that were developed in close consultation with NMFS. The Navy has identified mitigation measures as warranted to address environmental impacts in affected resource areas, and has conducted an appropriate analysis of cumulative effects of its Proposed Action. The EIS/OEIS inarguably takes a "hard look" at potential environmental consequences of the Proposed Action and alternatives, and provides sufficient information for careful agency decision-making.

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Central to NEPA is its requirement that, before any federal action that "may significantly degrade some human environmental factor" can be undertaken, agencies must prepare an EIS. Steamboaters v. F.E.R.C., 759 F.2d 1382, 1392 (9th Cir. 1985) (emphasis in original). The requirement to prepare an EIS "serves NEPA's action-forcing purpose in two important respects." Robertson, 490 U.S. at 349. First, "the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts[,]" and second, "the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision." Id. (emphasis added). As the Supreme Court explained: "NEPA's instruction that all federal agencies comply with the impact statement requirement…'to the fullest extent possible' [cit. omit.] is neither accidental nor hyperbolic. Rather the phrase is a deliberate command that the duty NEPA imposes upon the agencies to consider environmental factors not be shunted aside in the bureaucratic shuffle." Flint Ridge Development Co. v. Scenic Rivers Ass'n, 426 U.S. 776, 787 (1976). 9 (cont.)

The fundamental purpose of an EIS is to force the decision-maker to take a "hard look" at a particular action – at the agency's need for it, at the environmental consequences it will have, and at more environmentally benign alternatives that may substitute for it – before the decision to proceed is made. 40 C.F.R. §§ 1500.1(b), 1502.1; Baltimore Gas & Electric v. NRDC, 462 U.S. 87, 97 (1983). This "hard look" requires agencies to obtain high quality information and accurate scientific analysis. 40 C.F.R. § 1500.1(b). "General statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." Klamath-Siskiyou Wilderness Center v. Bureau of Land Management, 387 F.3d 989, 994 (9th Cir. 2004) (quoting Neighbors of Cuddy Mountain v. United States Forest Service, 137 F.3d 1372, 1380 (9th Cir. 1998)). The law is clear that the EIS must be a pre-decisional, objective, rigorous, and neutral document, not a work of advocacy to justify an outcome that has been foreordained.

In nearly every respect, the Navy's DEIS fails to meet the high standards of rigor and objectivity required under NEPA.

III. THE NAVY'S ANALYSIS OF IMPACTS IS FATALLY FLAWED

Fundamental to satisfying NEPA's requirement of fair and objective review, agencies must ensure the "professional integrity, including scientific integrity," of the discussions and analyses that appear in environmental impact statements. 40 C.F.R. § 1502.24. To this end, they must make every attempt to obtain and disclose data necessary to their analysis. The simple assertion that "no information exists" will not suffice; unless the costs of obtaining the information are exorbitant, NEPA requires that it be obtained. See 40 C.F.R. § 1502.22(a). Agencies are further required to identify their methodologies, indicate when necessary information is incomplete or unavailable, acknowledge scientific disagreement and data gaps, and evaluate indeterminate adverse impacts based upon approaches or methods "generally accepted in the scientific community." 40 C.F.R. §§ 1502.22(2), (4), 1502.24. Such requirements become 10

Response:

10. The Navy disagrees and notes that, for example, Section 4.2 of Appendix E in the Draft EIS/OEIS included relevant information even though it may be seen as being adverse to the Navy's interests. This includes discussions of all strandings alleged to have been associated with the use of sonar. In addition, Appendix B contains an up-to-date critical review of the evidence surrounding potential effects of MFA sonar on fish and invertebrates. In Chapter 3.5 and Appendices C, D, and E, the acoustic analysis methodology is explained in considerable detail, reflecting the Navy's serious efforts to inform both the scientific audience as well as the lay public as to how the analysis was prepared. The chosen methodologies are consistent with the weight of scientific evidence and practice as of the time the analysis was prepared.

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acutely important in cases where, as here, so much about a program's impacts depend on newly emerging science.

In this case, the Navy's assessment of impacts is consistently undermined by its failure to meet these fundamental responsibilities of scientific integrity, methodology, investigation, and disclosure. The DEIS disregards a great deal of relevant information adverse to the Navy's interests, uses approaches and methods that would not be acceptable to the scientific community, and ignores whole categories of impacts. In short, it leaves the public with an analysis of environmental harm—behavioral, auditory, and physiological—that is at odds with established scientific authority and practice. 10 (cont.)

A. Thresholds of Injury, Hearing Loss and Behavioral Change

At the core of the Navy's assessment of acoustic impacts are the thresholds it has established for physiological and behavioral effects. There are gross problems with the Navy's thresholds, as discussed below.

1. Permanent Threshold Shift

The DEIS sets its highest threshold for direct physical injury, such as permanent hearing loss or "permanent threshold shift," ("PTS"), at 215 dB re 1 μPa^2•s for cetaceans, 226 dB re 1 μPa^2•s for California Sea Lions, Steller Sea Lions and Northern Fur Seals, 203 dB re 1 μPa^2•s for Harbor Seals and 224 dB re 1 μPa^2•s for Northern Elephant Seals . DEIS at 3-115 to 116. The Navy's position, however, is inconsistent with the scientific literature.

For instance, the DEIS disregards data gained from actual whale mortalities. The best available scientific evidence, as reported in the peer-reviewed literature, indicates that sound levels at the most likely locations of beaked whales beached in the Bahamas strandings run far lower than the Navy's threshold for injury here: approximately 150-160 dB re 1 μPa for 50-150 seconds, over the course of the transit.[38] A further modeling effort, undertaken in part by the Office of Naval Research, suggests that the mean exposure level of beaked whales, given their likely distribution in the Bahamas' Providence Channels and averaging results from various assumptions, may have been lower than 140 dB re 1 μPa.[39] Factoring in duration, then, evidence of actual sonar-related mortalities would compel a maximum energy level threshold for serious injury on the order of 182 dB re 1 μPa^2•s, at least for beaked whales. Indeed, to 11

[38] J. Hildebrand, "Impacts of Anthropogenic Sound," in T.J. Ragen, J.E. Reynolds III, W.F. Perrin, and R.R. Reeves, Conservation beyond Crisis (2005). See also International Whaling Commission, 2004 Report of the Scientific Committee, Annex K at § 6.3.

[39] J. Hildebrand, K. Balcomb, and R. Gisiner, Modeling the Bahamas Beaked Whale Stranding of March 2000 (2004) (presentation given at the third plenary meeting of the U.S. Marine Mammal Commission Advisory Committee on Acoustic Impacts on Marine Mammals, 29 July 2004).

Response:

11. The scientific derivation of TTS and subsequent PTS is explained in Section 3.5.2 of the Draft EIS/OEIS. Contrary to the statement that the data from TTS studies upon which the PTS is derived are inapposite, the Navy relies upon these studies because they are the most controlled studies of behavioral reactions to sound exposure available and provide the greatest amount of data. The studies recorded baseline behavior of the test subjects over many sessions so that behavioral alterations could be defined as a deviation from normal behavior. The sound exposure level received by each animal was recorded and quantified. The exposure signals used were close to the frequencies typically employed by MFA sonar. No other study provides the same degree of control or relevance to signal type as the TTS studies from which much of the behavioral response thresholds are derived.

The data from these studies are the "best available" scientific data both with respect to quality and quantity. Data from animals in the wild were utilized when sufficient information on animal behavior (both baseline and reactionary) and sound exposure levels existed. It is recognized that this represents a sparse amount of data. Utilization of the copious other studies with inadequate control, observational periods, or ability to determine exposure levels of the animals introduces a large amount of guesswork and estimation that weakens any numerical association between behavioral reactions and sound exposure. Furthermore, the deficiencies of the TTS studies referred to in the comment were acknowledged in the original behavioral analysis. NMFS is aware of these deficiencies yet still approves of the usage of the data at this time because of the quality and quantity of the data. As quality data continue to be collected on animals in the wild, the relevance of the behavioral data collected during the TTS studies will decrease and these data will eventually be replaced. However, at this time, they provide the best available data for assessing the relationship between behavioral reactions and sound exposure.

The "identified or observed" injuries referred to in the comment have not been directly linked to sound exposure and may result from other processes related to the behavior of the animal. The Navy's position is consistent with the interpretation of the scientific literature and no scientific literature exists that demonstrates a direct mechanism by which injury will occur as a result of sound exposure levels less than those predicted to cause PTS in a marine mammal.

It is true that the criteria previously used in the COMPTUEX/JTFEX EA considered all animals exposed to 173 dB re 1μPa2 s or above as being harassed; however, both the Navy and NMFS agree that the studies of marine mammals in the wild and in experimental settings do not support these assumptions. Different species of marine mammals and different individuals of the same species respond differently to sonar exposure. (Continued)

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pay at least some deference to the literature, the Navy—under pressure from NMFS—has previously assumed that non-lethal injury would occur in beaked whales exposed above 173 dB re 1 µPa^{2}•s.[40] While we commend the Navy for counting "all predicted cases of Level B harassment of beaked whales" as Level A harassment (DEIS at 3-116), this approach nonetheless does not go far enough to protect marine mammals. 11 (cont.)

In addition, the DEIS glosses over published research on bubble growth in marine mammals, which separately indicates the potential for injury and death at levels far lower than what the Navy proposes. According to the best available scientific evidence, as represented by multiple papers in flagship journals such as *Nature* and *Veterinary Pathology*, gas bubble growth is the causal mechanism most consistent with the observed injuries;[41] in addition, it was singularly and explicitly highlighted as plausible by an expert panel convened by the Marine Mammal Commission, in which the Navy participated.[42] The Navy concedes that "exposure to sonar has been considered a potential indirect cause of the death of marine mammals…resulting from gas and fat embolic syndrome" (DEIS at 3-117), but then fails to actually evaluate the potential impacts. NEPA requires agencies to evaluate all "reasonably foreseeable" impacts, which, by definition, include "impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason." 40 C.F.R. § 1502.22. The scientific literature supporting bubble growth rises far above this standard, and the Navy's failure to incorporate it into its impact model is arbitrary and capricious. Thus, the Navy's refusal to consider these impacts is insupportable under NEPA. 40 C.F.R. §§ 1502.22, 1502.24. 12

[40] See, e.g., Navy, Joint Task Force Exercises and Composite Training Unit Exercises Final Environmental Assessment/ Overseas Environmental Assessment at 4-44, 4-46 to 4-47 (2007).

[41] See, e.g., A. Fernández, J.F. Edwards, F. Rodríguez, A. Espinosa de los Monteros, P. Herráez, P. Castro, J.R. Jaber, V. Martín, and M. Arbelo, 'Gas and Fat Embolic Syndrome' Involving a Mass Stranding of Beaked Whales (Family Ziphiidae) Exposed to Anthropogenic Sonar Signals, 42 Veterinary Pathology 446 (2005); P.D. Jepson, M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martín, A.A. Cunningham, and A. Fernández, Gas-Bubble Lesions in Stranded Cetaceans, 425 Nature 575-576 (2003); R.W. Baird, D.L. Webster, D.J. McSweeney, A.D. Ligon, G.S. Schorr, and J. Barlow, Diving Behavior of Cuvier's (Ziphius cavirostris) and Blainville's (Mesoplodon densirostris) Beaked Whales in Hawai'i," 84 Canadian Journal of Zoology 1120-1128 (2006).

[42] T.M. Cox, T.J. Ragen, A.J. Read, E. Vos, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, T. Hullar, P.D. Jepson, D. Ketten, C.D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner, Understanding the Impacts of Anthropogenic Sound on Beaked Whales, 7 Journal of Cetacean Research & Management 177-87 (2006).

Response:

11(Cont.) The Navy and NMFS have developed a new methodology called risk function that takes into account a variety of behavioral responses of marine mammals exposed to different sound levels down to 120 dB re 1µPa (see Draft EIS/OEIS Section 3.5.2). Based on previous studies of Temporary Threshold Shifts in hearing, 195 dB SEL is used for the onset of TTS and 215 dB SEL is used for the onset of PTS for all cetaceans including beaked whales (Section 3.5.2.4).

There are significant limitations and challenges to any risk function derived to estimate the probability of marine mammal behavioral responses; these are largely attributable to sparse data. Ultimately there should be multiple functions for different marine mammal taxonomic groups, but the current data are insufficient to support them. The goal is unquestionably that risk functions be based on empirical measurement. The risk function presented in Draft EIS/OEIS Section 3.5.2.5 is based on three data sets that NMFS and the Navy have determined are the best available scientific data at this time. Until additional data are available, NMFS and the Navy have determined that these datasets are the most applicable for the direct use in the development of risk function parameters to describe what portion of a population exposed to specific levels of MFA sonar will respond in a manner that NMFS would classify as harassment.

The Navy is contributing to an ongoing behavioral response study in the Bahamas that is anticipated to provide some initial information on beaked whales, the species identified as the most sensitive to MFA sonar.

12. The papers cited by NRDC (reference # 41) do not prove that decompression sickness (DCS) occurred in the Bahamas stranding. The papers state that the pathologies reported could be related to DCS but could also be caused by injuries sustained during beaching or the beginnings of decomposition in the warm climate of the Bahamas. Studies by Cox et al. (2006) and Romel et al. (2006) (which include some of the same authors as those cited by NRDC) concluded that the pathologies seen in the stranded animals could have been the result of DCS from sound exposure but that they were not diagnostic of DCS. In addition, for DCS to occur the animal would have to be supersaturated with nitrogen. Current information on the diving behavior of beaked whales make that unlikely (Tyack et al. 2006) and a recent study of diving dolphins did not show an increase in blood nitrogen levels that would lead to bubble formation (Houser 2007).

Sections 3.5.6.2, 3.5.7.2, and 3.5.8.2 of the Draft EIS/OEIS explained the potential effects on marine mammals from Navy mid-frequency active (MFA) sonar in the NAVSEA NUWC Keyport Range Complex. MFA sonar use in the Range Complex is not new and has occurred using the same basic sonar equipment and output for decades. Given this history and the scientific evidence, the Navy believes that the risk to marine mammals from sonar on the Range Complex is low. (Continued)

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Finally, the Navy's exclusive reliance on energy flux density levels ("ELs") as a unit of analysis is misplaced. DEIS at 3-115. It is appropriate for the Navy to set dual thresholds for behavioral effects, one based on ELs and one based on sound exposure levels ("SELs"). 13

2. Temporary Threshold Shift

The DEIS sets its threshold for temporary hearing loss and behavioral effects, or "temporary threshold shift" ("TTS"), at 195 dB re 1 $\mu Pa^{2} \cdot s$ for cetaceans, 206 dB re 1 $\mu Pa^{2} \cdot s$ for California Sea Lions, Steller Sea Lions and Northern Fur Seals, 183 dB re 1 $\mu Pa^{2} \cdot s$ for Harbor Seals and 204 dB re 1 $\mu Pa^{2} \cdot s$ for Northern Elephant Seals. DEIS at 3-115 to 116. It bases its cetacean threshold primarily on a synthesis of studies on two species of cetaceans, bottlenose dolphins and beluga whales, conducted by the Navy's SPAWAR laboratory in San Diego and, to a lesser extent, by researchers at the University of Hawaii. DEIS at 3-113. 14

Notably, the Navy's extrapolation of data from bottlenose dolphins and belugas to all cetaceans is not justifiable. Given the close association between acoustic sensitivity and threshold shift, such an approach must presume that belugas and bottlenose dolphins have the best hearing sensitivity in the mid-frequencies of any cetacean. However, harbor porpoises and killer whales are more sensitive over part of the mid-frequency range than are the two species in the SPAWAR and Hawaii studies.[43] Furthermore, the animals in the studies may not represent the full range of variation even within their own species, particularly given their age and situation: the SPAWAR animals, for example, have been housed for years in a noisy bay.[44]

3. "Risk Function" for Behavioral Effects

In contrast to the Navy's 2005 DEIS for the Undersea Warfare Training Range (which established a threshold of 190 dB re 1 $\mu Pa^{2} \cdot s$) and the threshold which NMFS insisted the Navy adopt during RIMPAC 2006 and subsequent exercises off California and Hawaii (173 dB re 1 $\mu Pa^{2} \cdot s$), here the Navy redefines its position by applying a dose-response risk function to measure behavioral effects that begins at 120 dB re 1 µPa and reaches its mean at 165 dB re 1 µPa. DEIS at 3-122. Agencies are not entitled to substantial deference under the Administrative Procedure Act when they reverse previously held positions. Some of the more significant problems with the Navy's new position include misusing SPAWAR and Haro Strait data, as well as failing to include data from the Hanalei Bay incident. 15

[43] Richardson et al., Marine Mammals and Noise at 209.

[44] M.L.H. Cook, Behavioral and Auditory Evoked Potential (AEP) Hearing Measurements in Odontocete Cetaceans (2006) (Ph.D. thesis).

Response:

12(Cont.) Though the Navy works to minimize impacts on marine mammals to the greatest extent practicable, they are not mandated by any statute to alleviate all risk to marine mammals. Also, it must be acknowledged that Navy RDT&E, as well as training activities have been conducted without incident for decades on the NAVSEA NUWC Keyport Range Complex. In fact, many populations of non-ESA and ESA species alike have been increasing in the Pacific Northwest and elsewhere over the last several decades. Given the natural variation of marine mammal location over time, variability of Navy RDT&E and training activities, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from the activities conducted by NUWC Keyport.

13. Regarding a dual threshold, as most recently discussed in Southall et al (2007), the Navy is applying a more conservative approach by using the risk function (SPL) for behavior and energy for PTS /TTS onset given that the 230 dB SPL (peak) metric would not reach beyond the sonar dome containing a 235 dB source. The methodology for assessing potential impacts from sound is discussed in Section 3.5.2 including the use of both an energy (EFD) metric and the sound pressure level (SPL) metric developed in coordination with NMFS.
14. The explanation for the derivation of the thresholds and the use of the specific data sets was explicit in Section 3.5.2 of the Draft EIS/OEIS. While there are many limitations on these data sets (as detailed), there remain no other more representative or rigorous data from which to derive alternative thresholds. The thresholds and criteria were developed in cooperation with NMFS and as more data become available, the methodology and thresholds will be revised as warranted.
15. The EIS/OEIS contains a methodology provided by NMFS for the Navy. Effects of multiple pings are considered under the energy metric (EFD) criteria beginning with TTS, which is the first measurable physiological effect presently known. The new risk function is used in the present analysis has a behavioral response curve with a lower mean (165 dB SPL) than the previously proposed 173 dB SPL.

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Once again, the Navy relies on studies of temporary threshold shift in captive animals for its primary source of data. DEIS 3-118 to 119. Marine mammal scientists have long recognized the deficiencies of using captive subjects in behavioral experiments, and to blindly rely on this material, to the exclusion of copious data on animals in the wild, is not supportable by any standard of scientific inquiry. Cf. 40 C.F.R. § 1502.22. The problem is exacerbated further by the fact that the subjects in question, roughly two belugas and five bottlenose dolphins, are highly trained animals that have been working in the Navy's research program in the SPAWAR complex for years.[45] Indeed, the disruptions observed by Navy scientists, which included pronounced, aggressive behavior ("attacking" the source) and avoidance of feeding areas associated with the exposure, occurred during a research protocol that the animals had been rigorously trained to complete.[46] The SPAWAR studies have several other major deficiencies that NMFS, among others, has repeatedly pointed out. In relying so heavily on them, the Navy has once again ignored the comments of numerous marine mammal behaviorists on the Navy's USWTR DEIS, which sharply criticized the Navy for putting any serious stock in them.[47] 16

In addition, the Navy appears to have misused data garnered from the Haro Strait incident—one of only three data sets it considers—by including only those levels of sound received by the "J" pod of killer whales when the USS Shoup was at its closest approach. DEIS at 3-120. These numbers represent the maximum level at which the pod was harassed; in fact, the whales were reported to have broken off their foraging and to have engaged in significant avoidance behavior at far greater distances from the ship, where received levels would have been orders of magnitude lower.[48] Not surprisingly, then, the Navy's results are inconsistent with other studies of the effects of various noise sources, including mid-frequency sonar, on killer whales. We must insist that the Navy provide the public with its propagation analysis for the Haro Strait event, and also describe precisely how this data set, along with results from the SPAWAR 17

[45] See, e.g., S.H. Ridgway, D.A. Carder, R.R. Smith, T. Kamolnick, C.E. Schlundt, and W.R. Elsberry, Behavioral Responses and Temporary Shift in Masked Hearing Threshold of Bottlenose Dolphins, Tursiops truncates, to 1-Second Tones of 141 to 201 dB re 1 μPa (1997) (SPAWAR Tech. Rep. 1751, Rev. 1).

[46] C.E. Schlundt, J.J. Finneran, D.A. Carder, and S.H. Ridgway, Temporary Shift in Masked Hearing Thresholds of Bottlenose Dolphins, Tursiops truncates, and White Whales, Delphinapterus leucas, after Exposure to Intense Tones, 107 Journal of the Acoustical Society of America 3496, 3504 (2000).

[47] See comments from M. Johnson, D. Mann, D. Nowacek, N. Soto, P. Tyack, P. Madsen, M. Wahlberg, and B. Møhl, received by the Navy on the Undersea Warfare Training Range DEIS. These comments, and those of the fishermen cited below, are hereby incorporated into this letter. See also Letter from Rodney F. Weiher, NOAA, to Keith Jenkins, Naval Facilities Engineering Command Atlantic (Jan. 30, 2006); Memo, A.R. document 51, NRDC v. Winter, CV 06-4131 FMC (JCx) (undated NOAA memorandum).

[48] See,. e.g., NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington—5 May 2003 at 4-6 (2005).

Response:

16. The Navy relies upon these studies because they are the most controlled studies of behavioral reactions to sound exposure available and provide the greatest amount of data. The studies recorded baseline behavior of the test subjects over many sessions so that behavioral alterations could be defined as a deviation from normal behavior. The sound exposure level received by each animal was recorded and quantified. The exposure signals used were close to the frequencies typically employed by MFA sonar. No other study provides the same degree of control or relevance to signal type as the TTS studies from which much of the behavioral response thresholds are derived.

    The data from these studies are the best available scientific data both with respect to quality and quantity. Data from animals in the wild were utilized when sufficient information on animal behavior (both baseline and reactionary) and sound exposure levels existed. It is recognized that this represents a sparse amount of data. Utilization of the copious other studies with inadequate control, observational periods, or ability to determine exposure levels of the animals introduces a large amount of guesswork and estimation that weakens any numerical association between behavioral reactions and sound exposure. Furthermore, the deficiencies of the TTS studies referred to in the comment were acknowledged in the original behavioral analysis. NMFS is aware of these deficiencies yet still approves of the usage of the data at this time because of the quality and quantity of the data. As quality data continues to be collected on animals in the wild, the relevance of the behavioral data collected during the TTS studies will decrease and they will eventually be replaced. However, at this time, they provide the best available data for assessing the relationship between behavioral reactions and sound exposure.

17. The three data sets used to calculate the mid-point of the risk function were weighted equally. The Haro Strait data were appropriately applied. NMFS and the Navy included the best available and most applicable data in the development of the risk function. While recognizing there is incomplete and unavailable information with regard to behavioral impacts on marine mammals, NMFS and the Navy closely coordinated the development of the risk function to represent the best available science. The cutoff for the risk function curve extends to 120 dB SPL specifically to encompass uncertainty and the potential for behavioral reactions in marine mammal species that may be affected by sounds perceived at levels just above ambient.

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and Nowacek et al. studies, were factored into its development of the behavioral risk function.

The Navy also fails to include data from the July 2004 Hanalei Bay event, in which 150-200 melon-headed whales were embayed for more than 24 hours during the Navy's Rim of the Pacific exercise. According to the Navy's analysis, predicted mean received levels (from mid-frequency sonar) inside and at the mouth of Hanalei Bay ranged from 137.9 dB to 149.2 dB.[49] The Navy has from the beginning denied any connection between its major international exercise and the mass stranding. DEIS at E-31 to D-34. However, the Navy's specious reasoning is at odds with the stranding behavior observed during the event and with NMFS' report on the matter, which ruled out every other known potential factor and concluded that sonar was the "plausible if not likely" cause.[50] The Navy's failure to incorporate these numbers into its methodology as another data set is unjustifiable. 18

Furthermore, the risk function should have taken into account the social ecology of some marine mammal species. For species that travel in tight-knit groups, an effect on certain individuals can adversely influence the behavior of the whole. (Pilot whales, for example, are prone to mass strand for precisely this reason; the plight of the 200 melon-headed whales in Hanalei Bay, and of the "J" pod of killer whales in Haro Strait, may be pertinent examples.) Should those individuals fall on the more sensitive end of the spectrum, the entire group or pod can suffer significant harm at levels below what the Navy would take as the mean. In developing its "K" parameter, the Navy must take account of such potential indirect effects. 40 C.F.R. § 1502.16(b). 19

We must also note that he Navy's exclusive reliance on sound pressure levels ("SPLs") in setting a behavioral threshold is misplaced. The discussion in the DEIS speaks repeatedly of uncertainty in defining the risk function and recapitulates, in its summary of the earlier methodology, the benefits implicit in the use of a criterion that takes duration into account. It is therefore appropriate for the Navy to set dual thresholds for behavioral effects, one based on SPLs and one based on energy flux density levels ("ELs"). 20

Finally, and as noted below in the discussion of Cumulative Impacts, the Navy's threshold is applied in such a way as to preclude any assessment of long-term behavioral impacts on marine mammals. It does not account, to any degree, for the problem of repetition: the way that apparently insignificant impacts, such as 21

[49] Navy, 2006 Supplement to the 2002 Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment D-1 to D-2 (May 2006).

[50] B.L. Southall, R. Braun, F.M.D. Gulland, A.D. Heard, R.W. Baird, S.M. Wilkin, and T.K. Rowles, Hawaiian Melon-Headed Whale (Peponacephala electra) Mass Stranding Event of July 3-4, 2004 (2006) (NOAA Tech. Memo. NMFS-OPR-31).

Response:

18. The Hanalei Bay "stranding" was discussed in the Draft EIS/OEIS, Section E.4.2.2 of Appendix E. Investigations of Hanalei Bay concluded that it was not known what caused the pod to enter the bay. The report indicated that sonar "may have contributed to a 'confluence of events', including human presence (notably the uncontrolled and random human interactions fragmenting the pods of whales on 3 July) and/or other unknown biological or physical factors.'

    Although the NMFS report concludes that MFAS was "… a plausible, if not likely, contributing factor in what may have been a confluence of events" other evidence indicates this was an instance of natural, although uncommon, behavior. Recent information on the Hanalei Bay stranding or "out of habitat event" showed MFAS may not have influenced this event. The lunar phase (near full moon) may have influenced the distribution of prey species of the melon-headed whales (Mobley et al. 2007). A simultaneous event of a mixed group of melon-headed whales and rough toothed dolphins that entered a bay at Rota Island with no associated Navy activity (Jefferson et al., 2006), and anecdotal evidence of previous events of dolphins entering bays in Hawaii to feed all occurred with no presence of Navy sonar.

19. The modeling undertaken does so, as explained in the Draft EIS/OEIS, Section 3.5.2, based on marine mammal densities evenly distributed over the entire area of potential effect. This is conservative since the tendency is to overestimate effects given that marine mammals appearing in pods will be easier to detect and therefore be avoided by use of the Navy's standard operating procedures serving as mitigation measures.

20. In this case, the Navy is using dual thresholds for assessing impacts on marine mammals by use of the sound exposure level (SEL) energy metric and the sound pressure level (SPL) behavioral criteria.

21. The thresholds and methodologies used represent the application of best available science to quantify acoustic behavioral impacts at the lowest levels that are consistent with the meaning of Level B harassment under the MMPA. This allows each individual exposure per day to be counted as harassment. To the extent that repeated exposures to the same individual are counted as separate "takes", repetition is accounted for. There is no rigorous method by which estimates of long-term "cumulative harassment" to individuals can be calculated. At present, it is speculative to suggest that exposures to sound levels below the threshold for an adverse behavioral reaction might have a longer-term adverse effect on those individuals. Examples of this phenomenon are unknown. It is equally plausible to suggest that habituation to sound levels may occur, reducing the effect over time.

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subtle changes in dive times or vocalization patterns, can become significant if experienced repeatedly or over time.[51] 21 (cont.)

In sum, the Navy has established thresholds and a risk function that are fundamentally inconsistent with the scientific literature on acoustic impacts and with marine mammal science in general. Indeed, using these thresholds to support a final EIS would violate NEPA.

B. Modeling of Acoustic Impacts

The Navy bases its calculation of marine mammal impacts on a series of models that determine received levels of sound within a limited distance of a sonar array and then estimate the number of animals that would therefore suffer injury or disruption. It is difficult to fully gauge the accuracy and rigor of these models with the limited information that the DEIS provides; but even from the description presented here, it is clear that they are deeply flawed. Among the non-conservative assumptions that are implicit in the model: 22

(1) As discussed above, the thresholds established for injury and behavioral effects are inconsistent with the available data and are based, in part, on assumptions not acceptable within the field;

(2) The Navy does not properly account for reasonably foreseeable reverberation effects (as in the Haro Strait stranding incident),[52] giving no indication that its modeling sufficiently represents areas in which the risk of reverberation is greatest;

(3) The model fails to consider the possible synergistic effects of using multiple sources, such as ship-based sonars, in the same exercise, which can significantly alter the sound field. It also fails to consider the combined effects of multiple exercises, which, as NMFS indicates, may have played a role in the 2004 Hanalei Bay strandings;[53]

(4) In assuming animals are evenly distributed, the model fails to consider the magnifying effects of social structure, whereby impacts on a single animal within a pod, herd, or other unit may affect the entire group;[54] and 23

[51] The importance of this problem for marine mammal conservation is reflected in a recent NRC report, which calls for models that, inter alia, translate such subtle changes into disruptions in key activities like feeding and breeding that are significant for individual animals. National Research Council. Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects 35-68 (2005).

[52] NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington, 5 May 2003 (2005).

[53] Southall et al., Hawaii Melon-Headed Whale at 31, 45.

[54] The effects of this deficiency are substantially increased by the Navy's use of a risk function, rather than an absolute threshold, to estimate Level B harassment.

Response:

22. The Draft EIS/OEIS sonar acoustic analysis used a risk function methodology provided by NMFS for the Navy. The methodology is thoroughly detailed in Section 3.5.2 and Appendix C and D. Data from the Haro Strait incident, the only data set available of the behavioral responses of wild, non-captive animal upon exposure to the AN/SQS-53 MFA sonar, were incorporated into this risk function. The Navy has used the best available scientific data in this analysis. The comment extrapolates concerns relevant to large-scale, multi-ship exercises, which do not apply to the RDT&E activities undertaken by NUWC Keyport. To the extent that they occur, the modeling does consider the effects of topography-bathymetry on sound propagation (Appendix C). As noted in the previous comment-response O1-21, multiple exposures are counted independently; this elevates the estimated number of takes and is therefore conservative.

23. As explained in the Draft EIS/OEIS, Appendix C, the modeling is based on marine mammal densities evenly distributed over the entire area of potential effect. This is conservative since the tendency is to overestimate effects given that marine mammals appearing in pods will be easier to detect and therefore be avoided by use of the Navy's standard operating procedures serving as mitigation measures. See O1-21 response regarding suggested cumulative effects on individuals. The suggested cumulative effects on groups of marine mammals are largely accounted for in the estimation of individual takes. Otherwise, the suggested higher-level effects on group dynamics and behavior are unknown, discussion of such effects would be speculative, and the results unquantifiable.

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(5) The model, in assuming that every whale encountered during subsequent exercises is essentially a new whale, does not address cumulative impacts on the breeding, feeding, and other activities of species and stocks. 23 (cont.)

To comply with NEPA, the Navy must revise its flawed modeling systems and make them available to the public.

IV. IMPACTS ON MARINE MAMMALS

The Navy's analysis of marine mammal distribution, habitat abundance, population structure and ecology contains false, misleading or outdated assumptions that tend to both underestimate impacts on species and to impede consideration of reasonable alternatives and mitigation measures.

A. Impacts on Wildlife in the Olympic Coast National Marine Sanctuary

The QUTR site (and proposed expansion) lies within the Olympic Coast National Marine Sanctuary ("NMS"), a region of extraordinary biological diversity. Twenty-nine species of marine mammals occur in the Olympic Coast NMS, including eight threatened or endangered species of whales, otters and pinnipeds. The sanctuary provides important regular foraging habitat for humpback and killer whales, including the endangered Southern Resident killer whale population (see below). Gray whales use the sanctuary during biannual migrations between calving and feeding areas, and a small, possibly distinct, group of gray whales known as "summer residents" use the area for feeding every summer. Additional cetacean species that have been observed in the waters of the sanctuary include: minke whales, fin whales, sei whales, sperm and pygmy sperm whales, blue whales, Hubb's beaked whale, Cuvier's beaked whale, Baird's beaked whale, Stejneger's beaked whale, Risso's dolphin, false killer whale, common dolphin, northern right whale dolphin, Pacific white-sided dolphin, Dall's porpoise, and harbor porpoise. Sea otters, Steller and California sea lions, harbor seals and elephant seals use near-shore areas within the sanctuary, haul out on land at a number of locations along the coast, and use deeper waters for foraging. A recent NOAA report identified both military activities and underwater noise pollution as two of several emerging threats to the Olympic Coast NMS.[55] The report recognizes that noise pollution has the potential to compromise habitat quality for the marine mammals, fishes and other wildlife that inhabit the sanctuary. In particular, it finds that "an increase in Navy activity or areas of operation, if not properly controlled, could have potential to disturb the seabed, introduce pollutants associated with test systems, and produce sound energy that could negatively alter the acoustic environment within the sanctuary."[56] 24

In addition to marine mammals, the Olympic Coast NMS includes habitat for abundant fish and invertebrate species, including many commercially important fish and shellfish. Thirty species of rockfish (including 13 species of concern in Washington state), as well 25

[55] NOAA, Olympic Coast National Marine Sanctuary, Condition Report 2008 (September 2008).

[56] Id. at 31.

Response:

24. Relevant data on marine mammals were included in the Draft EIS/OEIS, Section 3.5.8. The referenced report is concerned with all types of noise and all types of military activities, and does not contain any evidence that activities associated with NUWC Keyport have been or would be detrimental to sanctuary resources. Section 3.5.8.3 addresses the potential impacts relevant to NUWC Keyport activities.

25. Fish and invertebrates and risks to them associated with the Proposed Action were considered in the Draft EIS/OEIS in Sections 3.4.4 and 3.2.4, respectively. State-sensitive fish species do not have Federal status, but impacts on their habitats, i.e. EFH, have been sufficiently considered. Sensitive deepwater communities are not known to occur in the action area based on the Navy's Marine Resources Assessment study.

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as Pacific halibut, herring, Pacific cod, Pacific whiting, lingcod, sablefish, Dungeness crab, razor clams, and five species of Pacific salmon (Chinook, sockeye, pink, chum and coho) inhabit sanctuary waters. Threatened species in the sanctuary include the Olympic Coast populations of Ozette sockeye salmon and bull trout. Unique assemblages of cold-water corals and sponges, including gorgonians, stony corals and giant cup corals, have been found in the deeper waters of the sanctuary. 25 (cont.)

Despite the abundance of marine mammals, fish and invertebrates, as well as habitat for those species, the DEIS dismisses any significant risk to wildlife. Without further analysis, such a breezy conclusion does not pass NEPA muster.

B. Impacts on Southern Resident Killer Whales

The Extension overlaps with critical habitat designated for Southern Resident killer whales. This population, which is recognized as a Distinct Population Segment and protected under the Endangered Species Act, declined by nearly 20% between 1996 and 2001. A further decline in population numbers was observed in 2007, indicating that Southern Resident killer whales remain at high risk. Several anthropogenic factors have been implicated in the decline, including high contaminant loads of PCBs and PBDEs detected in blubber samples, declining prey availability due to overfishing and possibly climate change, and effects from vessels and noise pollution.[57] The National Marine Fisheries Service recognizes acoustic effects as one of the principle potential threats facing this population, and in its Final Recovery Plan for the Southern Resident killer whale population, proposed to "continue agency coordination and use of existing ESA and MMPA mechanisms to minimize potential impacts from anthropogenic sound."[58] The considerable uncertainty regarding the relative impacts of noise as well as other threats implies that additional anthropogenic stressors to the population should be minimized wherever possible. In particular, any additional incursions into critical habitat must be carefully evaluated for their impact on the extinction probability for this population.[59] As demonstrated by the events of May 5, 2003 in the Strait of Juan de Fuca and Haro Strait (described in further detail in section I.A., "Strandings and Mortalities Associated with Active Sonar"), exposure to military sonar is known to disrupt the behavior of southern resident killer whales, and thus particular attention is warranted to the location of any exercises involving sonar. Yet the DEIS completely dismisses the possibility of the potential impacts of Navy sonar on the endangered Southern Resident killer whale community and their endangered salmonid prey. DEIS 3-188 to 3-190. To comply with NEPA, the Navy must fully analyze these impacts. 26

[57] NMFS, Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*), (Jan. 17, 2008).

[58] Id. at v.

[59] See, e.g., Robert McClure, Are the orcas starving?, seattlepi.com (Oct. 24, 2008), available at http://seattlepi.nwsource.com/local/384854_orcas25.html (noting that as salmon numbers decline, seven killer whales have most likely died, bringing the population down to 83).

Response:

26. Effects on killer whales have been considered in the Draft EIS/OEIS, as well as in the separate Biological Evaluation and LOA application. Based on the analysis of impacts to salmonids and other fish in Section 3.4, there are minimal if any impacts to fish, indicating no potential indirect effects on marine mammals that feed on fish.

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C. Other Impacts on Marine Mammals

The activities proposed for the Extension can have impacts that are not limited to the effects of ocean noise. Unfortunately, the Navy's analysis of most of these other impacts is cursory and inadequate.

(1) The Navy fails to adequately assess the impact of "stress" on marine mammals, a serious problem for animals exposed even to moderate levels of sound for extended periods.[60] DEIS at 3-109. As the Navy has previously observed, stress from ocean noise—alone or in combination with other stressors, such as biotoxins—may weaken a cetacean's immune system, making it "more vulnerable to parasites and diseases that normally would not be fatal."[61] Moreover, according to studies on terrestrial mammals, chronic noise can interfere with brain development, increase the risk of myocardial infarctions, depress reproductive rates, and cause malformations and other defects in young—all at moderate levels of exposure.[62] Because physiological stress responses are highly conservative across species, it is reasonable to assume that marine mammals would be subject to the same effects, particularly—as appears to be the case here—if they are resident animals exposed repeatedly to a variety of stressors in the Keyport Range Complex area. Yet despite the potential for stress in marine mammals and the significant consequences that can flow from it, the Navy unjustifiably assumes that such effects would be minimal. 27

(2) The Navy fails to consider the risk of ship collisions with large cetaceans, as exacerbated by the use of active acoustics. DEIS 4-9, 13, 18. For example, right whales have been shown to engage in dramatic surfacing behavior, increasing their vulnerability to ship strikes, on exposure to mid-frequency alarms above 133 dB re 1 μPa (SPL)—a level of sound that can occur 28

[60] See National Research Council, Ocean Noise and Marine Mammals.

[61] Navy, Hawaii Range Complex Draft Environmental Impact Statement/ Overseas Environmental Impact Statement at 5-19 to 5-20 (2007). Additional evidence relevant to the problem of stress in marine mammals is summarized in A.J. Wright, N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C.Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L. Weilgart, B. Wintle, G. Notarbartolo di Sciara, and V. Martin, "Do marine mammals experience stress related to anthropogenic noise?", 20 International Journal of Comparative Psychology, 274-316 (2007); see also T.A. Romano, M.J. Keogh, C. Kelly, P. Feng, L. Berk, C.E. Schlundt, D.A. Carder, and J.J. Finneran, Anthropogenic Sound and Marine Mammal Health: Measures of the Nervous and Immune Systems Before and After Intense Sound Exposure, 61 Canadian Journal of Fisheries and Aquatic Sciences 1124, 1130-31 (2004).

[62] See, e.g., E.F. Chang and M.M. Merzenich, Environmental Noise Retards Auditory Cortical Development, 300 Science 498 (2003) (rats); S.N. Willich, K. Wegscheider, M. Stallmann, and T. Keil, Noise Burden and the Risk of Myocardial Infarction, European Heart Journal (2005) (Nov. 24, 2005) (humans); F.H. Harrington and A.M. Veitch, Calving Success of Woodland Caribou Exposed to Low-Level Jet Fighter Overflights, 45 Arctic vol. 213 (1992) (caribou).

Response:

27. There are no data regarding increased stress on marine mammals as a result of sonar. A discussion of potential effects of stress was presented in the Draft EIS/OEIS, Section 3.5.2. In general, studies on high levels of continuous noise effects on terrestrial species cannot be correlated with marine mammal species in the ocean exposed to intermittent and temporary exposure to relatively low sound pressure levels.

28. Ship strikes were discussed in the Draft EIS/OEIS, Section 3.5.6.2, 3.5.7.2, and 3.5.8.2; the risk of collisions associated with NUWC Keyport activities is considered nil due to lookouts and the slow-moving nature of the activities. Results of the research by Nowacek et al (2004), where right whales reacted to an "alert stimuli", used a sound source that has almost no correlation to MFA sonar. The results of that study were, however, used to develop the risk function from which the quantification of predicted exposures was derived.

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many tens of miles away from the sonar systems slated for the range.[63] It should be assumed that other large whales (which, as the DEIS repeatedly notes, are already highly susceptible to vessel collisions) are subject to the same hazard. 28 (cont.)

(3) In the course of its training activities, the Navy would release a host of toxic chemicals into the marine environment that could pose a threat to local wildlife over the life of the range. Nonetheless, the DEIS fails to consider the cumulative impacts of these toxins on marine mammals, from past, current, and proposed training exercises. DEIS 4-9, 13, 18. Careful study is needed into the way toxins might disperse and circulate around the area and how they may affect marine wildlife. The Navy's analysis of hazardous materials is therefore inadequate under NEPA. 29

(4) The Navy does not adequately analyze the potential impact of oil spills, particularly to the critically endangered Southern Resident killer whales. With the Puget Sound area being the world's third largest Navy homeport and the Nation's third largest container port complex, Canada's largest Port and one of this Nation's high volume oil ports means that there is a significant risk of an oil spill. The largest oil spill to occur in Washington waters was a result of the Navy vessel General Meiggs (releasing 2.3 million gallons). More recently, on August 4, 2006 the USS Nevada, a Navy Trident submarine based at Naval Base Kitsap-Bangor, severed the towline of the tug Phyllis Dunlap and its barge at the entrance to the Strait of Juan de Fuca. The tug Phyllis Dunlap was transiting with two empty barges when the incident took place. This incident is very similar to one that occurred off of Cape Flattery in October 2003 when the US Navy sub Topeka separated an empty oil barge from its tow. NOAA considers the possibility of a large spill to be one of the most important short-term threats to killer whales and other coastal organisms in the northeastern Pacific.[64] 30

(5) Finally, the Navy's analysis cannot be limited only to direct effects, i.e., effects that occur at the same time and place as the training exercises that would be authorized. 40 C.F.R. § 1508.8(a). It must also take into account the activity's indirect effects, which, though reasonably foreseeable (as the DEIS acknowledges), may occur later in time or are further removed. 40 C.F.R. § 1508.8(b). This requirement is particularly critical in the present case given the potential of sonar exercises to cause significant long-term impacts not clearly observable in the short or immediate term (a serious problem, as the 31

[63] Nowacek et al., North Atlantic Right Whales, 271 Proceedings of the Royal Society of London, Part B: Biological Sciences at 227. The North Pacific right whale is an endangered species closely related to the studied North Atlantic right whale.

[64] Krahn, M. M., P. R. Wade, S. T. Kalinowski, M. E. Dahlheim, B. L. Taylor, M. B. Hanson, G. M. Ylitalo, R. P. Angliss, J. E. Stein, and R. S. Waples. 2002. Status review of southern resident killer whales (Orcinus orca) under the Endangered Species Act. NOAA Technical Memorandum NMFS-NWFSC-54, U.S. Department of Commerce, Seattle, Washington.

Response:

29. Navy Shipboard Pollution Prevention (OPNAVINST 5090.1C, Chapter 22) strictly prohibits discharges of petroleum-based products, ballast, or other waste, and mandates effective cleanup of any discharges that do occur. The incidental loss of expended materials has been considered in the Draft EIS/OEIS, e.g., Section 3.6.1.1 and 3.6.1.2, and the analysis indicates no degradation of sediment or water quality has occurred as a result of these activities, nor would it occur with the Proposed Action. Given these results, there is no reason to expect that Navy activities would contribute to cumulative chemical effects on marine biota.

30. Potential oil spills and the Navy's procedures to minimize such risks are described in the Draft EIS/OEIS, e.g., Section 3.6.1.1 and 3.6.1.2. As stated in the Draft EIS/OEIS, NUWC Keyport activities represent a very small fraction of the large vessel activity – the primary source of oil spill risk, amounting to thousands of vessel transits annually - that occurs in Puget Sound and on the outer coast. For quantification of such vessel traffic, refer to data published by the Washington State Department of Ecology Spill Prevention, Preparedness and Response Program at http://www.ecy.wa.gov/biblio/0608002.html.

31. The potential for indirect effects on marine mammals has been considered in Section 3.5.2 in developing the methodology for assessing acoustic impacts, and it is thereby acknowledged that direct acoustic harassment of an individual can lead to other, indirect effects. The likely existence of such effects is accounted for in the estimation of "take" and they are otherwise not predictable or amenable to quantification.

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> National Research Council has observed).[65] Thus, for example, the Navy must not only evaluate the potential for mother-calf separation but also the potential for indirect effects—on survivability—that might arise from that transient change. 40 C.F.R. § 1502.16(b). 31 (cont.)

Without further consideration of these impacts, the DEIS does not pass NEPA muster.

V. IMPACTS ON FISH AND FISHERIES

Fish are important food stock for other fish, seabirds and marine mammals, as well as support important commercial, recreational and Tribal fishing and fisheries. These comments will focus mainly on the impacts of anthropogenic sound on fish. Though the architecture of their ears may differ, fish are equipped, like all vertebrates, with thousands of sensory hair cells that vibrate with sound; and a number of specialized organs like the abdominal sac, called a "swim bladder," that some species possess can boost hearing. Fish use sound in many of the ways that marine mammals do: to communicate, defend territory, avoid predators, and, in some cases, locate prey.[66] 32

One series of recent studies showed that passing airguns can severely damage the hair cells of fish (the organs at the root of audition) either by literally ripping them from their base in the ear or by causing them to "explode."[67] Fish, unlike mammals, are thought to regenerate hair cells, but the pink snapper in these studies did not appear to recover within approximately two months after exposure, leading researchers to conclude that the damage was permanent.[68] It is not clear which elements of the sound wave contributed to the injury, or whether repetitive exposures at low amplitudes or a few exposures at higher pressures, or both, were responsible.[69] Yet the DEIS dismisses this study, noting only that "it is hard to speculate" why it differed from a study conducted by a scientist contracted by the Navy. DEIS at B-27.

Sound has also been shown to induce temporary hearing loss in fish. Even at fairly moderate levels, noise from outboard motor engines is capable of temporarily deafening some species of fish, and other sounds have been shown to affect the short-term hearing of a number of other species, including sunfish and tilapia.[70] For any fish that is

[65] "Even transient behavioral changes have the potential to separate mother-offspring pairs and lead to death of the young, although it has been difficult to confirm the death of the young." National Research Council, Ocean Noise and Marine Mammals at 96.

[66] See, e.g., A.N. Popper, Effects of Anthropogenic Sounds on Fishes, 28(10) Fisheries 26-27 (2003); M.C. Hastings & A.N. Popper, Effects of Sound on Fish 19 (2005) (Report to the California Department of Transportation, Contract No. 43A0139), p., 19; D.A. Croll, Marine Vertebrates and Low Frequency Sound—Technical Report for LFA EIS 1-90 (1999).

[67] R. McCauley, J. Fewtrell, and A.N. Popper, High Intensity Anthropogenic Sound Damages Fish Ears, 113 Journal of the Acoustical Society of America 640 (2003).

[68] Id. at 641 (some fish in the experimental group sacrificed and examined 58 days after exposure).

[69] Id.

[70] A.R. Scholik and H.Y. Yan, Effects of Boat Engine Noise on the Auditory Sensitivity of the Fathead Minnow, Pimephales promelas, 63 Environmental Biology of Fishes 203-09 (2002); A.R. Scholik and

Response:

32. These effects were considered in the Draft EIS/OEIS. Refer to Appendix B, and its incorporation into the analysis of Section 3.4.2.2, 3.4.3.2, and 3.4.4.2.

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dependent on sound for predator avoidance and other key functions, even a temporary loss of hearing (let alone the virtually permanent damage seen in snapper) will substantially diminish its chance of survival.[71] 32 (cont.)

Hearing loss is not the only effect that ocean noise can have on fish. For years, fisheries in various parts of the world have complained about declines in their catch after intense acoustic activities (including naval exercises) moved into the area, suggesting that noise is seriously altering the behavior of some commercial species.[72] A group of Norwegian scientists attempted to document these declines in a Barents Sea fishery and found that catch rates of haddock and cod (the latter known for its particular sensitivity to low-frequency sound) plummeted in the vicinity of an airgun survey; in another experiment, catch rates of rockfish were similarly shown to decline.[73] Drops in catch rates in these experiments range from 40 to 80 percent.[74] A variety of other species, herring, zebrafish, pink snapper, and juvenile Atlantic salmon, have also been observed to react to various noise sources with acute alarm.[75] Despite acknowledging that these studies found a decline in catch rate associated with airgun use (DEIS at B-29), the DEIS nonetheless concluded that there would be no adverse effects on fish. DEIS 3-66, 83, 86, 97, 100. Such a conclusion is at odds with the scientific literature. 33

The Navy's conclusion also ignores the literature on noise exposure and fish development. A number of studies, including one on non-impulsive noise, show that

H.Y. Yan, The Effects of Noise on the Auditory Sensitivity of the Bluegill Sunfish, Lepomis macrochirus, 133 Comparative Biochemisty and Physiology Part A at 43-52 (2002); M.E. Smith, A.S. Kane, & A.N. Popper, Noise-Induced Stress Response and Hearing Loss in Goldfish (Carassius auratus), 207 Journal of Experimental Biology 427-35 (2003); Popper, Effects of Anthropogenic Sounds at 28.

[71] See Popper, Effects of Anthropogenic Sounds at 29; McCauley et al., High Intensity Anthropogenic Sound Damages Fish Ears, at 641.

[72] See "'Noisy' Royal Navy Sonar Blamed for Falling Catches," Western Morning News, Apr. 22, 2002 (sonar off the U.K.); Percy J. Hayne, President of Gulf Nova Scotia Fleet Planning Board, "Coexistence of the Fishery & Petroleum Industries," www.elements.nb.ca/theme/fuels/percy/hayne.htm (accessed May 15, 2005) (airguns off Cape Breton); R.D. McCauley, J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe, Marine Seismic Surveys: Analysis and Propagation of Air-Gun Signals, and Effects of Air-Gun Exposure on Humpback Whales, Sea Turtles, Fishes, and Squid 185 (2000) (airguns in general).

[73] A. Engås, S. Løkkeborg, E. Ona, and A.V. Soldal, Effects of Seismic Shooting on Local Abundance and Catch Rates of Cod (Gadus morhua) and Haddock (Melanogrammus aeglefinus), 53 Canadian Journal of Fisheries and Aquatic Sciences 2238-49 (1996); J.R. Skalski, W.H. Pearson, and C.I. Malme, Effects of Sound from a Geophysical Survey Device on Catch-Per-Unit-Effort in a Hook-and-Line Fishery for Rockfish (Sebastes spp.), 49 Canadian Journal of Fisheries and Aquatic Sciences 1357-65 (1992). See also S. Løkkeborg and A.V. Soldal, The Influence of Seismic Exploration with Airguns on Cod (Gadus morhua) Behaviour and Catch Rates, 196 ICES Marine Science Symposium 62-67 (1993).

[74] Id.

[75] See J.H.S. Blaxter and R.S. Batty, The Development of Startle Responses in Herring Larvae, 65 Journal of the Marine Biological Association of the U.K. 737-50 (1985); F.R. Knudsen, P.S. Enger, and O. Sand, Awareness Reactions and Avoidance Responses to Sound in Juvenile Atlantic Salmon, Salmo salar L., 40 Journal of Fish Biology 523-34 (1992); McCauley et al., Marine Seismic Surveys at 126-61.

Response:

33. Appendix B in the Draft EIS/OEIS included new findings by Popper et al. (2007) who exposed rainbow trout, a fish sensitive to low frequencies, to high-intensity low-frequency sonar (215 dB re 1 μPa2 170-320 Hz) with receive level for two experimental groups estimated at 193 dB for 324 or 648 seconds. Fish exhibited a slight behavioral reaction, and one group exhibited a 20-dB auditory threshold shift at one frequency. No direct mortality, morphological changes, or physical trauma was noted as a result of these exposures. While low-frequency sonar is not included in the Proposed Action, these results of low-frequency sonar effects on low-frequency sensitive rainbow trout are encouraging in that similar results may be found with mid-frequency active sonar use when applied to mid-frequency sensitive fish. The effects of airguns (used in seismic surveys) on fish are undoubtedly more extreme than those of MFA because of the intensity and broad-bandwidth of the airgun sound source.

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intense sound can kill eggs, larvae, and fry outright or retard their growth in ways that may hinder their survival later.[76] Significant mortality for fish eggs has been shown to occur at distances of 5 meters from an airgun source; mortality rates approaching 50 percent affected yolksac larvae at distances of 2 to 3 meters.[77] Also, larvae in at least some species are known to use sound in selecting and orienting toward settlement sites.[78] Acoustic disruption at that stage of development could have significant consequences.[79] The DEIS dismisses such studies as "in need of replication" (DEIS at B-32); however, the Navy cannot ignore those studies simply because they are contrary to its interest. 33 (cont.)

Although the Navy does attach one scientific article on the effects of sonar on fish (DEIS at Appendix B), it nevertheless capriciously dismisses the potential for adverse impacts on fish. DEIS 3-66, 83, 86, 97, 100. The Navy must rigorously analyze the potential for behavioral, auditory, and physiological impacts on fish, including the potential for population-level effects, using models of fish distribution and population structure and conservatively estimating areas of impact from the available literature. 40 C.F.R. § 1502.22. It must also provide appropriate mitigation measures, such as avoidance of spawning grounds and of important habitat for fish species, especially hearing specialists. Finally, the Navy should consider excluding important fish habitat in the Extension area. 34

VI. OTHER IMPACTS ON MARINE WILDLIFE

As discussed above, the Navy's proposed training activities pose risks to marine life other than that associated with ocean noise, such as injury or death from collisions with ships, bioaccumulation of toxins, and stress. These same concerns that apply to marine mammals apply to fish, sea turtles, and other biota as well. The Navy must adequately evaluate impacts and propose mitigation for each category of harm. 40 C.F.R. §§ 1502.14, 1502.16. 35

VII. IMPACTS ON WILDLIFE VIEWING INTERESTS

The DEIS does not adequately consider the effects on wildlife-viewing and other wildlife-dependent recreational interests from the proposal's impacts on marine 36

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[76] See, e.g., C. Booman, J. Dalen, H. Leivestad, A. Levsen, T. van der Meeren, and K. Toklum, Effecter av luftkanonskyting på egg, larver og yngel (Effects from Airgun Shooting on Eggs, Larvae, and Fry), 3 Fisken og Havet 1-83 (1996) (Norwegian with English summary); J. Dalen and G.M. Knutsen, Scaring Effects on Fish and Harmful Effects on Eggs, Larvae and Fry by Offshore Seismic Explorations, in H.M. Merklinger, Progress in Underwater Acoustics 93-102 (1987); A. Banner and M. Hyatt, Effects of Noise on Eggs and Larvae of Two Estuarine Fishes, 1 Transactions of the American Fisheries Society 134-36 (1973); L.P. Kostyuchenko, Effect of Elastic Waves Generated in Marine Seismic Prospecting on Fish Eggs on the Black Sea, 9 Hydrobiology Journal 45-48 (1973).

[77] Booman et al., Effecter av luftkanonskyting på egg, larver og yngel at 1-83.

[78] S.D. Simpson, M. Meekan, J. Montgomery, R. McCauley, R., and A. Jeffs, Homeward Sound, 308 Science 221 (2005).

[79] Popper, Effects of Anthropogenic Sounds at 27.

Response:

34. See previous response to O1-33. Reduced catch rates and any associated economic effects are not anticipated. The potential effects on fish from sonar will be negligible as most fish hear below the range of mid-frequency active sonar. Although some fishes may detect sonar, they will likely not respond to it, and it will not affect their hearing. A discussion of sonar and its effects on fishes was provided in the Draft EIS/OEIS, Section 3.4.2.2, 3.4.3.2, and 3.4.4.2 and Appendix B.

35. Non-acoustic effects were carefully considered in the Draft EIS/OEIS, as indicated by separate subheadings and discussions of these potential impacts for Terrestrial Wildlife (Section 3.1.2.2 for Keyport and corresponding sections for DBRC and QUTR), Sea Turtles (Section 3.3.4.2), Fish (Section 3.4.2.2 for Keyport and corresponding sections for DBRC and QUTR), and Marine Mammals (Section 3.5.6.2 for Keyport and corresponding sections for DBRC and QUTR).

36. Since no changes in wildlife numbers or distribution are anticipated, no secondary effects on wildlife viewing would be anticipated. As described in Sections 3.8.1.2, 3.8.2.2, and 3.8.3.2, no impacts on recreational access are anticipated.

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mammals. The DEIS makes no mention of the value lost from the harm to marine mammals that attract a number of our organizational members and members of the public to the potentially affected sites. One of NEPA's explicit purposes is to "assure esthetically and culturally pleasing surroundings," 42 U.S.C. 4331(b)(2), and caselaw makes clear that an agency must adequately consider such recreational impacts in its NEPA analysis. See, e.g., Lujan v. NWF, 497 U.S. 871, 887 (1990) ("no doubt that recreational use and aesthetic enjoyment are among the sorts of interests NEPA were specifically designed to protect"); LaFlamme v. FERC, 852 F.2d 389, 401 (1988) (because "there were substantial questions raised regarding whether the project may significantly affect recreational use in the project area, and that FERC failed to explain or discuss or discuss" these impacts, the court found that "this record reflects a decision which is neither 'fully informed or well-considered,'" and therefore concluded the agency's decision not to prepare an EIS was unreasonable). 36 (cont.)

VIII. ALTERNATIVES ANALYSIS

NEPA requires agencies to consider alternatives to their proposed actions. To comply with NEPA, an EIS must "inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1. This alternatives requirement has been described in regulation as "the heart of the environmental impact statement." Id. § 1502.14. The courts describe the alternatives requirement equally emphatically, citing it as the "linchpin" of the EIS. Monroe County Conservation Council v. Volpe, 472 F.2d 693 (2d Cir. 1972). The agency must therefore "[r]igorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." 40 C.F.R. § 1502.14(a). Consideration of alternatives is required by (and must conform to the independent terms of) both sections 102(2)(C) and 102(2)(E) of NEPA.

The Navy's alternatives analysis misses the mark. The DEIS purports to present alternatives for each of its proposed expansions: the preferred alternative for the Keyport Range Site (the only action reviewed); two alternatives for the DBRC Site; and three alternatives for QUTR Site; as well as a no-action alternative for each site. DEIS at 2-8. There are numerous problems, however, with its approach.

A. Failure to Identify Environmental Impact-Based Alternatives

The Navy claims it "considers potential environmental impacts" while executing its responsibilities under federal law, including NEPA. DEIS at 1-1. However, nothing could be further from the truth. The Navy's alternatives were not selected to "inform decision-makers and the public" of how the Navy could "avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1. Instead, as discussed in the DEIS and below, the Navy chose alternatives based on factors unrelated to the proposed action's environmental impacts. 37

Response:

37. The comment ignores the inclusion of the No-Action Alternative, which is given full consideration and is clearly a means of avoiding the impacts of the Proposed Action. In addition, this comment reveals a fundamental failure to comprehend both the nature of Navy RDT&E requirements and the mission of NUWC Keyport in meeting these requirements which underpins the discussion of the Proposed Action and alternatives in Chapter 1 and Chapter 2.

The Navy's range planning efforts do not assume a priori, as the commenter suggests, that its RDT&E cannot occur elsewhere. Those planning efforts do assume, contrary to the commenter's assumption, that there is a required level of Navy RDT&E to be conducted, and that it must occur somewhere. As explained in Chapter 2 of the Draft EIS/OEIS, an alternative that would decrease Navy RDT&E from current levels would not meet the purpose and need of the Proposed Action. A reduction in levels of RDT&E within the NAVSEA NUWC Keyport Range Complex would not support the Navy's ability to meet Federal statutory requirements. In addition, a reduction in RDT&E could jeopardize the ability of naval forces to be ready and qualified for deployment.

The statement of the purpose and need for the agency action appropriately defines the range of alternatives to be addressed in an EIS. In identifying the purpose and need for a major Federal action, the agency must consider the goals of Congress, such as those expressed in the agency's statutory authorization to act. With regard to the NAVSEA NUWC Keyport Range Complex, the purpose and need for the agency action is clearly defined in the Draft EIS/OEIS (Section 1.2).

The Navy has developed and fully analyzed appropriate alternatives based on this statement of the purpose and need for the Proposed Action. The Draft EIS/OEIS does not, as this comment suggests, summarily dismiss geographic and seasonal exclusions from its alternatives analysis. Alternatives that would impose limitations on RDT&E locations within the Range Complex, or seasonal constraints on RDT&E would not support the purpose and need. The analysis mandated by NEPA is not an evaluation of alternative means to accomplish the general goal of an action. Rather, alternatives to be evaluated should be those that reasonably satisfy the specific purpose and need for the agency action. The underlying need is not to generally conduct Navy RDT&E in the Range Complex. The underlying need is to conduct RDT&E of a specific nature, type, and scope that is required to ensure Navy personnel and units are properly equipped and fully trained. (Continued)

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Further, at no point in the DEIS does the Navy discuss how the alternatives pose different environmental choices for the public and decisionmakers. The DEIS fails entirely to comply with NEPA's regulations, requiring the Navy to "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among option by the decisionmaker and the public." 40 C.F.R. § 1502.14. The Navy fails to sharply define the environmental issues applicable to each alternative and include these differences in a comparison of alternatives. There is simply no comparison of the risks and benefits of each alternative site showing what is and is not known and what species and habitats would be most at risk from each alternative.

B. Identification of Alternative Sites

As an initial matter, the DEIS misses the mark completely on the proposed expansion for the Keyport Range. Ignoring NEPA's regulations requiring the inclusion of "reasonable alternatives" (40 C.F.R. § 1502.14(c) (emphasis added)), the Navy fails to provide and analyze any alternative for the Keyport Range expansion other than a no-action alternative. This is clearly insufficient. 37 (cont.)

Further, the DEIS tells the public very little about how it determined the boundaries of alternative sites (when it actually supplies alternative sites). For example, the DEIS fails to explain why each of the alternatives for the QUTR Site, which is currently 48.3 square nautical miles, include an expansion of the site to the entire W-237A special use airspace, which is approximately 1,800 square nautical miles. DEIS at 2-16 to 2-26. There is no explanation as to why none of the alternatives discuss a smaller expansion. Further, the DEIS fails to show how it picked the three different shore sites. Along approximately 35-miles of coastline, the DEIS merely discusses the conveniences of each shore site. Ibid. But at no point in the site selection process described in the DEIS are impacts to marine resources considered. DEIS at 2-9 to 2-26.

But not all of the factors of convenience discussed in the DEIS seem crucial enough to justify their wholesale dictation of location for the sites. The DEIS makes clear, for example, that in selecting QUTR Alternative 2 as its preferred alternative, the Navy relied upon matters of convenience such as the fact that "[t]he beach north of Annelyde Gap Road is open for driving year-round." DEIS at 2-26. The DEIS apparently finds this to be an "asset." Ibid. Under these circumstances, siting of the QUTR expansion because a road is open year round may work to the convenience of the Navy but is not necessary.

Factors of mere convenience alone cannot dictate an agency's choice of alternatives to evaluate in an EIS. An agency must discuss all reasonable alternatives – those that will accomplish the purpose and need of the agency and are practical and feasible – not simply those it finds most convenient. 40 C.F.R. § 1502.14. "The primary purpose of the impact statement is to compel federal agencies to give serious weight to environmental factors in making discretionary choices." I-291 Why? Ass'n v. Burns, 372 F.Supp. 233, 247 (D. Conn. 1974). If an agency is permitted to consider and

Response:

37 (Cont.) The Draft EIS/OEIS appropriately limits its analysis to alternatives that meet the Navy's congressionally-mandated mission requirements. Through the NEPA process, a Federal agency must certainly take a "hard look" at the potential environmental consequences of the Proposed Action. The Navy is unaware, however, of authority for the commenter's proposition that NEPA requires the Navy to take a "hard look" at geographical alternatives that, in the considered expertise of the Navy, do not meet the purpose and need of the Proposed Action.

The Navy has carefully defined its objectives and offers appropriate alternatives to achieve them. To implement its Congressional mandates, the Navy needs to support and to conduct current and emerging RDT&E in the NAVSEA NUWC Keyport Range Complex. To accomplish its mission, NUWC Keyport needs to extend the areas within which RDT&E activities managed by NUWC Keyport presently occur. The objectives set forth in this Draft EIS/OEIS are both reasonable and necessary. Consideration of alternative geographic siting does not support the Navy's purpose and need and is not required within the choice of alternatives. Consideration of alternative locations for RDT&E conducted on the Range Complex was rejected from further analysis because it does not meet the purpose and need of the Proposed Action.

Therefore, this EIS/OEIS meets NEPA requirements in informing the public of all reasonable alternatives.

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compare the environmental impacts of its proposed action with only other, equally convenient alternatives – and permitted to omit from such analysis any alternatives that are less convenient, no matter that they might result in significant environmental benefits – this purpose would be thwarted.

As an example in this case, posit an expansion of the QUTR site that meets the operational requirements of the Fleet with respect to geography and bathymetry, according to the Navy's own analysis. Then assume that the location would be vastly safer for marine life than the three action alternatives presented in the DEIS, perhaps because marine life is less abundant there. Under the analysis used by the Navy to select its action alternatives, such a location could easily have been omitted simply because it was slightly further from convenient roads or would require a marginally more expensive transit. Such a result is not permissible under NEPA; indeed NEPA's EIS requirement is aimed precisely at ensuring that policy-makers and the public are aware of such potential trade-offs and environmental benefits before discretionary decisions are made. Trout Unlimited v. Morton, 509 F.2d 1276, 1282 (9th Cir. 1974). 37 (cont.)

Carefully siting the range to avoid concentrations of vulnerable and endangered species and high abundances of marine life is the most critical step the Navy can take in reducing the environmental impacts of this project. Because the Navy has failed to undertake an alternatives analysis that allows it to make an informed siting choice, the DEIS is inadequate and must be withdrawn.

C. Other Reasonable Alternatives

Even aside from the omission of reasonable alternative locations, the DEIS fails to consider any alternatives beyond alternative sites. While the question of proper siting is crucial, it is not the only factor that must be considered in identifying other, less harmful ways to fulfill the Navy's purpose. Indeed, it appears that many reasonable alternatives are missing from the Navy's analysis that might fulfill that purpose while reducing harm to marine life and coastal resources. For example:

(1) The DEIS fails entirely to consider seasonal restrictions on the use of the range. Instead, all of the action alternatives propose year-round use without regard to seasonal variations in marine mammal and fish abundance. This is true despite the well-documented seasonal migrations of numerous endangered species. For example, the Southern Resident killer whale population of Puget Sound, totaling less than 90 whales, lives in the area only during the spring and summer. Studies have shown that killer whales engage in dramatic flight behavior – increasing their exposure to ship strikes – in response to mid-frequency signals.[80] Yet the DEIS fails even to consider the feasibility of 38

[80] See,. e.g., NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington—5 May 2003 at 4-6 (2005).

Response:

38. Seasonal restrictions would not be consistent with the purpose and need for the action because of the importance of conducting RDT&E under a variety of realistic conditions. Furthermore, a priori seasonal restrictions would not be warranted unless there was a clear cause and effect between the timing of activities and a significant resource impact. In the Draft EIS/OEIS, no such impacts have been identified.

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avoiding these seasonal migrations, or any other seasonal variation in marine life abundance. This omission is plainly unacceptable. 38 (cont.)

(2) The DEIS fails to include a range of mitigation measures among its alternatives. Many such measures are employed by other countries in their sonar exercises and even by the U.S. Navy in other contexts, as discussed below at section IX; and there are many others that should be considered. Such measures are reasonable means of reducing harm to marine life and other resources on the proposed range, and their omission from the alternatives analysis renders that analysis inadequate. 39

(3) The Navy declines to consider a reduction in the level of proposed training in the Keyport Range Complex. Yet the Navy's assumption that sonar exercises must occur at the level proposed may well be an artifact of the Navy's Tactical Training Theater Assessment and Planning Program (TAP) process, which, in requiring separate environmental analysis of existing ranges and operating areas, seems to assume a priori that exercises cannot be reapportioned. 40

(4) The Navy's statement of purpose and need contains no language that would justify the limited set of alternatives that the Navy considers (or the alternative it ultimately prefers). Yet it is a fundamental requirement of NEPA that agencies preparing an EIS specify their project's "purpose and need" in terms that do exclude full consideration of reasonable alternatives. 40 C.F.R. § 1502.13; City of Carmel-by-the-Sea v. United States Dep't of Transp., 123 F.3d 1142, 1155 (9th Cir. 1997) (citing Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 196 (D.C. Cir. 1991)). "The existence of a viable but unexamined alternative renders an environmental impact statement inadequate," Idaho Conservation League v. Mumma, 956 F.2d 1508, 1519 (9th Cir. 1992), and an EIS errs when it accepts "as a given" parameters that it should have studied and weighed. Simmons v. U.S. Army Corps of Eng'rs, 120 F.3d 664, 667 (7th Cir. 1997). 41

In sum, the DEIS shortchanges or omits from its analysis reasonable alternatives – with regard to both the siting of the range and other operational choices – that might achieve the Navy's core aim of testing and training while minimizing environmental harm. For these reasons, we urge the Navy to withdraw its DEIS or to issue a supplemental EIS that adequately informs the public of all reasonable alternatives that would reduce adverse impacts to whales, fish, and other resources. 40 C.F.R. § 1502.1.

IX. MITIGATION MEASURES

A. General Mitigation

To comply with NEPA, an agency must discuss measures designed to mitigate its project's impact on the environment. See 40 C.F.R. § 1502.14(f). There is a large and growing set of options for the mitigation of noise impacts to marine mammals and other marine life, some of which have been imposed by navies—and by the Navy itself, in

Response:

39. Mitigation measures have been identified where appropriate and necessary to reduce impacts, such as in the ROP. The Draft EIS/OEIS found the extent of "harm" to be minimal, being of limited scale and severity, such that additional mitigation measures are not warranted.
40. Reduction of RDT&E would not meet the mission. The comment incorrectly links RDT&E planning to Fleet training activities being evaluated through the TAP process. RDT&E is inherently variable and must be flexible and responsive to new technology. The EIS/OEIS has used a reasonable worst-case (i.e. maximum) estimate of the number and types of activities that would occur in order to allow that flexibility and responsiveness.
41. See response to O1-37.

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other contexts—to limit harm from high-intensity sonar exercises. Yet here the Navy does little more than set forth a cribbed set of measures, falling short even of what other navies have implemented for transient exercises and providing no discussion on a variety of other options. 42

All of the mitigation that the Navy has proposed for acoustic impacts boils down to the following: a very small safety zone around the sonar source, maintained primarily with visual monitoring by personnel with other responsibilities, with aid from passive monitoring when personnel are already using such technology. Under the proposed scheme, operators would shut down the system if a marine mammal is detected within 1,000 yards. DEIS at 3-154 to 3-155, 3-169, 3-198 to 3-199. 43

This mitigation scheme disregards the best available science on the significant limits of that technique. Detection rates for marine mammals generally only approach 5 percent. Moreover, the species perhaps most vulnerable to sonar-related injuries, beaked whales, are among the most difficult to detect because of their small size and diving behavior. It has been estimated that in anything stronger than a light breeze, only one in fifty beaked whales surfacing in the direct track line of a ship would be sighted; as the distance approaches 1 kilometer, that number drops to zero.[81] The Navy's reliance on visual observation as the mainstay of its mitigation plan is therefore profoundly misplaced.

Moreover, the Navy's analysis ignores or improperly discounts an array of options that have been considered and imposed by other active sonar users, including avoidance of coastal waters, high-value habitat, and complex topography; the employment of a safety zone more protective than the 1,000-yard shutdown proposed by the Navy; general passive acoustic monitoring for whales; special rules for surface ducting and low-visibility conditions; monitoring and shutdown procedures for sea turtles and large schools of fish; and many others.[82] The Navy's conclusions are all the more remarkable given recent court decisions finding that the Navy can and must do more to reduce harm to protected species from sonar training. NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd 518 F.3d 658 (9th Cir. 2008); Ocean Mammal Institute v. Gates, 546 F.Supp.2d 960 (D. Haw. 2008). 44

B. Measures the Navy Should Adopt

The Navy should include the following measures, inter alia:

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[81] J. Barlow and R. Gisiner, Mitigating, Monitoring, and Assessing the Effects of Anthropogenic Noise on Beaked Whales, 7 Journal of Cetacean Research and Management 239-249 (2006).

[82] See, e.g., Royal Australian Navy, "Maritime Activities Environmental Management Plan," Procedure S-1 and Planning Guide 16 (July 8, 2005); NATO Undersea Research Centre, Human Diver and Marine Mammal Risk Mitigation Rules and Procedures (2006) (NURC-SP-2006-008); ICES, Report of the Ad-hoc Group on the Impacts of Sonar on Cetaceans and Fish 33-36 (2005) (ICES CM 2005/ACE:06). The U.S. Navy has also used additional mitigation measures for various exercises in the past.

Response:

42. It is unreasonable to suggest the application of mitigation measures developed for large-ship, high intensity sonar use during large-scale training exercises, to the much smaller scale and intensity of activity associated with RDT&E. As made clear in the scenarios described in Chapter 2 of the Draft EIS/OEIS, RDT&E activities are fundamentally different from large-ship, large-scale training exercises. Measures appropriate and specific to the action are identified in the Draft EIS/OEIS.

43. See response to O1-5. Marine mammals can and will be detected and avoided before sonar impacts from RDT&E occur. For inland waters the areas are small, the animals fewer. The speeds are lower and the numbers of vessels are less and they are smaller. Mitigation is in keeping with size of the activity. The LOA request to NMFS includes estimates of "take" if this mitigation measure is not effective, and the results of NMFS' review will be reflected in the ROD.

44. See previous response O1-43. Additional safeguards are incorporated as were described in Table 2-8 of the Draft EIS/OEIS. Again, the uncritical application of mitigation measures developed for large sonar training exercises elsewhere is not warranted here.

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(1) Establishment of a coastal exclusion zone for acoustics training and testing in the QUTR action area, such as one that would exclude activities shoreward of the 1,500 meter isobath;

(2) Seasonal avoidance of marine mammal feeding grounds, calving grounds, and migration corridors;

(3) Avoidance of or extra protections in federal and state marine protected areas, including the Olympic Coast National Marine Sanctuary, Waketickeh Creek Marine Protected Area, Copalis Marine Protected Area, Quillayute Needles Marine Protected Area, and other Marine Protected Areas and Marine Sanctuaries in the areas considered.

(4) Avoidance of bathymetry likely to be associated with high-value habitat for species of particular concern, including submarine canyons and large seamounts, or bathymetry whose use poses higher risk to marine species; 45

(5) Avoidance of fronts and other major oceanographic features, such as the California Current, warm core rings, and other areas with marked differentials in sea surface temperatures, which have the potential to attract offshore concentration of animals, including beaked whales;[83]

(6) Avoidance of areas with higher modeled takes or with high-value habitat for particular species;

(7) Concentration of exercises to the maximum extent practicable in abyssal waters and in surveyed offshore habitat of low value to species;

(8) Use of sonar and other active acoustic systems at the lowest practicable source level, with clear standards and reporting requirements for different testing and training scenarios;

(9) Expansion of the marine species "safety zone" to a 4km shutdown, reflecting international best practice, or 2 km, reflecting the standard prescribed by the California Coastal Commission and adopted in NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd 518 F.3d 658 (9th Cir. 2008);[84]

[83] See, e.g., Carretta et al., U.S. Pacific Marine Mammal Stock Assessments: 2007 at 142 (reporting that "Baird's beaked whales have been seen primarily along the continental slope from late spring to early fall.").

[84] California Coastal Commission, Adopted Staff Recommendation on Consistency Determination CD-08606 (2007); Approved Letter from M. Delaplaine, California Coastal Commission, to Rear Adm. Len Hearing, Navy (Jan. 11, 2007).

Response:

45. The comment suggests the application of mitigation measures that in most cases would be incompatible with the action's purpose and need, and presume that substantial harm to the environment would otherwise occur, which is not the case. In some cases, measures are already being implemented. Following are itemized responses to suggested measures:

    1) Excluding the use of acoustics from shoreward of the 1,500 meter isobath would be an unprecedented new restriction in an area that historically supports acoustic training and RDT&E as authorized under the OCNMS regulations.

    2) Seasonal avoidance of marine mammal locations is not warranted by the extent of impacts or vulnerability of the animals, as indicated in Sections 3.5.6.2, 3.5.7.2, and 3.5.8.2.

    3) Protected areas would not be adversely impacted (Section 3.9).

    4) Use of variable bathymetry is essential to the purpose and need. Such areas would experience minimal impacts due to expendable materials.

    5) Avoidance of such large-scale oceanographic features would be incompatible with the purpose and need without demonstrable benefit.

    6) Avoidance of habitat features would be incompatible with the purpose and need without demonstrable benefit.

    7) Same as #6.

    8) Sonar use is specific to the RDT&E requirement being addressed. Standard reporting requirements are already observed.

    9) Such safety zones would be impractical and unnecessary.

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(10) Suspension of relocation of exercises when beaked whales or significant aggregations of other species, such as killer whales, are detected by any means within the orbit circle of an aerial monitor or near the vicinity of an exercise;

(11) Use of simulated geography (and other work-arounds) to reduce or eliminate chokepoint exercises in near-coastal environments, particularly within canyons and channels, and use of other important habitat;

(12) Avoidance or reduction of training during months with historically significant surface ducting conditions, and use of power-downs during significant surface ducting conditions at other times;

(13) Use of additional power-downs when significant surface ducting conditions coincide with other conditions that elevate risk, such as during exercises involving the use of multiple systems or in beaked whale habitat; 45 (cont.)

(14) Planning of ship tracks to avoid embayments and provide escape routes for marine animals;

(15) Suspension or postponement of chokepoint exercises during surface ducting conditions and scheduling of such exercises during daylight hours;

(16) Use of dedicated aerial monitors during chokepoint exercises, major exercises, and near-coastal exercises;

(17) Use of dedicated passive acoustic monitoring to detect vocalizing species, through established and portable range instrumentation and the use of hydrophone arrays off instrumented ranges;

(18) Modification of sonobuoys for passive acoustic detection of vocalizing species;

(19) Suspension or reduction of exercises outside daylight hours and during periods of low visibility;

(20) Use of aerial surveys and ship-based surveys before, during, and after major exercises;

(21) Use of all available range assets for marine mammal monitoring;

(22) Use of third-party monitors for marine mammal detection;

(23) Establishment of long-term research, to be conducted through an independent agent such as the National Fish and Wildlife Foundation, on the distribution, abundance, and population structuring of protected species in the

Response:

45 (Cont.)

10) Consistent with the ROP (Table 2-8), sonar use is suspended when marine mammals are in the vicinity.
11) Same as #6.
12) Same as #6.
13) Same as #6.
14) The scenario suggesting entrapment of marine mammals in narrow confines is not relevant to the NUWC Keyport range sites.
15) Chokepoint exercises are not part of the RDT&E activities.
16) Same as #15.
17) Passive acoustics are and will continue to be used in conjunction with other monitoring.
18) Sonobuoy modification is not warranted for the limited scope and scale of activities undertaken by NUWC Keyport alone.
19) This is already implemented as warranted by conditions as part of the ROP (Table 2-8).
20) Infeasible and not warranted for NUWC Keyport activities.
21) Not warranted; inconsistent with the purpose and need.
22) Not warranted; Navy monitors are well trained.
23) Not warranted; the presumption that such areas must be identified and avoided by RDT&E is unjustified.

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Keyport Range Complex, with the goal of supporting adaptive geographic avoidance of high-value habitat;

(24) Application of mitigation prescribed by state regulators, by the courts, by other navies or research centers, or by the U.S. Navy in the past or in other contexts;

(25) Avoidance of fish spawning grounds and of important habitat for fish species potentially vulnerable to significant behavioral change, such as wide-scale displacement within the water column or changes in breeding behavior;

(26) Avoidance of high-value sea turtle habitat; 45 (cont.)

(27) Evaluating before each major exercise whether reductions in sonar use are possible, given the readiness status of the strike groups involved;

(28) Dedicated research and development of technology to reduce impacts of active acoustic sources on marine mammals;

(29) Establishment of a plan and a timetable for maximizing synthetic training in order to reduce the use of active sonar training;

(30) Prescription of specific mitigation requirements for individual classes (or sub-classes) of testing and training activities, in order to maximize mitigation given varying sets of operational needs; and

(31) Timely, regular reporting to NOAA, state coastal management authorities, and the public to describe and verify use of mitigation measures during testing and training activities.

Consideration of these measures is minimally necessary to satisfy the requirements of NEPA, and we note that similar or additional measures may be required under the Marine Mammal Protection Act, Endangered Species Act, and other statutes.

The Navy's proposal for protecting endangered sea turtles is likewise lacking. Though admitting that the endangered turtles face dangers from ship strikes, the Navy will only avoid interactions with sea turtles "when feasible." DEIS at 3-42. The DEIS's conclusion that this measure is sufficient such that no additional mitigation measures for sea turtles are necessary is inadequate. In addition, the Navy states that there "would be minimal impacts to marine fish" but refuses to offer any mitigation measures for those impacts. See, e.g., DEIS at 3-100. The Navy must address possible mitigation measures in any final document. 46

In addition, the Navy states that the "presence of marbled murrelets…can reasonably be anticipated, and hence the species may be affected, and accordingly, the Navy is consulting with USWFS." DEIS at 3-7. This statement is wholly inadequate under 47

Response:

45 (Cont.)

24) Such mitigations have not been shown to be necessary, and what the comment suggests would be an unlawful delegation of Navy authority.

25) Absent the presumed impact, the measure is unwarranted.

26) No such habitat is present in the action area.

27) Irrelevant to RDT&E.

28) The Navy as a whole supports such research.

29) Irrelevant to RDT&E, the purpose of which is field testing, and unwarranted to reduce impacts.

30) The mitigation measures contained in the ROP (Table 2-8) are sufficient for the variety of RDT&E activities conducted.

31) Annual reporting to NMFS already occurs. NUWC Keyport reporting is in accord with applicable statutory/regulatory requirements.

46. As discussed in Section 3.3, sea turtle encounters would be extremely rare in any case, but we have deleted the words "when feasible" for the Final EIS/OEIS to reinforce that these animals will be avoided. The statement of minimal impacts reflects the absence of circumstances that would engender harm to populations or important habitats. Mitigation in such cases would be of little benefit.

47. The Draft EIS/OEIS did consider and describe potential impacts to marbled murrelets in Sections 3.1.2.2, 3.1.3.2, and 3.1.4.2. These are the subject of consultation with USFWS, the results of which will be reflected in the ROD.

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NEPA as it defers decision making and fact finding without public comment and potentially after the expansion decision is finalized. Furthermore, no mitigation is considered, let alone offered, for any effects on diving birds, let alone the marbled murrelet, which "is presumed to be especially vulnerable to waterborne disturbances during molting when it cannot fly. Ibid. The Navy must address these issues in any final document. 47 (cont.)

X. CUMULATIVE IMPACTS

In order to satisfy NEPA, an EIS must include a "full and fair discussion of significant environmental impacts." 40 C.F.R. § 1502.1. It is not enough, for purposes of this discussion, to consider the proposed action in isolation, divorced from other public and private activities that impinge on the same resource; rather, it is incumbent on the Navy to assess cumulative impacts as well, including the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future significant actions." Id. § 1508.7. A meaningful cumulative impact analysis must identify (1) the area in which the effects of the proposed project will be felt; (2) the impacts that are expected in that area from the proposed project; (3) other actions—past, present, and proposed, and reasonably foreseeable—that have had or are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact that can be expected if the individual impacts are allowed to accumulate. Grand Canyon Trust v. FAA, 290 F.3d 339, 345 (D.C. Cir. 2002) (quotation and citation omitted). The Navy "cannot treat the identified environmental concern in a vacuum." TOMAC v. Norton, 433 F.3d 852, 863 (D.C. Cir. 2006) (quoting Grand Canyon Trust, 290 F.3d at 345).

The Navy's cumulative impact analysis fails to meet these basic requirements. The Navy provides no support for its conclusion that the sum of the various environmental impacts that are enumerated will not be significant; moreover the Navy's analysis cannot provide such support because the Navy fails to explain what the sum of these impacts is expected to be. The Navy capriciously assumes that its Extension will not result in the single death of an animal. Instead, the Navy anticipates that the sonar activities will have "minimal," "limited" and even "negligible" effects. DEIS at 4-7, 8, 12, 13, 17, 18. To reach this conclusion, it simply assumes that all behavioral impacts are short-term in nature and cannot affect individuals or populations through repeated activity – even though the anticipated takes at its preferred alternatives would affect the same populations. Further, the Navy does not even attempt to examine any specific marine mammal population affected by the Extension, particularly in the Olympic Coast National Marine Sanctuary. Indeed, the DEIS lacks any population analysis or quantitative assessment of long-term effects. 48

Nor does the Navy consider the potential for acute synergistic effects from sonar training. Although the DEIS discusses the potential for ship strike in the training area, it does not consider the greater susceptibility to vessel strike of animals that have been temporarily harassed or disoriented by certain noise sources. The absence of analysis is particularly glaring in light of the Haro Strait incident, in which killer whales and other

Response:

48. Cumulative impacts have been considered in the Draft EIS/OEIS. As required under NEPA, the level and scope of the analysis are commensurate with the potential impacts of the action as reflected in the resource-specific discussions in Chapter 4. The Draft EIS/OEIS did consider its activities alongside those of other activities in the region, among which are the NWTRC (Section 4.1.3). Also note that the Keyport EIS process began before the TAP process. Therefore the public was advised in 2003 that NUWC Keyport would do a detailed analysis of the activities that are undertaken by this organization. This separation of the RDT&E application of sonar is unique and has not been folded into the Fleet Training analysis as had been done in Hawaii and SOCAL. This analysis describes in detail the smaller footprint of the RDT&E activities conducted by NUWC Keyport. NWTRC activities are included in the cumulative impact section of the EIS/OEIS and have been addressed in the NWTRC EIS/OEIS which was released to the public in December 2008.

    The potential additive effects of sonar exposure were considered in the development of thresholds and the methodology for assessing sonar impacts (Section 3.5.2). However, with regard to hypothetical synergistic effects of sub-TTS behavioral exposures, or of exposures to sound levels below currently accepted thresholds of response, there is no clear evidence that such effects occur, nor is there a rigorous, accepted quantitative basis to estimate such effects.

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marine mammals stampeded.[85] Neither does the Navy consider the synergistic effects of noise with other stressors in producing or magnifying a stress-response.[86] For these reasons alone, the Navy's conclusion that cumulative and synergistic impacts from sonar training are insignificant cannot plausibly be supported.

Although the Navy acknowledges that the Keyport Range Complex is crowded with human and military activities, many of which introduce noise, chemical pollution, debris, and vessel traffic into the habitat of protected species, it nonetheless concludes that only insignificant cumulative effects are anticipated. DEIS at 4-7, 8, 12, 13, 17, 18. The idea that all of these events, when taken as a whole, are having at most "limited" or "negligible" effects is, to say the least, implausible.

Given the scope of the proposed action, the deficiencies of the Navy's cumulative impacts assessment represents a critical failure of the DEIS. At a minimum, the Navy must evaluate the potential for cumulative impacts on populations that would occur on and near the Extension, clearly define the extent of expected cumulative impacts, and assess the potential for synergistic adverse effects (such as from noise in combination with ship-strikes). 48 (cont.)

In addition, the Navy must consider the cumulative impacts of the Keyport Range Complex Extension project in conjunction with the Northwest Training Range Complex expansion project. Regardless of whether the Navy considers these actions "connected" (which we would argue they are and must be considered in the same EIS), the effects of these two proposals must be considered together as "cumulative impacts." 40 C.F.R.§ 1508.25(c)(3). A cumulative impact is: "[T]he incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…. [c]umulative impacts can result from individually minor but collectively significant actions taking place over a period of time." 40 C.F.R. § 1508.7. Courts have found that even where several actions were not "connected" or "similar" enough to warrant consideration in a single EIS, their impacts must still be addressed as cumulative impacts. See Earth Island Institute v. U.S. Forest Service, 351 F.3d 1291, 1306 (9th Cir. 2003) ("Even if a single, comprehensive EIS is not required, the agency must still adequately analyze the cumulative effects of the projects within each individual EIS."). Because NEPA does

[85] Christopher Dunagan, Navy Sonar Incident Alarms Experts, Bremerton Sun, May 8, 2003.

[86] A.J. Wright, N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C.Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L. Weilgart, B. Wintle, G. Notarbartolo di Sciara, and V. Martin, "Do marine mammals experience stress related to anthropogenic noise?", 20 International Journal of Comparative Psychology, 274-316 (2007); see also Andrew J. Wright, Natacha Aguilar Soto, Ann L. Baldwin, Melissa Bateson, Colin M. Beale, Charlotte Clark, Terrence Deak, Elizabeth F. Edwards, Antonio Fernández, Ana Godinho, Leila Hatch, Antje Kakuschke, David Lusseau, Daniel Martineau, L. Michael Romero, Linda Weilgart, Brendan Wintle, Giuseppe Notarbartolo-di-Sciara, and Vidal Martin, "Anthropogenic noise as a stressor in animals: a multidisciplinary perspective," 20 International Journal of Comparative Psychology, 250-273 (2007).

Response:

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not allow the Navy to compartmentalize the impacts of the Keyport Range Extension and expansion of the Northwest Training Range Complex, the Navy must address the relationship between these two proposals and their cumulative impacts. Until the Navy considers the impacts of both projects, the DEIS is woefully inadequate. 48 (cont.)

XI. PROJECT DESCRIPTION AND MEANINGFUL PUBLIC DISCLOSURE

Disclosure of the specific activities contemplated by the Navy is essential if the NEPA process is to be a meaningful one. See, e.g., LaFlamme v. F.E.R.C., 852 F.2d 389, 398 (9th Cir. 1988) (noting that NEPA's goal is to facilitate "widespread discussion and consideration of the environmental risks and remedies associated with [a proposed action]").

With regard to noise-producing activities, for example, the Navy must describe source levels, frequency ranges, duty cycles, and other technical parameters relevant to determining potential impacts on marine life. The DEIS provides some of this information, but it fails to disclose sufficient information about helicopter dipping sonar, active sonobuoys, acoustic device countermeasures, training targets, or range sources that would be used during the exercise. DEIS at 1-19 to 1-23; DEIS at 3-133 to 3-136. And the DEIS refrains from giving any indication of platform speed, pulse length, repetition rate, beam widths, or operating depths—that is, most of the data that the Navy used in modeling acoustic impacts. DEIS at 3-134; DEIS at C-1 to C-15. 49

The Navy—despite repeated requests—has not released or offered to release CASS/GRAB or any of the other modeling systems or functions it used to develop the biological risk function or calculate acoustic harassment and injury. See, e.g., DEIS at C-10 to C-15. These models must be made available to the public, including the independent scientific community, for public comment to be meaningful under NEPA and the Administrative Procedure Act. 40 C.F.R. §§ 1502.9(a), 1503.1(a) (NEPA); 5 U.S.C. § 706(2)(D) (APA). In addition, guidelines adopted under the Data (or Information) Quality Act also require their disclosure. The Office of Management and Budget's guidelines require agencies to provide a "high degree of transparency" precisely "to facilitate reproducibility of such information by qualified third parties" (67 Fed. Reg. 8452, 8460 (Feb. 22, 2002)); and the Defense Department's own data quality guidelines mandate that "influential" scientific material be made reproducible as well. We encourage the Navy to contact us immediately to discuss how to make this critical information available. 50

XII. SCOPE OF REVIEW

As a threshold issue, we are concerned about the Navy's understanding of its obligations under applicable law. The Navy indicates that its analysis of "extraterritorial" activities, those activities that would take place outside U.S. territorial waters, was prepared under the authority of Executive Order 12114 rather than under NEPA. See DEIS at 1-28. Not only is this position on the scope of review inconsistent with the statute (see, e.g., Environmental Defense Fund v. Massey, 968 F.2d 528 (D.C. 51

Response:

49. Noise source data were provided in Table 3.5-6 of the Draft EIS/OEIS. These data parameterize the types of sources used in NUWC Keyport activities. Sources with lower output level or less time duration fall within the parameters of the types of sources analyzed. Worst case and most frequently used systems have been modeled for analysis to determine the effect the NUWC Keyport activities would have.

50. The model has been evolving in response to new data and will be subject to independent peer review for conferences or journal submissions. The Draft EIS/OEIS provides details for eight representative sources. These details include source levels, frequency ranges, run length and other technical parameters relevant to determining potential impact on marine life. Representative sources were used both to avoid information that was classified, and to model unknown future sources. Based on the information provided in the Draft EIS/OEIS, others with the required technical expertise can use the existing information to calculate similar results.

    The CASS/GRAB program is export-controlled and not available for public release; however, approximate results can be obtained using other mathematical models commonly available to those with the technical expertise to utilize those tools.

51. This is untrue. NEPA does not apply to actions whose effects occur beyond 12 nm; EO 12114 established the requirement for analysis of these actions. Continuing Navy activity within and beyond the 12 nm limit predates NEPA; only new *Proposed* Actions and the corresponding decisions on their implementation are subject to NEPA. As cited in the Draft EIS/OEIS (Section 1.6), there is previous NEPA compliance documentation on the three sites: Keyport AUV Fest EA, the DBRC Operations EA, and the OCNMS EIS.

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Cir. 1994) and NRDC v. Navy, No. CV-01-07781, 2002 WL 32095131 at *9-12 (C.D. Cal. Sept. 19, 2002)), but, insofar as it represents a broader policy, it provides further indication that current operations are likewise out of compliance. Most of the area used for sonar training is sited beyond the 12nm territorial boundary, within the U.S. Exclusive Economic Zone. If, as we expect, activities currently taking place there have not received their due analysis in a prior environmental impact statement, then the Navy is operating in ongoing violation of NEPA. 51 (cont.)

XIII. COMPLIANCE WITH OTHER APPLICABLE LAWS

A number of other statutes and conventions are implicated by the proposed activities. Among those that must be disclosed and addressed during the NEPA process are the following:

(1) The Marine Mammal Protection Act ("MMPA"), 16 U.S.C. § 1361 et seq., which requires the Navy to obtain a permit or other authorization from NMFS or the U.S. Fish and Wildlife Service prior to any "take" of marine mammals. The Navy must apply for an incidental take permit under the MMPA, and NRDC will submit comments regarding the Navy's application to NMFS at the appropriate time. 52

(2) The Endangered Species Act, 16 U.S.C. § 1531 et seq., which requires the Navy to enter into formal consultation with NMFS or the U.S. Fish and Wildlife Service, and receive a legally valid Incidental Take Permit, prior to its "take" of any endangered or threatened marine mammals or other species, including fish, sea turtles, and birds, or its "adverse modification" of critical habitat. See. e.g., 1536(a)(2); Romero-Barcelo v. Brown, 643 F.2d 835 (1st Cir. 1981), rev'd on other grounds, Weinberger v. Romero-Carcelo, 456 U.S. 304, 313 (1982). The Navy must consult with NMFS over numerous endangered and threatened species including, but not limited to, humpback whale, killer whale, north pacific right whale, blue whale, fin whale, sei whale, sperm whale, steller sea lion, snowy plover, marbled murrelet, spotted owl, leatherback sea turtles and other sea turtles, Puget Sound Chinook salmon, Hood Canal Summer-run chum salmon, Puget Sound steelhead trout, and coastal-Puget Sound bull trout.

(3) The Coastal Zone Management Act, and in particular its federal consistency requirements, 16 U.S.C. § 1456(c)(1)(A), which mandate that activities that affect the natural resources of the coastal zone—whether they are located "within or outside the coastal zone"—be carried out "in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs." The Navy must fulfill its CZMA commitments.

(4) The Magnuson-Stevens Fisheries Conservation and Management Act, 16 U.S.C. § 1801 et seq. ("MSA"), which requires federal agencies to "consult with

Response:

52. Compliance with other requirements was detailed in Table 4-3 of the Draft EIS/OEIS.

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the Secretary [of Commerce] with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken" that "may adversely affect any essential fish habitat" identified under that Act. 16 U.S.C. § 1855 (b)(2). In turn, the MSA defines essential fish habitat as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." 16 U.S.C. § 1802 (10). The preferred alternatives contain such habitat. As discussed at length above, anti-submarine warfare exercises alone have the significant potential to adversely affect at least the waters, and possibly the substrate, on which fish in these areas depend. Under the MSA, a thorough consultation is required.

(5) The Marine Protection, Research and Sanctuaries Act, 33 U.S.C. § 1401 et seq., which requires federal agencies to consult with the Secretary of Commerce if their actions are "likely to destroy, cause the loss of, or injure any sanctuary resource." 16 U.S.C. § 1434(d)(1). Since the Navy's exercises would cause injury and mortality of species, consultation is clearly required if sonar use takes place either within or in the vicinity of the sanctuary or otherwise affects its resources. Since sonar may impact sanctuary resources even when operated outside its bounds, the Navy should indicate how close it presently operates, or foreseeably plans to operate, to such sanctuary and consult with the Secretary of Commerce as required. 52 (cont.)

In addition, the Sanctuaries Act is intended to "prevent or strictly limit the dumping into ocean waters of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities" (33 U.S.C. § 1401(b)), and prohibits all persons, including Federal agencies, from dumping materials into ocean waters, except as authorized by the Environmental Protection Agency. 33 U.S.C. §§ 1411, 1412(a). The Navy has not indicated its intent to seek a permit under the statute.

(6) The Migratory Bird Treaty Act, 16 U.S.C. § 703 et seq. ("MBTA"), which makes it illegal for any person, including any agency of the Federal government, "by any means or in any manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation. 16 U.S.C. § 703. After the District Court for the D.C. Circuit held that naval training exercises that incidentally take migratory birds without a permit violate the MBTA, (see Center for Biological Diversity v. Pirie, 191 F. Supp. 2d 161 (D.D.C. 2002) (later vacated as moot)), Congress exempted some military readiness activities from the MBTA but also placed a duty on the Defense Department to minimize harms to seabirds. Under the new law, the Secretary of Defense, "shall, in consultation with the Secretary of the Interior, identify measures-- (1) to minimize and mitigate, to the extent practicable, any adverse impacts of authorized military readiness activities on affected species of migratory birds; and (2) to monitor the impacts of such military readiness activities on affected species of migratory birds." Pub.L. 107-314, § 315 (Dec. 2, 2002). As the Navy acknowledges, migratory birds occur within the preferred alternative. The Navy

Response:

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must therefore consult with the Secretary of the Interior regarding measures to minimize and monitor the effects of the proposed range on migratory birds, as required. 52 (cont.)

(7) Executive Order 13158, which sets forth protections for marine protected areas ("MPAs") nationwide. The Executive Order defines MPAs broadly to include "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." E.O. 13158 (May 26, 2000). It then requires that "[e]ach Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions," and that, "[t]o the extent permitted by law and to the maximum extent practicable, each Federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA." Id. The Navy must therefore consider and, to the maximum extent practicable, must avoid harm to the resources of all federally- and state-designated marine protected areas. 53

The proposed activities also implicate the Clean Air Act and Clean Water Act as well as other statutes protecting the public health. The USWTR exercises cannot legally be undertaken absent compliance with these and other laws. 54

XIV. CONFLICTS WITH FEDERAL, STATE, AND LOCAL LAND-USE PLANNING

NEPA requires agencies to assess possible conflicts that their projects might have with the objectives of federal, regional, state, and local land-use plans, policies, and controls. 40 C.F.R. § 1502.16(c). The Navy's training and testing activities may certainly affect resources in the coastal zone and within other state and local jurisdictions, in conflict with the purpose and intent of those areas. The consistency of Navy operations with these land-use policies must receive more thorough consideration. 55

XV. ALTERNATIVES ANALYSIS UNDER SECTION 102(2)(E) OF NEPA

Above and beyond the EIS requirement, NEPA directs agencies to "study, develop, and describe appropriate alternatives" to any project that presents "unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E). Courts have concluded that this duty is "both independent of, and broader than, the EIS requirement." Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1229 (9th Cir. 1988), cert. denied, 109 S.Ct. 1340 (1989). Because the Navy's proposal presents "unresolved conflicts" about the proper use of "available resources," the Navy must explicitly address its separate and independent obligations under section 4332(2)(E). 56

Response:

53. As stated in Table 4-3, MPAs had not been formally designated when the Draft EIS/OEIS was in preparation. The identification of MPAs is still in progress as described on the MPA website (http://mpa.gov/helpful_resources/inventory.html). MPAs that are overlapped by the action areas may ultimately be designated, but no harmful effects on these areas are anticipated.

54. Clean Air Act and Clean Water Act compliance are included in Table 4-3 of the Draft EIS/OEIS. Reference to USWTR does not apply.

55. The State of Washington Department of Ecology has concurred with the Navy's Coastal Consistency Determination. This information will be included in the Final EIS/OEIS.

56. There are not unresolved conflicts surrounding the Proposed Action.

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CONCLUSION

For the reasons set forth above, we urge the Navy to withdraw its DEIS and to revise the document to comply with federal law.

Very truly yours,

Michael Jasny
Senior Policy Analyst

Taryn Kiekow
Staff Attorney

Zak Smith
Litigation Fellow

Encl.: NRDC extension request letter

Response:

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NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Overnight Mail and Electronic Comment **<u>REQUEST FOR EXTENSION OF PUBLIC COMMENT PERIOD</u>**

October 22, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101
Phone: (360) 396-0927

Re: *Petition for Extension of Public Comment Period on NAVSEA NUWC Keyport Range Complex Extension Draft Environmental Impact Statement/ Overseas Environmental Impact Statement*

Dear Ms. Kler:

On behalf of the Natural Resources Defense Council ("NRDC") and our 1.2 million members and activists, I am writing to petition the Navy for an extension of the public comment period on its NAVSEA NUWC Keyport Range Complex Extension Draft Environment Impact Statement / Overseas Environmental Impact Statement. ("Keyport Range Complex Extension DEIS"). 57

Notice of the comment period was published in the Federal Register on September 12, 2008. <u>See</u> 73 Fed. Reg. 53002. The public has been given *only 45 days* to submit comments by October 27, 2008 on the over 700 pages of dense information. On the same day, the Navy released the latest DEIS for its planned development of an Undersea Warfare Training Range off the southeast coast of the United States, as well as a DEIS for sonar and other naval training exercises in the Cherry Point Operating Area off the coast of North Carolina. Although the DEISs were over 1,000 and 700 pages long respectively, the Navy once again limited its comment period to only 45 days. In light the simultaneous issuance of related documents, the dense information provided by the Navy in justifying its plans, and the extensive range of activity proposed, I respectfully request an extension to submit written comments of at least 45 days.

Such an extension is necessary to fully protect the public interest by giving citizens the time to thoroughly analyze the Navy's proposals and submit comments on these critical issues. The Navy's Keyport Range Complex Extension DEIS raises many new concerns.

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Response:

57. In order for the Navy to meet the required permit timelines with NMFS to continue activities in the NAVSEA NUWC Keyport Range Complex, the public comment period must remain at 45 days.

 The 45-day public comment period provided sufficient time for all commenters to review and comment on the Draft EIS/OEIS.

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Kimberly Kler
October 22, 2008
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Notably, the extension extends into the Olympic National Marine Sanctuary, affecting migration routes for gray and humpback whales as well as many other species. The public, as well as the scientific community, needs sufficient time to identify, analyze, and comment on this site expansion and on the Navy's analysis.

Because of the size of the Keyport Range Complex Extension DEIS and the many issues it raises, we believe that an extension is warranted here. Therefore, we strongly urge you to grant this petition and extend the comment period. As always, we would welcome discussion with the Navy at any time.

Very truly yours,

Taryn Kiekow

Taryn G. Kiekow
Staff Attorney, Marine Mammal Program
Natural Resources Defense Council

Response:

O2 – Olympic Coast National Marine Sanctuary Advisory Council *(page 1 of 13)*

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Olympic Coast National Marine Sanctuary
115 East Railroad Avenue, Suite 301
Port Angeles, WA 98362-2925

October 22, 2008

Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Ms. Kler:

As requested by the Olympic Coast National Marine Sanctuary Advisory Council, I am forwarding the enclosed comments on the U.S. Navy's Draft NAVSEA NUWC Keyport EIS/OEIS. These comments were developed by the advisory council's Keyport DEIS workgroup and presented to the full advisory council at a meeting on October 22, 2008. The advisory council discussed the comments and unanimously adopted them with modifications. This meeting was open to public participation.

As stated in the advisory council letter to the sanctuary superintendent, these comments represent the views of the advisory council only and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Olympic Coast National Marine Sanctuary.

The Olympic Coast National Marine Sanctuary is also preparing its own comments on the Keyport DEIS and will be forwarding them to NOAA for inclusion in the agency review of the document.

If you have any questions regarding the advisory council's comments, please direct them to me and I will refer them to the appropriate person on the advisory council. Thank you for the opportunity to provide comments.

Sincerely,

Carol Bernthal
Superintendent

Response:

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SANCTUARY ADVISORY COUNCIL

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NOAA Fisheries
U.S. Coast Guard
U.S. Navy
Northwest Straits Commission

Artwork: David Sones

October 22, 2008

Carol Bernthal, Superintendent
Olympic Coast National Marine Sanctuary
115 East Railroad Ave.
Port Angeles, WA 98362

Dear Ms. Bernthal:

On behalf of the Olympic Coast National Marine Sanctuary Advisory Council (SAC), I am forwarding to you comments on the U.S. Navy's NAVSEA Keyport Range Complex Extension DEIS (DEIS). These comments were developed by the Navy Keyport DEIS work group that was established by the advisory council to prepare comments. Subsequently, the advisory council discussed and adopted these comments unanimously at an advisory council meeting on October 22, 2008 that was convened for the purpose of considering these comments. The advisory council requests that you forward these comments to the appropriate persons in the U.S. Navy, as indicated in the Federal Register Notice, Vol. 68, No. 168 of September 11, 2008.

Support for "No Action" Alternative

In general, the advisory council does not believe that the Navy makes a compelling case for an expansion of this size, and prefers the No-Action Alternative among the range of alternatives posed by the DEIS. When the Olympic Coast National Marine Sanctuary 1
(OCNMS) was originally designated, there were activities specific to the Quinault Underwater Training Range (QUTR) as described in the OCNMS 1993 Final Environmental Impact Statement (FEIS) that were exempt from sanctuary regulations. Under the current proposal, roughly one-third of sanctuary waters would be impacted (see DEIS figure 2-6a). The advisory council is concerned that the proposed expansion of the QUTR from the current size of 48.3 nm^2 to 1,854.6 nm^2 (Alternative 3) will adversely effect a significantly larger portion of OCNMS waters, with the result that

Response:

1. See response to comment F2-3.

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additional types of habitats and living marine resources that do not occur in the present, smaller QUTR, would be impacted. Expansion also increases conflicts with present uses of the sanctuary. The advisory council believes that the needs of the Navy and the interests of the public could have been better served if there had been an alternative that included a much smaller QUTR operating area with a potential linked surf zone area. 1 (cont.)

Surf zone should be located outside OCNMS waters

The advisory council is further concerned about the request for a new surf-zone landing area inside the sanctuary. The activities listed in Table 2-6 in the surf-zone and intertidal areas within the sanctuary are incompatible uses of sanctuary resources. The table indicates that up to 40 unmanned undersea vehicle (UUV) activities are contemplated annually. In addition to impacting surf-zone, intertidal, and subtidal habitats and organisms, it would also impact other human uses of these areas at times when the Navy would deploys UUVs. Other activities intended to occur in the surf zone include inert mine detection, non-Navy testing, acoustic and non-acoustic sensors, and static in-water testing. Therefore, the advisory council prefers the surf-zone be located outside of the sanctuary, as contemplated in Alternative 3. For the reasons stated above, however, the advisory council does not endorse any of alternatives except the No-Action Alternative. 2

The advisory council finds the DEIS inadequate, as indicated by the following comments.

Resource impacts are inadequately assessed

The National Environmental Policy Act (NEPA) requires an EIS to provide a much more thorough analysis of the risks to each biological and environmental element than is provided in the present document. An EIS must also discuss alternatives and mitigation measures as well for each risk identified if they are critical to the subsequent analysis of potential impacts. The advisory council's understanding of the level of Navy activity is based on descriptions in Table 2-6. Activities beyond those levels would require additional environmental review.

Concerns include:

- Bottom contact activities (test vehicles, etc.) could impact areas of known fragile resources, or impact as-yet-unsurveyed seafloor habitat. Impacts on habitat-forming invertebrates such as deep sea corals are inadequately assessed in the DEIS. 3
- Increases in toxic substances could have substantial impacts through bioaccumulation. Bioaccumulation of toxics has not been addressed in the DEIS. 4
- Impacts to marine mammals are not adequately assessed in the DEIS. Citations on the effects of sonar on marine mammals are out-of-date. Proposed mitigation is inadequate. 5

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Response:

2. The Navy recognizes that the beach is a shared resource. Any request to the public to avoid foot or vehicle traffic in a particular location would be a) temporary - limited to the time when equipment and personnel are on the beach; and b) small in scope – limited to the area necessary to protect equipment and the public from inadvertent damage or injury. Impact to habitat would be minimal and temporary as described in Section 3.1.4.2.
3. No large-scale disturbance of the seabed is proposed or anticipated under the Proposed Action. Bottom contact activities would be very small in scope, e.g. placement and retrieval of a mine shape on the bottom, temporary vessel or instrument anchoring, and crawler tracks on shallow substrates, and would not occur at depths that support deep sea corals. These activities would occur closer to shore and in the intertidal zone where wave action and naturally occurring debris such as driftwood cause much greater disturbance to the bottom in comparison to the proposed activities. Because of the effects of waves and currents, substrate disturbances associated with our activities would be ephemeral and are not likely to affect benthic habitat or any other marine resources.
4. Existing and proposed NUWC Keyport activities in general do not involve discharges or other releases of materials that would present bioaccumulation risks, such as mercury. Expended materials may include metal constituents, such as copper, lead, zinc, iron, aluminum, and lithium, as well as nylon. In manufactured form, these materials are essentially inert. The loss of expended materials is minimized, as instruments and equipment are retrieved whenever possible. When loss is unavoidable, the breakdown of these materials in seawater occurs very slowly, such that their bioavailability is limited. Metallic surfaces corrode gradually, become encrusted or buried, and, in the case of metals, form insoluble salts or complexes with clay, sulfides, and organic matter in the sediments. Small quantities of these materials are lost over very large areas, and there is no evidence of their buildup in sediments or water to potentially harmful levels, as described in Sections 3.6.1.1 and 3.6.1.2 of the Draft EIS/OEIS.
5. Marine mammals are adequately addressed in the EIS/OEIS. The EIS/OEIS is the product of extensive analysis applying best available science, including methodologies for analyzing impacts of MFA sonar on marine mammals that were developed in close consultation with NMFS. Density estimates were obtained from the most recent NMFS surveys. The Navy has identified mitigation measures as warranted to address environmental impacts, and has conducted an appropriate analysis of cumulative effects of its Proposed Action. The EIS/OEIS inarguably takes a “hard look” at potential environmental consequences of the Proposed Action and alternatives, and provides sufficient information for careful agency decision-making.

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Planning documents are not sufficient

- Current contingency and response plans for oil spills and hazardous substance releases are inadequate for the outer coast. In order for mitigation measures to be considered and evaluated in the DEIS, spill response plans must be available to the public. Consideration of the impact of spills and plans for mitigation is inadequate in the DEIS. 6
- Prevention plans for activities in the QUTR and proposed surf zone must be developed to address measures to prevent oil spills and hazardous substance releases. 7

The advisory council is submitting additional comments on specific issues raised by the DEIS. These compiled in a comment table matrix attached to this letter.

The Council is an advisory body to the Sanctuary Superintendent. The opinions and findings of this letter/publication do not necessarily reflect the position of the OCNMS and the National Oceanic and Atmospheric Administration. Thank you for the opportunity to comment.

Sincerely,

Terrie Klinger, Chair
Olympic Coast National Marine Sanctuary Advisory Council

Attachment:

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Response:

6. Spills on the open ocean are addressed in OPNAVINST 5090.1C Ch. 22. The Navy has a no-discharge policy and bilges are not pumped at sea. The Draft EIS/OEIS states the relatively low risk of a spill that would have significant consequences. The proposed and alternative actions do not include vessels carrying large quantities of oil; these are small to mid-size naval vessels and represent a very small fraction of the vessel traffic in the area. (Refer to WDOE Publication 06-08-002 for information regarding vessel traffic in Washington waters. (Available online at: www.ecy.wa.gov/pubs/0608002.pdf).

   Under naval regulations, each vessel carries spill response equipment and has a shipboard spill contingency plan including protocols for contacting and obtaining assistance from Navy, Coast Guard, or State organizations as may be warranted. For spills outside 12 nm that exceed the craft crew's response capability, the Supervisor of Salvage and Diving (SUPSALV) and/or a national response organization provides oil spill response. SUPSALV are technical experts providing a complete spill response capability including spill management, equipment operations, on-site training of local labor, recovered oil storage and full logistics support.

7. See response to O2-6 above.

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OLYMPIC COAST NATIONAL MARINE SANCTUARY ADVISORY COUNCIL COMMENTS ON THE DRAFT NAVSEA NUWC KEYPORT RANGE COMPLEX EXTENSION ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (DEIS)

DEIS Page Number	Section Heading	Subject	Comments	
1-15	1.3.3.1	Fleet Activities (Excluding RDT&E)	Do the UUV crawlers have potential to break corals or sponges? Was this looked at?	8
1-19	1.3.3.6	Overview of tests	Is expendable another term for disposable? These targets should be recovered.	9
1-24			Communications with non military vessels will be greatly enhanced through cooperative relationships with Tribal and non-tribal fisherman prior to the training exercises.	10
1-27	1.4.2	Public Scoping Process	While this section describes Tribal consultations and Agency briefings and documents the areas of concern, it does not state or reference where the responses to these concerns are in the DEIS.	11
2-2	2.2.1	Table 2-1	Table 2-1. Fleet activities at NUWC do not include hull-mounted sonars, does that mean all Fleet activities in QUTR do include them, what about Fleet vessels during Deployment Systems operations?	12
2-27	2.3.2.3	Description of QUTR Site Alternatives and Example Scenario	Figures should also include other pertinent information such as EFH, HAPC, and bathymetry -- this would demonstrate how expanding the area provides benefits to the training.	13
2-27	2.3.4	Range Operating Policies and Procedures	The statement that "exclusion zones" would be set up to "ensure that there are no marine mammals within a prescribed area prior to commencement of each in-water exercise ......" is not realistic. Throughout this section while the use of the term "ensure" may be good to indicate operations will be stopped if a cetacean is spotted, it should not imply that such a mitigation strategy can be effective for deep diving cetaceans or operations in poor visibility.	14
2-27	2.3.4	Range Operating Policies and Procedures	In Table 2.8 the procedure for identifying marine mammals through passive acoustic is not clear since there are serious challenges in identifying or classifying potential marine mammal sounds or determining the range or location of the source of these sounds.	15
			The exact nature of the sonar operations being used was not always easy to evaluate. For marine mammals, the critical question is if any of the sources were the 53C mid-frequency sonar that has been directly associated with beaked whale strandings. This association and which sound source this is should be clearly stated as well as the changes in use of this specific sonar. A clear statement	16

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Response:

8. No, UUV crawlers are not used at the depths in which fragile corals or sponges found. They are in areas of very deep water and not in the shallow water where surf zone activity would occur. Request NOAA provide specific areas of concern so that the Navy can add them to the charts.
9. The Navy retrieves as many as is reasonably possible. However, some are too small for tracking pingers to allow for recovery.
10. With respect to Tribal communications, this is one of the discussion points for Government-to-Government consultation. With respect to fishermen, recreational boaters, or any other members of the general public, NOTAMs are used to inform the public if any navigational hazards are in place. Communications are also readily available by monitoring Channel 16.
11. All the information gathered through scoping was considered in the drafting of the EIS/OEIS. However, specific responses are typically not included and this document is consistent with other Navy EISs.
12. No. This Draft EIS/OEIS only covers NUWC Keyport activities. Another EIS, the NWTRC EIS, is being prepared to describe Navy Fleet activities. The geographic areas of these EISs overlap. The Keyport EIS/OEIS was started prior to the NWTRC EIS and the public at that time was promised a detailed description of Keyport activities. It was felt that in combining both efforts the promised detail, including acoustic information, would be lost in the larger description of Fleet activities. So it was determined that in order to keep that promise to the public it would be necessary to consider Keyport activities separately from Fleet activities. The NWTRC EIS is discussed in the Cumulative Impacts section of this Draft EIS/OEIS.
13. Bathymetry in the QUTR area has been added to Figure 2-6b. As described in Sections 3.4.1.5, the EFH for species at the QUTR site encompasses the entire offshore area, so adding it to the map would not provide additional useful information. EFH for highly migratory species includes all marine waters from the shoreline extending out to the full extent of the EEZ 200 nm offshore. Salmon EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington. Salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the EEZ 200 nm offshore of Washington (PFMC 2000). Species specific distribution information for the QUTR site can be found in Figures 3.4-11 through 3.4-13. The discussion of HAPCs in the QUTR site is found in Section 3.4.4.1. All waters and sea bottom in Washington State waters shoreward from the 3-nm boundary of the Territorial Waters to mean higher high water (MHHW) has been designated as an HAPC for groundfish.

(See responses to 14, 15, and 16 on next page.)

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DEIS Page Number	Section Heading	Subject	Comments	
			would also be helpful whether any proposed use of LFA sonar is anticipated.	16 (cont.)
3-18 to 3-34	3.2	Marine Flora and Invertebrates	Here there is a statement there are no ESA-listed species or critical habitat. However, this presumes that care standards should not be the same. We want to maintain the current health of these species and there is little discussion as to potential harm to them. We know UUV crawlers are being used and there is no discussion of how their impact if any is assessed. The very fact that all the algae and invertebrates (great numbers of phyla, great species diversity) are being so lumped is indicative of lack of attention on these. Yet they are the food chain for the larger animals given so much attention. Discussion of decapod mechanoreceptors is limited to morphology and not to impact. So no conclusions are drawn. Discussion of cephalopods presumes low impact. We don't see a full discussion that would lead to this conclusion. On page 3-19, discussion of amphipods is mixed into eel grass information. This should not be under "marine flora." Again, we have life cycle information but no discussion of impact, from UUV or other disruption.	17
3-21	3.2.2.2	Marine Flora and Invertebrates	There are a number of invertebrates listed but no discussion of potential harm to their habitat, other than attempts to reduce spills.	18
3-23	3.2.2.2	Marine Flora and Invertebrates	The Navy admits that crawlers or anchors or recovery activities could disrupt marine flora, but there is a conclusion that no long-term changes would result. We see no foundation for the conclusion and must take their word. Were there studies? Just below the Navy state benthic invertebrates could be similarly disrupted. Again, we must take on faith that there will be no long-term disruption. If the tests are ongoing, how can we assume this?	19
3-23	3.2.2.2	Marine Flora and Invertebrates	Spill risk is addressed on the same page. The following raised concern: "loss of non-recovered metallic components were also found to have insignificant effects on water quality due to the absorption of dissolved metals to sediments." This passage belongs under water quality and not under invertebrates and flora. However, on reading the water quality section 3.6, concerns were reduced.	20
3-32	3.2.4.2	QUTR Alternative 1	Figure 3.2-6 depicts areas of clam harvest and not clam distribution. Clams are present at various locations along the entire figure.	21
3-30 to 3-34		Marine Flora and Invertebrates	QUTR is discussed at 3-30 and 3-31. Many invertebrates, plankton, and algae described. Again, at 3-33, the assumption is made that impacts from UUVs or recovery activities, anchors, or targets would be short term and not result in long-term changes. We simply don't have points of reference from which to agree or disagree with this statement and therefore it is too pat. An EIS should provide the basis for a conclusion. The timeframe of	22

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Response:

14. We believe the measures implemented as part of the existing ROP are effective for NUWC Keyport activities under the conditions in which we operate. These activities typically involve slow-moving or stationary vessels on the surface which afford relatively good conditions for observation and maximize the likelihood of detecting marine mammals in the vicinity. The Navy is currently consulting with NMFS on these measures as part of the application for an LOA, the results of which will be reflected in the ROD.

    Because continuous visual monitoring by range craft is critical to ship safety and operational effectiveness, training and execution in spotting techniques is, and long has been, integral to ship handling and operation. The Navy is better positioned, trained, and equipped to spot marine mammals and other sea life than most marine vessels. While visual detection of marine mammals is not 100-percent effective, Navy lookouts and bridge personnel (5 in total on surface ships) are highly qualified and experienced marine observers. Compared to commercial vessels, range craft's bridges are positioned forward to allow more optimal scanning of the ocean area from the bridge and bow area. Navy lookouts undergo extensive training to include on-the job instruction under supervision of an experienced lookout followed by completion of Personnel Qualification Standard Program. Navy lookouts use both hand held and "Big Eye" (20X110) binoculars. In addition to visual monitoring, passive acoustic systems may be used by to monitor for marine mammal vocalizations, which are then reported to the appropriate watch station for dissemination to observers. Range craft also monitor their surroundings using all appropriate sensors at night and with night vision goggles as appropriate for activities conducted at night. The Navy believes visual spotting provides effective avoidance of marine mammals.
15. Passive acoustic methods are used to help determine whether or not there are any marine mammals on the range. They are not used to classify or identify the specific species of marine mammal.
16. Use of LFA and the 53C MFA sonar at tactical sonar levels are not part of this Proposed Action. All output levels would fall within the parameters described in Chapter 3 and Appendix C. LFA is not authorized for use in this area.
17. Consideration of the potential impacts on benthic habitats did not indicate an appreciable impact on these organisms and their habitat, and hence no indirect (food-chain) effects are anticipated. The basis for the conclusion regarding effects on decapods and cephalopods is provided in Section 3.2.1. Since amphipods are abundant in eelgrass, it is not inappropriate to mention them in that discussion. The size, weight, and tread of the crawler are such that its impact on eelgrass is roughly comparable to that of a person walking on the beach.
18. See response to O2-17.
19. No long-term changes would result from crawlers or anchors. As indicated in the Draft EIS/OEIS, substrate disturbance would be superficial, small-scale, and temporary.
20. Noted.
21. Figure 3.2-6 has been modified to reflect distribution.

(See response to 22 on next page.)

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DEIS Page Number	Section Heading	Subject	Comments	
			disturbance may or may not be the determinative factor. The conclusion that no mitigation is necessary (page 3-34) is not supported by any probative material in the text.	22 (cont.)
3-38	3.3.4	Sea Turtles	In the discussion regarding sea turtle entanglement, it is mentioned that nylon parachutes are utilized for aircraft launched test items. The Navy should utilize biodegradable materials for the "disposable" parts on test items reducing the risk of entanglement, ingestion, and/or smothering. This could impact other animals in addition to turtles.	23
	3.5.8	QUTR Site Marine Mammals at the QUTR site	Expansion of QUTR site is not only a major expansion <50 nm2 to 1,804 nm2 but also involves dramatic expansion of habitat types and therefore species of marine mammals likely present. Expansion to waters that include the shelf edge as well as the Quinault and Grays Canyon and offshore waters bring operations into contact with beaked whales, the most sensitive species to mid-frequency sonar.	24
3-171	3.5.8	QUTR Site Marine Mammals at the QUTR site	The citations used in this marine mammal sections are incomplete and often miss some of the most relevant publications on a topic. Of greatest surprise, the marine mammal section does not reference or use what is the single most relevant study of marine mammals in the proposed QUTR area, a study specifically initiated and funded by the Navy (Olesson et al. 2007a). While this work is ongoing, results acoustic and visual surveys done in proposed region are available in progress reports published by the Navy on the web site of the Naval Postgraduate School.	25
	3.5.8	QUTR Site Marine Mammals at the QUTR site	Additionally, the most recent publication summarizing the marine mammal results from detailed annual summer surveys of the Olympic Coast Sanctuary conducted over an extended number of years (Calambokidis et al. 2004) is also not used in this section (although it is referenced in Appendix D). http://www.nps.edu/Research/publications/07techrpt.html	26
	3.5.8	Gray Whales	Gray whales: Gray whales utilize broader habitat with the proposed QUTR site than is indicated here. While gray whales do commonly feed on mysid's in rocky coastal waters, they are also know to feed along the bottom in soft sediments that also occur in the broader proposed QUTR zone. Surveys conducted for the Navy in 2007 revealed areas of concentration of bottom-feeding gray whales in waters up to 10 nmi offshore within the proposed QUTR range. It does not seem appropriate to consider the density of migrating gray whales 0 just because they are migrating through the area. The fact that virtually the entire gray whale population of close to 20,000 has to migrate through the QUTR twice each year is a rather significant presence and makes potential impacts of Navy activities in this zone of some	27

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Response:

22. Navy Shipboard Pollution Prevention (OPNAVINST 5090.1C, Chapter 22) strictly prohibits discharges of petroleum based products, ballast, or other waste, and mandates effective cleanup of any discharges that do occur. The incidental loss of expended materials has been considered in the Draft EIS/OEIS, e.g., Section 3.6.1.1 and 3.6.1.2, and the analysis indicates no degradation of sediment or water quality has occurred as a result of these activities, nor would it occur with the Proposed Action. Given these results, there is no reason to expect that Navy activities would contribute to cumulative chemical effects on marine biota.
23. Comment noted.
24. It should be recognized that Navy vessels and aircraft currently operate in W-237A/PACNW OPAREA, and that NUWC Keyport activities represent a small portion of Navy activities in these waters and airspace. These activities have been and will continue to be subject to NEPA and EO 12114 as applicable. The proposed extension actually represents a small increase in the number of certain types of activities (Draft EIS/OEIS Table 2-6), but allows these activities to be conducted in more varied, realistic environments. With respect to beaked whales, the modeling used in the Draft EIS/OEIS took a conservative approach to minimize potential impacts to beaked whales, described in Section 3.5.2 (Assessing Marine Mammal Acoustic Effects). Based on this analysis, no impacts to beaked whales are anticipated (See Section 3.5.8.2).
25. All data must be vetted through NMFS prior to use per Navy business rules.
26. This reference has been incorporated through Appendix D.
27. This is described in the document 3-171 table 3.5-16. The gray whale characteristic is accurate.

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DEIS Page Number	Section Heading	Subject	Comments	
			importance. It appears the density estimates may only reflect the smaller number of seasonal resident animals and exclude the migratory animals which is no appropriate.	27 (cont.)
	3.5.8	Beaked Whales	Beaked whales: This group of species is a major concern for two reasons: 1) they have been shown to be impacted by Navy activities in other areas, and 2) the expansion of the QUTR range results in Navy operations now being conducted in prime beaked whale habitat. The one statement in the beaked whale section about impacts of anthropogenic sounds is both an extreme understatement and provides a somewhat bizarre and not widely accepted reason for beaked whale sensitivity. The simple point that should be made and which could use many other citations is that it is now widely accepted that beaked whales have stranded and died in many other areas as a result of exposure to mid-frequency Navy sonar. This could cite a review publication like Cox et al. (2006).	28
	3.5.8	Killer Whales	Killer whales: Surveys sponsored by the sanctuary revealed that all three types of killer whales including both southern and northern residents occur in these waters (Calambokidis et al. 2004).	29
	3.5.8	Northern Fur Seals	Northern fur seals: As documented in the Olesson et al publication mentioned above, northern fur seals are the most common pinniped seen in offshore waters in the QUTR area.	30
	3.5.8	Humpback Whales	Humpback whales: This is the most common large whale in the QUTR area and is very commonly seen in the spring, summer, and fall, and occasionally in winter. The clarification of this species in Table 3.5-16 as Uncommon is not appropriate and should be considered Common. For this species the failure to cite or use either the publication from the OCNMS cruises (Calambokidis et al. 2004) or the Navy-sponsored acoustic and visual surveys (Olesson et al. 2007a) is particularly glaring. These studies demonstrate the common occurrence of humpback whales in these waters not just in summer but in all seasons. The conclusion about the specifics of the population structure of humpback whales off Washington is inaccurate. The US/BC border rather than representing the border of a population (even though for US Stock Assessments they may have to be treated that way) is not appropriate and in fact the humpback whales off northern Washington are part of the same feeding aggregation occurring in southern BC. This is part of a relatively small unit numbering just a few hundred animals. There are now new estimates of humpback whale abundance for the entire North Pacific as well as the Washington/S BC feeding areas from the SPLASH humpback whale project (Calambokidis et al. 2008). This study also provides more accurate determination of migratory movements of these animals than had been available previously.	31

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Response:

28. Occurrence and susceptibility of beaked whales acknowledged in the Draft EIS/OEIS. See response to O2-24 and Appendix D.
29. This is stated in the Draft EIS/OEIS. See both the Non ESA-Listed and ESA-Listed subsections and Table 3.5-16 of Section 3.5.8.
30. See Table 3.5-16.
31. Characterizations of abundance are consistent with the data sets approved by NOAA and used in the analysis, and with the criteria by which the terms are defined.

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DEIS Page Number	Section Heading	Subject	Comments	
	3.5.8	Blue Whales	Blue whales: Section on blue whale vocalizations and the function it plays is somewhat out of date. More recent work has shown that it is almost exclusively males that produce the long patterned vocalizations and therefore the function is more related to reproduction (Olesson et al. 2007b, 2007c).	32
	3.5.8	Fin Whales	Fin whales: It would be appropriate to mention the high mortality of fin whales from ship strikes noted in the Pacific Northwest in recent years (Douglas et al. 2008).	33
	3.5.8.2	Environmental Consequences	Focus of marine mammals impacts is appropriately on noise exposure, however, the focus on TTS and PTS is not the primary issue. While TTS and PTS are worth considering, the well-documented impacts of mid-frequency sonar on beaked whales occurs at exposure levels way below those that cause even TTS but still result in lethal consequences.	34
3-41		Bottom-Anchored Targets	Bottom Anchored targets should be removed when no longer necessary, especially those made of plastic components.	35
3-46	3.4.1	Overview Existing Conditions	Tribal fisheries include commercial fisheries. Throughout the document tribal fisheries are described as "usual and accustomed fisheries", a more correct terminology is that tribes engage in commercial, ceremonial, and subsistence fisheries. These fisheries take place in Usual and Accustomed Fishing Areas (U & A's). U & A's have been determined by treaties and subsequent court decisions.	36
3-212	3.6.3	QUTR Site	Under the section discussing "tidal currents" which is typically related to local tide cycles. Also in this section there is reference to the Davidson and the California current, this is confusing as these two named currents are the result of larger oceanographic processes. Both currents have seasonal cycles of where they are located in the water column, and vary in direction, speed, and distance from shore.	37
3-213	3.6.3	QUTR Site	Sediment composition and quality neglects to describe glacial influences in offshore sediment characteristics. Quality is a relative term that needs definition.	38
3-213	3.6.3	QUTR Site	Water Quality section discusses currents but not water quality parameters: turbidity, oxygen etc...	39
3-213	3.6.3	QUTR Site	Activities that affect water quality and sediment quality describe dilution as the solution to toxin being released in the environment. This could lead to low level chronic exposure of marine organisms to toxic substances that are released.	40
3-214	3.6.3	QUTR Site	While cables may become covered with sediment they do not become "part of the substrate".	41
3-200	3.6	Sediments and Water Quality	At page 200-sediments are evaluated for possible release of hazardous constituents...Studies were done at Dabob Bay by Batelle in 2001, where activities had taken place. Metals studied: Cadmium, Copper, Lithium, Lead, Zinc, and Zirconium. The levels were below non-urban portions of Puget Sound and met state water quality standards.	42

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Response:

32. The information provided by the commenter is of specialized interest but is not germane to the effects analysis since it does not pertain to abundance or distribution.
33. Ship strikes are discussed in detail in Appendix E.
34. The threshold levels used are set by NMFS. The modeling used in the Draft EIS/OEIS takes a conservative approach to minimize potential impacts to beaked whales. As described in Section 3.5.2 (Assessing Marine Mammal Acoustic Effects), all beaked whale TTS and PTS exposures are considered Level A harassment. Based on this analysis, no impacts to beaked whales are anticipated (See Section 3.5.8.2).
35. NUWC Keyport routinely recovers all major test components including targets and inert mine shapes.
36. Usual and Accustomed fishing is accurate terminology. Whether the fishing is for commercial, ceremonial, or subsistence it is still based on treaty rights.
37. Text clarified.
38. Comment noted.
39. The water quality section is brief is because the action does not contribute to turbidity or oxygen levels in the ocean that would affect the water quality parameters.
40. All releases are prevented and minimized to the maximum extent practicable. As described in the Draft EIS/OEIS (Section 3.6), NUWC Keyport commissioned a field study to document water and sediment quality conditions at DBRC Site in Dabob Bay (Battelle 2001). Although conducted for the DBRC Site, the results of the study are applicable to the other range sites because the nature of the activities is reasonably similar. Laboratory results for both the surface and bottom seawater samples indicated that metal concentrations were low in Dabob Bay compared to background levels present in non-urban portions of Puget Sound. Laboratory results for the sediment samples indicated that metal concentrations were low, and consistent with levels found in other muddy, non-urban bays in Puget Sound. Under the Proposed Action and alternatives, the types of activities currently conducted would continue to be conducted; the only change would be the extension of range boundaries to accommodate tests with larger area requirements. Since the components used in future activities would not differ from existing activities, results of the detailed analysis in the NUWC Keyport Dabob Bay water quality and sediment report (Battelle 2001) are applicable to activities conducted under the Proposed Action and alternatives and indicate that impacts to water and sediment quality would not occur.
41. Text clarified to state that cables would become a new substrate.
42. Comment noted.

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DEIS Page Number	Section Heading	Subject	Comments	
3-202	3.6	Sediments and Water Quality	Washington State has Sediment Management Standards for marine, low salinity, and freshwater surface sediments, and freshwater surface sediments, to eliminate adverse effects on biological resources and human health. The main threat seems to be spills of materials (throughout the chapter), or temporary increases in turbidity in the water column during tests.	43
3-209 and 3-214	3.6.2 and 3.6.3	Sediments and Water Quality	The biggest concern is found at page 3-209, where heavy metals could leach into sediments and the water column form lead anchors and copper core guidance wires. While most anchors are recovered, some are lost. Lead, copper, cadmium and aluminum can be toxic to marine organisms, the Navy admits. It finds the leaching amount to be insignificant to water quality. However, these could be ingested by marine worms and get into the food chain and bioaccumulate. The risk has not been addressed. No mitigation is planned	44
3-215	3.6.3	Sediments and Water Quality	At page 3-213, the higher energy of the QUTR site is discussed, and the risk of fuel discharges. At page 3-314 is a very cursory repeat of the risk of metals from expendable materials. Again, only the risk of exceeding the SMS standards is addressed, not the risk of bioaccumulation. So no mitigation is planned.	45
3-213	3.6.3.1	Sediments and Water Quality	The DEIS says the Oil and Hazardous Substance Release Contingency and Response Plan (NUWC Keyport 2002) will be used to ensure oil and hazardous material spills and accidental discharges are kept to a minimum, however, this plan is designed to respond to a spill, not prevent one. A prevention plan specific to operations in the QUTR should be developed in coordination with the Olympic Coast National Marine Sanctuary to fully plan for spills. It should include specific prevention measures that will be put in place to prevent any oil or hazardous materials from entering the water.	46
3-213	3.6.3.1	Sediments and Water Quality	The DEIS States occasional accidental discharges of materials (e.g., leak of oils, fuel from test components) do occur within QUTR Site boundaries; however, such discharges are minimal and disperse over large areas due to ocean mixing. This does not adhere to the Navy policy noted below. Navy OPNAVINST 5090.1C Section 12-3.5 states discharge "Includes any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil or an actual or substantial threat of any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil." Section 12-3.31 defines release as "Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing, including an actual or substantial threat of any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing, into the environment, of any hazardous substance (including the abandonment or discarding of	47

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Response:

43. Comment noted.
44. See response to O2-40 above.
45. As indicated in Section 3.6, risks of toxicity or bioaccumulation due to accidental losses of expended materials are negligible and do not warrant mitigation.
46. The Navy has existing procedures in place for prevention and minimization of releases.
47. Operations are consistent with OPNAV requirements. The Navy has existing procedures in place for prevention and minimization of releases. See response to O2-48 below.

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DEIS Page Number	Section Heading	Subject	Comments	
			barrels, containers, and other closed receptacles containing any HS or pollutant or contaminant)." Section 12-3.37 defines a Spill to "include both releases of hazardous substances and discharges of oil." OPNAVINST 5090.1C, Section 22-5.3 further states ships "will comply with applicable oil discharge regulations and the operational requirements contained in this chapter. Compliance will ensure that Navy ships operate with due regard to all recognized standards for environmental protection, while not detracting unreasonably from the Navy's mission to protect the national security interests of the United States. ... Commanding officers will make every effort to minimize oil spill risks across all navy operations through application of aggressive spill prevention measures. All ships should strive to continuously reduce oil spills through proper preparation, rigid adherence to published procedures, and application of the full measure of command attention to any operation involving movement of oil and oily waste. Preventing oil spills is one of the Navy's top priorities." Oil spills, hazardous material releases of materials such as Otto II fuel must be handled as a spill, with the appropriate planning and training. Operations in the QUTR must have defined procedures to prevent oil spills of any amount.	47 (cont.)
3-213	3.6.3.1	Sediments and Water Quality	The COMNAVREG NW Oil and Hazardous Substance Integrated Contingency Plan (CNRNW ICP) includes NUWC Keyport. The ICP is only applicable to incidents that occur within 12 nm of the assigned shorelines and the NRNW area of operations. The QUTR is not included in this area. A separate plan or annex must be developed to include this area.	48
3-213	3.6.3.1	Sediments and Water Quality	The vast majority of the Navy response assets identified in the CNRNW ICP are located within Puget Sound, not on the outer coast. For this reason, response equipment and personnel would be greatly delayed in the case of a spill in the QUTR area. Resources to respond to a spill or release must be identified, pre-positioned, and training conducted to cover this gap.	49
3-213	3.6.3.1	Sediments and Water Quality	For a spill, the DEIS states " impacts are minimal because the spills are small, ocean currents dilute hazardous constituent concentrations, and it is extremely unlikely that the same volume of water is affected by more than one occurrence. Even if two accidental discharges were to occur simultaneously, it is unlikely that the two events affect the same volume of water." The CNRNW ICP states environmental sensitivities must be used to determine characterization of a spill. Sensitive areas are one of the factors to be considered for this. The DEIS incorrectly states that impacts are minimal due to the small size and will be diluted, without considering the environmental sensitivities. In addition, the DEIS does not	50

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Response:

48. Spills on the open ocean are addressed in OPNAVINST 5090.1C Ch. 22. The Draft EIS/OEIS states the relatively low risk of a spill that would have significant consequences. The proposed and alternative actions do not include vessels carrying large quantities of oil; these are small to mid-size naval vessels. Under naval regulations, each vessel carries spill response equipment and has a shipboard spill contingency plan including protocols for contacting and obtaining assistance from Navy, Coast Guard, or State organizations as may be warranted. For spills outside 12 nm that exceed the craft crew's response capability, the Supervisor of Salvage and Diving (SUPSALV) and/or a national response organization provides oil spill response. SUPSALV are technical experts providing a complete spill response capability including spill management, equipment operations, on-site training of local labor, recovered oil storage and full logistics support.

49. See response to O2-48 above.

50. Any accidental spill, however small, will be cleaned up as required by Navy policy (OPNAVINST 5090.1C Ch. 22) and the Clean Water Act. Even a faint sheen on the water would be a reportable event and every effort would be made to clean it up. Following clean-up, residual oil on the surface which cannot be captured would be minimal and become dispersed by wind and waves, such that impacts to marine (or terrestrial) organisms would likewise be minimal. Such events are expected to occur rarely, if ever, and their location is not predictable. In any case, it is not anticipated that the quantity of oil that escapes in this hypothetical scenario would be enough to have an adverse impact on any sensitive environmental resource.

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DEIS Page Number	Section Heading	Subject	Comments	
			provide any capacities of oil or hazardous substances that would be involved in the operations which makes it impossible to determine a spill as "small" beforehand.	50 (cont.)
3-213	3.6.3.3	Sediments and Water Quality	The ICP sets the goal of preventing pollution incidents "through effective planning, training, and operational risk management. The DEIS does not address this goal or propose any additional planning, training, or resource deployment for the operations for QUTR. No mitigation measures are included in the DEIS. The ICP also sets a goal of conducting "thorough contingency planning efforts through a focused program of preparation and cooperation." There are no new efforts identified to address planning for operations in the QUTR.	51
3-250	3.9.4	QUTR Site	Regulatory setting: Both Olympic National Park and Olympic Coast National Marine Sanctuary while possessing regulatory authorities also have limitations as described in agency documents. The all encompassing statement in this section is misleading. Additionally there are Tribal and State regulatory authorities in these same areas.	52
3-258	3.10.3	QUTR Site	Tahola is spelled Taholah	53
3-270	3.11.3	QUTR Site	Tokelad is spelled Tokeland	54
3-278	3.12.3	QUTR Site	Air discussion fails to discuss sources from China which are documented.	55
4-2	4.1.2	Geographic Areas for Cumulative Impacts	Cumulative impacts should include Grays Harbor County and Clallam County species, as many mobile species know no boundaries (salmon, whales).	56
4-6 to 4-8	4.1.4	Cumulative impacts	Under QUTR Site, the deep sea coral study is referenced but nothing is said about impact on these invertebrates. At page 4-7, the section on marine flora and invertebrates, "anthropogenic activities would have negligible cumulative effects on marine flora and invertebrates." Shoreline disturbance is the only harm acknowledged. At page 4-8, it is concluded that there will be no long-term disruption or harm. These are just statements and there are no studies referenced so it is hard to accept them at face value.	57
4-9	4.1.4	Cumulative impacts	There are statements made that there are no long-term adverse effects and that water quality is meeting standards. Turbidity would settle out. While we can agree that turbidity will settle out, we find no valid discussion of bioaccumulation in the food chain regarding some of the minerals from discarded or lost lead anchors, or the like.	58

Citations referenced in Advisory Council comments (above) include:

Calambokidis, J., G.H. Steiger, D.K. Ellifrit, B.L. Troutman and C.E. Bowlby. 2004. Distribution and abundance of humpback whales and other marine mammals off the northern Washington coast. Fisheries Bulletin 102(4):563-580.

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Response:

51. Operations are consistent with OPNAV requirements. The Navy has existing procedures in place for prevention and minimization of releases. See response to O2-48 above.
52. Text clarified to state that intertidal zone resource management jurisdiction is under the Olympic National Park and the Sanctuary (OCNMS 2004) and there is also co-management of the resources with Tribal and State regulatory authorities in some areas.
53. Spelling corrected.
54. Spelling corrected.
55. This information is not essential to understanding the action or its environmental effects.
56. The scope of the cumulative analysis is dictated by the effects of the action, not by the movement of animals or resources.
57. Description of the deepwater environment has been added to the appropriate sections of the Final EIS/OEIS.

    The nature of existing and proposed activities, which entail very limited bottom disturbance over a very large area, does not suggest there could be a significant impact on these rare communities.
58. As indicated in Section 3.6, risks of toxicity or bioaccumulation due to accidental losses of expended materials are negligible and do not warrant mitigation.

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Calambokidis, J., E.A. Falcone, , T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn , A. Havron, J. Huggins, N. Maloney, J. Barlow, and P.R. Wade. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final report for Contract AB133F-03-RP-00078 prepared by Cascadia Research for U.S. Dept of Commerce. May 2008.

Cox ,T.M., T.J. Ragen, A.J. Read, E. Vos, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, T. Hullar, P.D. Jepson, D. Ketten, C.D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management* 7:177-187.

Douglas, A.B., J. Calambokidis, S. Raverty, S.J. Jeffries, D.M. Lambourn, and S.A. Norman. 2008. Incidence of ship strikes of large whales in Washington State. *Journal of the Marine Biological Association of the United Kingdom* 88:1121-1132.

Jeffries, S., H. Huber, J. Calambokidis and J. Laake. 2003. Trends and status of harbor seals in Washington State: 1978-1999. Journal of Wildlife Management 67(1):201-219.

Oleson, E.M., J.A. Hildebrand, J, Calambokidis, G, Schorr, and E. Falcone. 2007a. 2006 Progress Report on Acoustic and Visual Monitoring for Cetaceans along the Outer Washington Coast. Report NPS-OC-07-003 to Naval Postgraduate School, Monterey, Ca. 30pp. (Available from www.cascadiaresearch.org)

Oleson, E.M., J. Calambokidis, J. Barlow, and J. A. Hildebrand. 2007b. Blue whale visual and acoustic encounter rates in the Southern California Bight. *Marine Mammal Science* 23:574-597

Oleson, E.M., J. Calambokidis, W.C. Burgess, M.A. McDonald, C.A. LeDuc, and J.A. Hildebrand. 2007c. Behavioral context of call production by eastern North Pacific blue whales. *Marine Ecology Progress Series* 330:269-284.

Response:

P1 – Aker, William *(page 1 of 2)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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MS. TURNER: Thank you, Mr. Beck, for your comment.

At this time, that is all the speaker request cards I have received, so I would like to open the floor. Is there anyone else that would like to submit an oral comment at this time?

Yes, please come forward, and if you could provide your name and spell your last name, please.

MR. AKER: My name is William Aker, A-K-E-R. Address is 303 N. Webster Lane, Lilliwaup, 98555.

I have been traveling around the canal here and bought a property here in 1961. So we have been -- little by little we get fished more and more, the last five or six years. Our bottom fish has been closed. Our salmon fishing, the summer salmon fishing, here has been closed. We have Winter Black Mouth. That is the only salmon fishing we have left.

We get very nervous when they say there is going to be an impact on our area here, because there's -- my neighbors are all retired neighbors down there, so the economic side is secondary, but part of taking your great-grandkids out fishing is pretty tough when you haven't got it. 1

We have had sub activity past our place regularly, which we just wait until they're clear. We

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Response:

1. The EIS/OEIS evaluates the potential impacts of the proposed range extensions and associated activities on public use of shoreline and other resources. For example, fishing and recreational boating impacts were assessed in Sections 3.8 (Recreation) and 3.11 (Socioeconomics and Environmental Justice). Conditions associated with public access and fishing activities are not expected to change appreciably and therefore impacts of the Proposed Action would not be significant.

P1 – Aker, William *(page 2 of 2)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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have got pots on the other side. So 1500 feet, we probably keep a mile clearance from anything coming by. We don't want to spoil it for them or us or anybody else. I just wondered if the addition of the property, of the range as far as the Hamma Hamma, what additional impacts that will have on things, is our biggest concern. 1 (cont.)

I see usage of the area about two hundred days a year now. The use you are doing and the use we are doing, I mean there is no conflict as far as I know with any of the ships coming down, the mother ships over the subs and all that type of thing. So we are getting along fine the way it is now, but is it going to get any tougher. I mean that's what my friends are going to be asking me when I get home. That's about it. Thank you. 2

MS. TURNER: Thank you, Mr. Aker, for your comment.

Would anyone else like to provide an oral comment this evening? Would any of our previous commenters like more time?

Okay, at this time we will take a short recess until 8 o'clock. If you would like to make a comment at 8 o'clock, we will reconvene the public hearing. We will have the poster stations open, if you would like to circulate through the open house session again. So we will reconvene at 8 o'clock. Thank you.

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Response:

2. Boaters, fishermen (including shrimpers and crabbers), divers and other users should notice little or no change on these waterways.

P2 – Bailey, Jack *(page 1 of 5)*

Navy Base Hearing, Session 1 - Keyport, Washington

speak. Please honor any request that I make for you to stop speaking if you reach the three-minute time limit. To aid you in knowing when your time is up, the timekeeper will hold up the yellow card when you have one minute left. This should allow you to find a comfortable place to conclude your comments. A red card will be held up when your three minutes have elapsed. When you see the red card, please conclude your comments. Depending on the number of speakers and the duration of the public hearing, I may offer additional time to speak. Written comments are also encouraged.

Third, if you have a written statement, you may turn it in to the court reporter and/or you may read it out loud within the time limit.

We are now ready to begin. The first speaker is Jack Bailey. Please come to the front of the room.

MR. BAILEY: There is nothing like being first. My name is Jack B. Bailey, Post Office Box 31, Keyport.

I am a retiree from NUWES, if anybody knows what that means, and 30 years of service here and I've worked on the range and R&D projects, and so I kind of understand what is going on. I also am the Commissioner at the Port of Brownsville and have been for eight years. I am also a resident of Brownsville and I live on the water at Brownsville.

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Response:

P2 – Bailey, Jack *(page 2 of 5)*

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My concerns are the economic and human impact. The Port of Brownsville has been in existence as a port since the '20s, but we've been there a lot longer than that, since about 1902, I believe. The port is located directly south of the current range limits and we're a neighbor. We share a common border. If I can find the rest of my notes here. Here we go.

In September of 2003, I believe I was president of the board at that time, and yet we were not notified, and in fact until yesterday we had no indication at all that anything was in the works as far as extending the range. As a matter of fact, on Saturday I talked to the fellow who is in charge of the Old Man Four. Is that the boat? He didn't even know there was a range there, and I explained to him there was a range.

Anyway, as a neighbor and a stakeholder, and I would say the major stakeholder, as I think we have the largest financial impact or financial asset in this area, we're really concerned that we weren't notified or that you have gone this far without us having a clue that you intend to do this, 1

and it certainly will have an effect on boating and recreation, because if you have ever sailed a boat, you know it is kind of hard to sail in the limited corridors that look like are mapped out for people for boat passage. 2

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Response:

1. Port of Brownsville was not notified. As described in Chapter 2 of the Draft EIS/OEIS, official notification of the Navy proposal began with the publication of the Notice of Intent (NOI) on September 11, 2003, in the Federal Register. A copy of the NOI is presented in Appendix A of the EIS/OEIS. Press releases were sent to several newspapers in the Washington State area announcing the NOI publication. Following this, letters outlining the Navy proposal and announcing scoping meetings were sent to Federal, state, and local agencies; Native American Indian Tribes and Nations; elected officials; and various interest groups. Scoping meetings were held in four counties adjacent to the current and proposed sites that could potentially be affected by the Proposed Action or alternatives: Keyport, Kitsap County (November 17, 2003); Belfair, Mason County (November 18, 2003); Quilcene, Jefferson County (November 19, 2003); and Hoquiam, Grays Harbor County (November 20, 2003). Advertisements describing the Proposed Action and alternatives were placed in nine local newspapers one week before the scoping meetings. The advertisements provided the times, dates, and locations of the scoping meetings. As part of the public outreach effort, flyers were also posted in local marinas, grocery stores, and post offices. Public comment was solicited in the advertisements, flyers, and the scoping meetings themselves. Input from the public obtained during the scoping process was used to further refine the alternatives that were carried forward for analysis in this EIS/OEIS. Newsletters describing the status of the EIS/OEIS process were sent out from 2004 through 2007. The outreach effort implemented to provide for public comments on the Draft EIS/OEIS was as comprehensive as that conducted for the scoping process.

2. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue.

P2 – Bailey, Jack *(page 3 of 5)*

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I would point out that one of the most dangerous and treacherous points is the point right at the end of the peninsula off of Keyport here. If you have ever sailed over in that direction, you will see the converging waters are pretty treacherous. So if your range forces people into that area, small boats, I would have a safety concern. 3

MS. TURNER: Thank you, Mr. Bailey.

MR. BAILEY: The rest will be submitted by letter, and thank you.

MS. TURNER: Thank you for your comment.

Mr. John Veatch?

MR. VEATCH: I may not be able to make exactly three minutes. This is pretty tough, but I will try to read fast, I guess. I think you are all fine people, you are good people, your intentions are good, and I hope that doesn't count in my time.

I wish to express concern over several elements in the proposed EIS. My comments are focused on the Keyport Range part of the EIS, as that is the area for which I have the most background and most affected. I should know, as I was employed at NUWC Keyport for nearly 34 years and have a sailboat moored at Brownsville Marina.

Three topics: First is timing. It seems odd

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Response:

3. The Navy places a very high priority on ensuring and promoting safe testing and training activities. Public safety is a primary concern and boat traffic would not be detoured into harms way as a result of the Proposed Action. Boaters should notice little or no change on local waterways.

P2 – Bailey, Jack *(page 4 of 5)*

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vehicle will surface at the end of a test run. Are these retrieved so they don't become a hazard to civilian boat traffic.

And the last one is, what is going to be the impact to the salmon runs in Steel Creek through Burke Bay.

Do you need my spelling? My name is M-A-C-I-N-T-Y-R-E, James. Thank you.

MS. TURNER: Thank you, Mr. MacIntyre.

Do we have any additional commenters at this time? Would any of the previous commenters like additional time? Mr. Bailey?

MR. BAILEY: Yes. I would have to say the second speaker had access to information that we were unable to find, and I would like to have had that. I thought maybe we would be getting that this evening from you, but I searched all day yesterday, or today, as did our manager, looked at the website trying to find the EIS and the proposed impacts. So he had a little bit of uppance there. 4

I would like to say that one of our concerns is that we have traffic coming and going at all hours, day and night, and we have a large population of commercial fishing boats that come in at the marina and have catches that are significantly time-dependent. They need to get 5

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Response:

4. The EIS/OEIS was available on the NUWC Keyport project website and at local repositories. A point of contact was also provided to request information from Keyport PAO.

5. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

P2 – Bailey, Jack *(page 5 of 5)*

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them out of there and on the planes headed to Asia. So it's critical that those boats be able to come and go as they need. 5 (cont.)

So that's it. The rest will be submitted in writing. Three minutes seems like a small amount of time, considering you don't have that many folks. Thank you. 6

MS. TURNER: Thank you, Mr. Bailey.

Mr. Veatch?

MR. VEATCH: My first point was timing. Second is environmental consequences.

In the Keyport Range Alternative 1, it is again claimed that the operational tempo will only increase marginally by 5 days to 60. My experience at Keyport, in sailing in the area, would suggest that the operational tempo would actually increase quite dramatically, from zero to 60 days. Hence, the Navy's conclusion is misleading and to my knowledge not based on fact.

Because of paragraph 3811, the Navy did not acknowledge the significant amount of boat traffic that is in the area. The conclusion that the impact is minor is not valid. Everything you showed had to do with fish in broad terms.

In the same paragraph, regarding the comment that although they, recreational boats, may be required

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Response:

6. Additional time to comment was provided later in the hearing after the first group of speakers had completed their comments.

P3 – Beck, Herb ***(page 1 of 5)***

Navy Base Hearing, Session 4 - Quilcene, Washington

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Our fourth commenter, Mr. Herb Beck.

MR. BECK: I am Herb Beck, 250 Frank Beck Road, Quilcene, Washington.

First of all, I want to say I am not against the range, to start off, but in 1948 I attended the hearing of the range when it was first opened. Your date here stating 1956 is inaccurate when that range was opened, because I was in high school at that particular time and friends of mine used to salvage or collect torpedos that would come up on shore and got 250 bucks a piece. Of course, they would hide them under some brush or something so they could get the reward.

Now, what I am really concerned about is about the economic impact on the community. At that particular time, at Linger Longer -- we have a lodge called Linger Longer Lodge -- due to the fact of the Navy range activity, first of all, when you have civilian-type of vessels and boats, first they hear Navy and they quit 1
coming to our community here, our economic access. We have lost that, and we still have lost that, and it also affects the capability of our folks being able to go on out to sea, to do their business, say do repairs and so forth, and trips and so on.

I know you need a range activity, but I would like to see the limit. At that particular time in '48,

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Response:

1. The socioeconomic impact assessment described in the EIS/OEIS found that no significant impacts to the economy would occur. Refer to Section 3.11 of the EIS/OEIS for additional information.

P3 – Beck, Herb *(page 2 of 5)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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if I remember correctly, it was from 8 o'clock until 4 o'clock in the afternoon five days a week, but it went on the Federal Register that it was seven days a week, or 7/24.

That is the problem I have. I would like to see that we could, say, have a three-day transit, say a Friday, Saturday and a Sunday, that the Navy makes their test evaluations during four days a week. Of course, I know that it takes time to put these things together, but the impact to the community and such, as the gentleman from Pleasant Harbor is saying, is a major factor, and the gentleman here, his boating. 2

I know of folks that had to heave. Of course I know of folks who went right up on the beach and went ahead anyway and were chased by the chasers, but I'd like to see on your EIS -- I went through it and I don't see anything on economic impact to the various communities along the Sound. You have everything else. Fish, okay, we all worry about fish, we all worry about life, but it is the income the folks have to have to survive, and it is a tough business right now trying to make a living, and of course we pay taxes and it goes to the Navy to support their activity. 3

So I think it should be given a two-way street on this particular activity that, say, perhaps four days 2 (cont.)

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Response:

2. The majority of testing occurs during regular business hours Monday through Friday. No increase in weekend activities or additional operational tempo is proposed for Hood Canal.
3. Submarine escort boats are primarily operated by the Coast Guard and are therefore separate from most NUWC Keyport activities. The Navy has met with the Coast Guard regarding this regional issue and it is being addressed with regional staff. Refer to the response to comment P3-1 regarding economic impacts.

P3 – Beck, Herb *(page 3 of 5)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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a week or something to this effect that the range would be used, and if there is a Saturday, Friday, Saturday or something, that it would not be used so that we can get our folks coming back and visiting our port-of-calls. 2 (cont.)

Now, we don't have great job opportunities in this area. We have lost our timber. We have lost just about everything you can imagine around here for economics, but we do have some nice opportunities for people for recreation and I'd hate to see that be destroyed.

It needs to be limited, your time of operation. I know you have the lights to blink, but sometimes the lights stay on 24 hours a day. This gentleman, I know exactly what he is talking about, because I got phone calls on it. It is a two-way street. 4

And the equipment and so forth that you use, I don't know the ranging. I don't know what weapon systems you are using now. I don't know if you have 4850's or Mod0's or whatever you are testing or if you are using sonar to test the capabilities of the subs and so forth, 5

but I'd like to see in the EIS part of it the economic impact to the community. It has never been in there, and this is devastating to some folks here. We don't have the proper training to get some cushy job, but we are here trying to survive. Thank you. 1 (cont.)

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Response:

4. Warning lights and procedures are described in Section 1.3.4.1 of the Draft EIS/OEIS. Lights are checked by Keyport staff before they leave for the day. The public can call the duty office if there is a concern or question, use radio channel 16, or dial 911 in case of emergency.

5. Chapters 1 and 2 of the EIS/OEIS provide a thorough discussion of current and proposed activities by NUWC Keyport within the affected range sites.

P3 – Beck, Herb ***(page 4 of 5)***

Navy Base Hearing, Session 4 - Quilcene, Washington

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through.

Two hundred days of use a year, which I just can't say enough, we have maybe ninety days of fishing in the canal, if that. That would be a maximum figure. Thirty of those ninety days Dabob Bay is closed and you are not allowed to go in there to fish. I don't know what else to say. It would just be catastrophic on our little bit of economy we have left.

MS. TURNER: Thank you, Mr. Hogan, for your comment.

Is there anyone else that would like to give an oral comment? Please.

MR. BECK: I am going to put my other hat on, Herb Beck, Port of Port Townsend Commissioner.

At the Quilcene Marina, the hours of operation are very critical to our survival, and I wish that there would be a limitation when you would do your timing, such as, say, maybe three, four days a week or something to that effect. 2 (cont.)

We don't have much going for ourselves. We have to maintain the facilities, build new facilities for the community, and we do have folks that come in and stay overnight that take up moorage for, let's say, an evening or so forth and they use the community facilities, the restaurants and some of the other opportunities that are

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Response:

P3 – Beck, Herb ***(page 5 of 5)***

Navy Base Hearing, Session 4 - Quilcene, Washington

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here to create income for the community, and I don't see anything in this plan that is going to help us to continue. I would like to see that we could get more cooperation on this aspect.

Like the gentleman says, we've got businesses. They've got enough problems. So I want to take a good look at the economic impact of this particular range, what effect it is going to have on our folks in this particular area. I am down here and I hear about this stuff. They don't pay any attention to you, but I hear about it. Thank you.

1 (cont.)

MS. TURNER: Thank you, Mr. Beck, for your comment.

Would anyone like to submit an oral comment this evening?

I would like to call another recess until 8:45. We will reconvene the public hearing at 8:45. If you would like to give a public comment, we will take it at that time. Thank you.

(A break was taken.)

MS. TURNER: We have not received any additional speaker request cards. Would anyone like to make a comment at this time?

Okay, we will recess until 8:55. Thank you.

(A break was taken.)

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Response:

P4 – Boldt, Jim *(page 1 of 2)*

-----Original Message-----
From: jim boldt [mailto:duckabushcommunications@gmail.com]
Sent: Monday, October 13, 2008 4:09 PM
To: Jennings, Diane M CIV NAVSEA KPWA
Subject: questions for q and a re; EIS

attached are our questions. We would appreciate seeing them or something like, very like, very similar to them in the formal Q and A.......................Please let me know if I need to alter the format or submission process.

Thanks for you time last week.

Jim Boldt

--
Duckabush Communications
40600 Hwy 101 North
Lilliwaup, Washington 98555
Jim Boldt
President

1

Response:

P4 – Boldt, Jim ***(page 2 of 2)***

Dear:

Thank you for your time on the phone last week. As you suggested we are writing with questions about the planned expanded us of Hood Canal for ______________________. Please consider these comments and questions formal input for your "comments" to the draft EIS.

Concerns: Those of us living on the west side of Hood Canal are concerned that the expansion planned by the Navy may interrupt our use of the canal for recreational boating and fishing, or otherwise restrict our historical access to the water way. The draft EIS claims that the canal will not be "closed" to use by civilians.

1. Is it true that even with the expanded use plan, the Hood Canal will not be closed to civilian recreational use?
2. Are there any circumstances or situations that would permit the Federal or State government to close Canal for civilian use? 1
3. Under provisions of the expansion, would pleasure boat use on the canal be limited in anyway?

Response:

1. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

P5 – Caldwell, John *(page 1 of 2)*

John H. Caldwell
573 Redwood Street
Port Townsend, WA 98368

September 19, 2008

Kimberly Kler (EIS/OEIS PM)
Naval Facilities Command
1102 Tautog Circle, Suite 203
Silverdale, WA 98315

Subject: Hood Canal – Naval test site

I am a strong advocate of the U.S. Navy – served in World War II and Korea. I am also an advocate of moving freight by water thus making our highways safer and reducing surface damage and diesel oil consumption - with benefits to solving global warming. This is apparent with our current barging of paper and wood products on Puget Sound.

<u>Please do not deter</u> the Fred Hill Sand and Gravel from barging on Hood Canal. Their location at the extreme end of Hood Canal at the bridge should in no way interfere with the Navy. 1

Our Navy has done more to eliminate our dependency on oil (nuclear subs and carriers) than any other organization in the world. Here is just another way the Navy can contribute. Let Fred Hill use the barges, please!

Sincerely,

Jack Caldwell

Cc: County Commissioners
PT Leader
Peninsula Daily News
Fred Hill Sand and Gravel

Response:

1. The Fred Hill Project is included in the cumulative impacts section in Chapter 4.

P5 – Caldwell, John *(page 2 of 2)*

Barge Shipping-Hills Bros.
Wood Products & Paper
products are keeping
100's of heavy, diesel
trucks off our highways
This is how to ship Sand & Gravel

Wood chip barges on Puget Sound.
Each barge = 12 truck loads.

Waterfront: Barge

CONTINUED FROM D1

The tug is powered by a 16-cylinder Caterpillar D399 that generates 1,150 horsepower.

The engine room also has a small but well-equipped machine shop and an abundance of tools and spare parts for making repairs while under way.

Glen Cove has a large winch on her stern that is wound with 2,000 feet of 1 5/8-inch towing cable.

Towing the barge

Typically the barge is towed about 800 to 1,000 feet behind the tug — more when the weather is rough.

While a barge is under tow, the cable dips into the water 40 feet or more. This acts as shock absorber to keep the bitts from being ripped off the deck of either vessel.

The barge used to transport the rolls of paper from Nippon was once owned by Puget Sound Freight Lines and hauled pulp and paper from the old Rayonier mill to Seattle.

She is now enclosed with corrugated metal to protect the cargo.

Three loads of paper a month are taken from Nippon to Pier 7 in Seattle. The paper is then transferred to rail cars or containers for shipping overseas.

Up to 1,500 tons of paper rolls — the equivalent of 60 to 80 semi-truck loads — are transported at a time, yet Gregg says the fuel consumed by the tug when towing the barge to Seattle only equals that of three semis.

Response:

P6 – Carle, Renée *(page 1 of 2)*

October 24, 2008

To: Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

From: Renée Carle
12391 S. Keyport Rd NE
Poulsbo, WA 98370

Subject: NAVSEA NUWC Keyport Range Extension Draft EIS/OEIS

Dear Mrs. Kler,

With regard to the subject draft EIS/OEIS, I submit the following comments for consideration as a matter of public record.

Regarding public notification and input:

The NEPA process allows the public the right to provide input on what issues should be addressed in an EIS and to comment on the findings in an agency's NEPA documents during the scoping stage. To achieve this goal public notification is required; you are required to notify the public of your intended action and make available for public comment the draft EIS/OEIS. I am concerned that the form(s) and frequency of public notification used, did not meet the intent under the NEPA process of which is to garner widespread public attention of the proposed action as was evident by the lack of public turnout at your October 1st public hearing. If public notification was lacking from the outset of the development of this proposal, then the public's right to have input during initial scoping and subsequent development of the draft EIS/OEIS may have been usurped. 1

Although public meetings were held, I was only recently made aware of your proposal to expand the Northwest Training Range Complex by word of mouth. Additionally, I never received the draft copy of the EIS/OEIS for which I filled out a mailing request form at the open house preceding your public hearing on October 1, 2008. I was unsuccessful at downloading this document from your website which seemed to have been experiencing technical difficulties. I was only able to obtain a copy of this document through a friend two weeks prior to your comment deadline. This did not allow me to conduct a full reading of this 740 page document. I found your methods for providing copies of the draft EIS/OEIS to the public woefully inadequate. 2

Regarding protection of marine mammals:

In the letter dated June 2, 2008 from EPA subject: "EPA comments on the Southern California Range Complex Draft Environmental Impact Statement (DEIS), California (CEQ # 20080119)" to Naval Facilities Engineering Command Southwest (NAVFAC); the EPA expresses concerns over the NAVFAC Southwest methodology used to evaluate the impacts on marine mammals from Mid-Frequency Active Sonar. The concerns result from NAVFAC basing its methodology to predict harm to marine mammals on sparse data. The EPA's opinion considers the impacts to be potentially significant under NEPA and recommends NAVFAC Southwest outline greater measures to mitigate environmental impacts. I am concerned that under the NUWC Keyport Range Extension Draft EIS/OEIS the methodology for predicting environmental impact is based on the same sparse data. I would expect that the recommendations 3

Response:

1. As described in Chapter 2 of the Draft EIS/OEIS, official notification of the Navy proposal began with the publication of the Notice of Intent (NOI) on September 11, 2003, in the Federal Register. A copy of the NOI is presented in Appendix A of the Draft EIS/OEIS. Press releases were sent to several newspapers in the Washington State area announcing the NOI publication. Following this, letters outlining the Navy proposal and announcing scoping meetings were sent to Federal, state, and local agencies; Native American Indian Tribes and Nations; elected officials; and various interest groups. Scoping meetings were held in four counties adjacent to the current and proposed sites that could potentially be affected by the Proposed Action or alternatives: Keyport, Kitsap County (November 17, 2003); Belfair, Mason County (November 18, 2003); Quilcene, Jefferson County (November 19, 2003); and Hoquiam, Grays Harbor County (November 20, 2003). Advertisements describing the Proposed Action and alternatives were placed in nine local newspapers one week before the scoping meetings. The advertisements provided the times, dates, and locations of the scoping meetings. As part of the public outreach effort, flyers were also posted in local marinas, grocery stores, and post offices. Public comment was solicited in the advertisements, flyers, and the scoping meetings themselves. Input from the public obtained during the scoping process was used to further refine the alternatives that were carried forward for analysis in this Draft EIS/OEIS. Newsletters describing the status of the EIS/OEIS process were sent out from 2004 through 2007. The outreach effort implemented to provide for public comments on the Draft EIS/OEIS was as comprehensive as that conducted for the scoping process.
2. The request for a copy at the 1 October hearing was for a Final EIS/OEIS not a Draft EIS/OEIS. The Final EIS/OEIS will be sent as requested once it is publically available. The website did provide contact information for such problems. Website monitoring indicated hundreds of hits per day. In addition, the document was made available through local repositories including Kitsap County libraries. Information could also be requested from the NUWC Keyport Public Affairs Office.
3. The EPA did not raise the same concerns in its comments on this document. EPA comments and responses are included in this appendix. Data sources and any limitations have been thoroughly discussed in this EIS/OEIS.

P6 – Carle, Renée *(page 2 of 2)*	
October 24, 2008 by the EPA as outlined in the June 2, 2008 letter to NAVFAC Southwest, be incorporated into the NUWC Keyport Range Extension Draft EIS/OEIS as applicable. 3 (cont.) Respectfully, Renee M. Carle Renee Carle	**Response:**

P7 – Coleman, Don *(page 1 of 2)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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speak. Please honor any request that I make for you to stop speaking if you reach the five-minute time limit. To aid you in knowing when your time is almost up, the timekeeper will flash a yellow slide on the screen when you have one minute left. This should allow you to find a comfortable place to conclude your comment. A red slide will be held up when your five minutes have elapsed. When you see the red slide, please conclude your comments. Depending on the number of speakers and the duration of the public hearing, I may offer additional time to speak. Written comments are also encouraged.

Third, if you have a written statement, you may turn it in to the court reporter and/or you may read it out loud within the time limit.

We are now ready to begin the comment period. The first commenter this evening is Mr. Don Coleman. Please come up to the microphone here.

MR. COLEMAN: My name is Don Coleman. I represent my personal business, Pacific Adventure. I've run a recreational scuba diving charter boat out of Pleasant Harbor for the last eight years. I also have comments for Pleasant Harbor Marina, where I also work.

I think my biggest concern is because a great part of the economic development future of Hood Canal,

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Response:

P7 – Coleman, Don *(page 2 of 2)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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including Brinnon and Hoodsport and Quilcene, relies on recreational activities in the water, and my concern is that this range expansion proposal may limit recreational activities on the water. My business requires that I schedule trips knowing that I will have access to the dive sites that I need to go to. So that's one of my big concerns. 1

Another possible concern that may be addressed would be with the Black Point development in the future, the increase in float plane travel and how the airspace over the range expansion areas may or may not affect planes coming in and out of the marina for the marina clients. 2

And I think that's it. Those are my concerns, basically to make sure that we have open access to the water for recreational activities.

MS. TURNER: Thank you, Mr. Coleman.

Our second commenter is Mr. Ralph Hogan.

MR. HOGAN: My name is Ralph Hogan, and I live in Brinnon. Captain, I am a licensed merchant marine officer.

My concern is to the security of Dabob Bay and the surrounding area. I have been told to leave the area when I am not in the Navy's range. When it has not been active, they have a lighting system in Hood Canal of

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Response:

1. Safety is first priority and operators look for dive flags. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

2. The Black Point Development is listed in the cumulative impacts section in Chapter 4. Airspace and flight regulations are dealt with by the FAA.

P8 – Hager, John *(page 1 of 2)*

NAVSEA NUWC Keyport
Range Complex Extension
Public Hearing Comment Sheet

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Location: ______
Date: ______

Keyport 10/1/08

Public Hearing Comment Sheet

Thank you for providing your comments on the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. Please provide comments no later than October 27, 2008. They may be submitted in the following ways: 1) by filling out this comment sheet and placing it in the drop box provided at each hearing meeting; 2) by providing oral comments at one of the public hearings; and 3) by sending comments via postal service to the address below.

This comment addresses the proposed Keyport Range Expansion, but the gist is also applicable to the other Northwest range sites. This concerns private and commercial boating use of the waters, shoreline, and ports in the range area.

Continuation of the range use and activities of the past 30 years will have essentially no adverse impact on recreational and commercial boaters. However, future significant changes of range operations, particularly closure of the range area to recreational or commercial

Please Print—Additional space is provided on back (cont. on back)

1. Name John B. Hager
2. Address 2574 NE William E. Sutton Rd. Bremerton, WA 98311
3. Please check here ☐ if you would like to be on the mailing list.
4. Please check here ☐ if you would like your name/address kept private.
5. Would you like to receive a hard copy ☐ or CD ☒ of the *Final EIS/OEIS*?

Please Note: Comments will be published in the Final EIS/OEIS. The name, city, and state locations of persons making comments will appear in the Final EIS/OEIS. Specific address information of commenters and meeting attendees will not be printed in the Final EIS/OEIS, but will be used to create a mailing list for the document.

Please give this form to one of the Navy Representatives, place in the drop box, or mail by October 27, 2008 to:
Mrs. Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Response:

P8 – Hager, John *(page 2 of 2)*

boaters and boating, must be specifically limited in the ~~expans~~ range expansion authorization.

A reasonable limit would be:
When the range, or a portion thereof, must be closed to private or commercial use, the following limits must be observed:

A) The area to be closed, and the times of closure must be publicized at least one day in advance. 1

B) Any closure must not exceed one hour, and must be preceded and followed by a one hour open period for public use and transit. 2

Visit our website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

The Navy Wants Your Input!

Public involvement is a fundamental part of the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS development and the Navy wants and appreciates your comments.

Comments on the Draft EIS/OEIS will be accepted via mail or the project web site. All comments should be submitted no later than October 27, 2008 to ensure consideration in the Final NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS.

For more information or to submit comments, please contact:

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Website: http://www-keyport.kpt.nuwc.navy.mil/EIS_Home.htm

Response:

1. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

2. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

P9 – Hogan, Ralph ***(page 1 of 4)***

Navy Base Hearing, Session 4 - Quilcene, Washington

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including Brinnon and Hoodsport and Quilcene, relies on recreational activities in the water, and my concern is that this range expansion proposal may limit recreational activities on the water. My business requires that I schedule trips knowing that I will have access to the dive sites that I need to go to. So that's one of my big concerns.

Another possible concern that may be addressed would be with the Black Point development in the future, the increase in float plane travel and how the airspace over the range expansion areas may or may not affect planes coming in and out of the marina for the marina clients.

And I think that's it. Those are my concerns, basically to make sure that we have open access to the water for recreational activities.

MS. TURNER: Thank you, Mr. Coleman.

Our second commenter is Mr. Ralph Hogan.

MR. HOGAN: My name is Ralph Hogan, and I live in Brinnon. Captain, I am a licensed merchant marine officer.

My concern is to the security of Dabob Bay and the surrounding area. I have been told to leave the area when I am not in the Navy's range. When it has not been active, they have a lighting system in Hood Canal of 1

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Response:

1. Submarine escort boats are primarily operated by the Coast Guard and are therefore separate from most NUWC Keyport activities. The Navy has met with the Coast Guard regarding this regional issue and it is being addressed with regional staff.

P9 – Hogan, Ralph *(page 2 of 4)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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yellow-and-red flashing lights that tell you when to stay out of the area. I have been chased out of that area by security when these lights have not been active.

What you are proposing by this extension to the south is, if that range is active, you are proposing that anyone coming out of Pleasant Harbor has to go 30 miles now out of their way down to the south end of Hood Canal to the Hamma Hamma and back up the east side of Hood Canal to exit the canal, because we will not be able to cross from Pleasant Harbor over to the Seabeck side because that is part of your new inclusion of the range.

1 (cont.)

I have been told to not go around. There is a point up north called Pulali Point. Your range goes up to Pulali Point. I have been told not to go into Quilcene Bay when the range is active.

I can appreciate this, I understand the laws, I am familiar with them, but they have been overexecuted. Like I said, I will comment again, I have been chased out of the area when I am not in the Navy's range and I am fully against this expansion. Thank you.

MS. TURNER: Thank you, Mr. Hogan, for your comment.

Our next commenter, Mr. Norman Pollock.

MR. POLLOCK. I will pass.

MS. TURNER: Mr. Pollock passes.

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Response:

P9 – Hogan, Ralph ***(page 3 of 4)***

Navy Base Hearing, Session 4 - Quilcene, Washington

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(A break was taken.)

MS. TURNER: Ladies and gentlemen, I have not received any additional speaker request cards. I hate to disrupt your conversation, but I did want to reconvene the public hearing, since I said 8 o'clock.

Would anyone like to give an oral comment at this time?

MR. HOGAN: I would like to say one more thing.

MS. TURNER: Before you start, let's go ahead and wait for everyone to take their places and then we will reopen.

Mr. Hogan, is that correct?

MR. HOGAN: Yes.

MS. TURNER: Please.

MR. HOGAN: Just to reemphasize, the extension to the south of this range in Dabob that extends down to the Hamma Hamma, the effects of that on what few businesses we have left in Brinnon and Pleasant Harbor are going to be catastrophic. 2

When that range is active, there will be no boat traffic allowed to cross from the bottom of Toandos Peninsula over to Pleasant Harbor without having to go 30 miles out of their way, and people are not willing to do that today. Don Coleman runs a diving business. It would put him out of business if this extension goes

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Response:

2. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).

The socioeconomic impact assessment described in the EIS/OEIS found that no significant impacts to the economy would occur. Refer to Section 3.11 of the EIS/OEIS for additional information.

P9 – Hogan, Ralph *(page 4 of 4)*

Navy Base Hearing, Session 4 - Quilcene, Washington

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through.

Two hundred days of use a year, which I just can't say enough, we have maybe ninety days of fishing in the canal, if that. That would be a maximum figure. Thirty of those ninety days Dabob Bay is closed and you are not allowed to go in there to fish. I don't know what else to say. It would just be catastrophic on our little bit of economy we have left. 2 (cont.)

MS. TURNER: Thank you, Mr. Hogan, for your comment.

Is there anyone else that would like to give an oral comment? Please.

MR. BECK: I am going to put my other hat on, Herb Beck, Port of Port Townsend Commissioner.

At the Quilcene Marina, the hours of operation are very critical to our survival, and I wish that there would be a limitation when you would do your timing, such as, say, maybe three, four days a week or something to that effect.

We don't have much going for ourselves. We have to maintain the facilities, build new facilities for the community, and we do have folks that come in and stay overnight that take up moorage for, let's say, an evening or so forth and they use the community facilities, the restaurants and some of the other opportunities that are

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Response:

P10 – MacIntyre, James *(page 1 of 2)*

Navy Base Hearing, Session 1 - Keyport, Washington

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then it should be substantiated. I will try to skip a little bit.

MS. TURNER: We are at three minutes. Thank you, Mr. Veatch. There may be additional time.

So at this time we have had two people turn in speaker comment forms. Is there anyone else that would like to speak at this time?

Please come to the microphone. If you could please give us your name and spell your last name for the court reporter.

MR. MACINTYRE: My name is MacIntyre. We live on Ordis (phonetic) Road, just off the Keyport Range. I just have four questions. Until I heard the discussion about the project itself, I wasn't sure exactly what I wanted to talk about.

My questions are, will there be any increase in noise in any communities bordering these extensions. We'd get some strange noise in the past and I am never sure whether any of it is because of projects you are running or not. That's the first thing. 1

The second thing, will civilian traffic ever be halted in the test areas. I'm kind of confused. If you set a test area, are there times when you physically shut that off or is that always open for boating traffic. 2

The third thing is, one class of underwater 3

National Court Reporters
888.800.9656

Response:

1. No increase in noise in the surrounding communities is expected.
2. Access would remain open. Restrictions on boater access would occur very infrequently and only when there is a safety issue. Boaters, fishermen, divers and other users should notice little or no change on local waterways. If access to a specific portion of a range is required during test activities, NUWC Keyport range operators will direct boaters around the immediate test area. Should vessel movement be restricted for safety reasons, it would be rare and for short periods of time (30 minutes or less), and the areas of restriction would be small and very localized (not range-wide).
3. UUVs would be retrieved and would not cause a navigational hazard.

P10 – MacIntyre, James *(page 2 of 2)*

Navy Base Hearing, Session 1 - Keyport, Washington

27

vehicle will surface at the end of a test run. Are these retrieved so they don't become a hazard to civilian boat traffic. 3 (cont.)

And the last one is, what is going to be the impact to the salmon runs in Steel Creek through Burke Bay. 4

Do you need my spelling? My name is M-A-C-I-N-T-Y-R-E, James. Thank you.

MS. TURNER: Thank you, Mr. MacIntyre.

Do we have any additional commenters at this time? Would any of the previous commenters like additional time? Mr. Bailey?

MR. BAILEY: Yes. I would have to say the second speaker had access to information that we were unable to find, and I would like to have had that. I thought maybe we would be getting that this evening from you, but I searched all day yesterday, or today, as did our manager, looked at the website trying to find the EIS and the proposed impacts. So he had a little bit of uppance there.

I would like to say that one of our concerns is that we have traffic coming and going at all hours, day and night, and we have a large population of commercial fishing boats that come in at the marina and have catches that are significantly time-dependent. They need to get

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888.800.9656

Response:

4. As described in Section 3.4.2 of the EIS/OEIS, no impacts to any salmon species from proposed or current activities are expected, including those found in Burke Bay and Steele Creek.

P11 – Milner, Glen *(page 1 of 4)*

GLEN MILNER 206 365 7865 09/14/08 02:10pm P. 002

#17

Glen Milner
3227 NE 198th Place
Seattle, WA 98155
(206) 365-7865
gkaajm@juno.com

September 14, 2008

Naval Facilities Engineering Command Northwest
ATTN: Mrs. Kimberly Kler—NWTRC EIS
1101 Tautog Circle Suite 203
Silverdale, WA 98315-1101

VIA FACSIMILE: (360) 396-0857

RE: Keyport Range Complex Extension Draft Environmental Impact Statement/Overseas Environmental Impact Statement

Mrs. Kimberly Kler

I would like to comment on the Navy's proposed Keyport Range Complex Extension Draft Environmental Impact Statement/Overseas Environmental Impact Statement. However, I have not received a copy of the report. I had asked for a copy in electronic format.

I am unable to download the Draft EIS on my computer. Is the Navy sending the Draft EIS to those who asked to receive them? When will they be sent?

Please send me a copy of the Draft EIS in electronic form to the above listed address. 1

In addition, I would like to attend the first public review of the Draft EIS. I noticed the Navy has scheduled this again at a location that may be restricted to some members of the public. I am requesting that the first meeting be moved to a new location or that the Navy publicly announce that it will not arrest or prosecute citizens in attendance who may have received a barment letter from the Navy.

Please keep in mind that the Navy has arbitrarily banned some members from the base without a trial or hearing. In my case, I was praying in front of the base in December 1987. For that reason, the Navy has decided I cannot attend the first public review of the Draft EIS. This is an arbitrary decision by the Navy and does not comply with NEPA regulations.

Below is a statement I made in a letter dated December 2, 2003 regarding the Navy's proposals. It appears little has changed regarding the Navy's failure to keep citizens informed of U.S. Navy proposals.

Response:

1. A CD containing an electronic copy of the EIS/OEIS was sent to this commenter on October 2nd, 2008. In addition, the document was available for download on the NUWC Keyport website. As requested, an electronic copy of the Final EIS/OEIS will be mailed to this commenter.

   In addition to the Keyport hearing, three other hearings were held. It was also possible to receive information or comment via the NUWC Keyport website, e-mail or general mail.

P11 – Milner, Glen *(page 2 of 4)*

I am requesting that the public comment period be extended and that at least one public hearing be held in the Seattle area. On November 28, 2003, the Seattle Post-Intelligencer had an article on the range extension plans, showing public interest in the Seattle region. Naval activities in Hood Canal and off the Washington Coast can have a significant impact upon the Seattle/Puget Sound region. 2

The Navy's leaflet on the proposed range extension plans states, "It is the Navy's responsibility to keep communities informed and involved." The Navy has not done this. The Seattle region is affected by the Navy ranges. The Seattle region did not have a public hearing.

In addition, the Navy's literature does not clearly state what the Navy intends to do in the proposed range extension areas. It appears the expansion is close to 30 times the size of the current ranges. No reason is given other than "to meet both the existing and future operational requirements…" What are the existing and future operations?

The Navy has not tried to keep the public informed about Navy activities in the proposed range extension areas. I have done extensive research and writing on Navy activities and the Trident submarine system. I have filed a number of Freedom of Information Act requests regarding these activities. The Navy's responses show the Navy is not interested in public disclosure.

One Freedom of Information Act request dated August 16, 2002, specifically concerning issues involved in the range extension areas, is for *"documents on file showing submarine exercises, practice patrols, drills and/or tours in or near Dabob Bay, Washington… the type of exercises, length of exercises and type of support ships involved….documents showing the frequency of the submarine exercises, practice patrols, drills and/or tours in or near Dabob Bay… documents describing submarine activities in Dabob Bay…documents showing whether torpedoes are fired in Dabob Bay."* The Navy is required by law to release documents showing this type of activity. The Navy has not released information regarding this, with the exception of records regarding submarine tours. This delay is 14 months longer than the time frame established by the Freedom of Information Act for the release of information. 3

There have been other Freedom of Information Act requests, specifically concerning issues involved in the range extension areas, in which the Navy has prevented the release of information. A February 9, 2002 Freedom of Information Act request was for *"documents on file regarding the compliance to environmental laws and regulations for ongoing and proposed construction projects at Naval Submarine Base Bangor since December 31, 2000…all Biological Assessments during this time period."* The Navy would not grant a

Response:

2. In order for the Navy to meet the required permit timelines with NMFS to continue activities in the NAVSEA NUWC Keyport Range Complex, the public comment period must remain at 45 days.

   The 45-day public comment period provided sufficient time for all commenters to review and comment on the Draft EIS/OEIS.

   Four hearings were held in the counties where potentially affected communities are located. In addition to the public hearings, it was possible to comment via the NUWC Keyport website, e-mail or general mail.

3. The FOIA request dated 8/16/2002 did not come to NUWC Keyport. Other FOIA requests from Glen Milner were received in the Spring of 2003 and responses were sent.

P11 – Milner, Glen *(page 3 of 4)*

waiver of fees for the processing of this request, even though I have demonstrated an ability to understand and disseminate the information to the public. The Navy insists on payment of $1,545.00 for the requested documents showing environmental compliance for a 13-month period.

The Navy's handling of Freedom of Information Act requests, by the same offices now requesting a range extension, shows an unwillingness to work with the public for a better understanding of Navy activities. It is very doubtful, now that the Navy is requesting an expansion for areas involved, that the Navy will "keep communities informed and involved." My experience with the Navy has been the opposite.

The Navy has not been a good neighbor in the Puget Sound region. Recently I discovered through a Freedom of Information Act request regarding Trident submarine navigation hazards that the Navy has been firing radioactive ammunition off the coast of Washington State. The areas could include the proposed Quinault Site extension. The Navy has never supplied documents showing how many radioactive rounds have been fired and where. Even though strict monitoring of ammunition stocks is required in the Navy's Nuclear Regulatory Commission license, the Navy claims it has no records regarding this activity.

Another activity in Hood Canal shows how the Navy does not "keep communities informed and involved." Approximately six days per month, Hood Canal becomes an explosives handling zone originating at the Trident Explosives Handling Wharf at Bangor. The Navy has spent millions of dollars to move buildings out of the larger Trident D-5 missile explosives handling zones, yet it has never informed the public of the threat. The Navy is not a good neighbor. 4

Much of the activities of the Navy involves locating a target and then, once the target is located, destroying it. The Navy also conducts mine demolition exercises. In locating a target, the Navy utilizes various types of sonar. Little has been done to minimize or study the affects of this sonar on marine mammals. When a court decision ruled against the Navy's use of a particular type of sonar in various situations, the Navy obtained an exemption through Congress. 5 Test firing, mine demolition activities, etc., often employ explosive charges. This is harmful to marine life and to the larger Pacific Northwest environment. 4 (cont.)

I feel that the basic function of the Navy is to increase the warfighting ability of the U.S. military at all costs. Environmental protection is seen as a constraint by the Navy instead of an issue the Navy willingly studies and addresses. The Pentagon often states that environmental protection is a hindrance to military activities. Why would we trust the Navy to be environmentally sensitive to expanded testing ranges?

I have asked the Navy a number of questions in the past through the Freedom of

Response:

4. No explosive warheads are currently tested or planned for testing within the Keyport Range, DBRC, and QUTR sites.
5. Extension of areas would allow the Navy to test more complex systems but acoustic energy (i.e., sonar) would not change. NUWC Keyport personnel take great care to detect the presence of marine mammals prior to and during our activities. Range operators are trained in marine mammal detection, and our Keyport and Dabob Bay range sites are within shore-to-shore view of the operators. There have been no reported incidents involving marine mammals in NUWC Keyport's many decades of operation. Refer to the acoustic analysis for marine mammals in Section 3.5 of the Draft EIS/OEIS.

P11 – Milner, Glen *(page 4 of 4)*

Information Act. I have another question for the Navy regarding these range extensions. Does the Navy expect to move any facet of torpedo testing from the Nanoose Range to the proposed extended ranges? Does the use of the Nanoose Range, or possible restrictions for use of the Nanoose Range, affect the usage of the Navy's proposed range extension plans? 6

For the above listed reasons, I am requesting that the Navy hold at least one public hearing in the Seattle region. I am requesting that any range extensions in the Pacific Northwest by the U.S. Navy be denied.

Please send me a CD-ROM copy of the EIS/OEIS. Please keep me informed of all public hearings and public comment opportunities regarding the Navy's proposed range extensions.

Regarding the policy of secrecy by the U.S. Navy, a recent request for information through the Freedom of Information Act on projects at Naval Base Kitsap-Bangor was denied because the budget information on the projects was considered "predecisional." The Navy stated this was because the budget was subject to change. The Navy continues to search for new and creative ways to withhold information, yet publicly states it wishes to inform the public of its activities.

Please send the CD-ROM copy of the Draft EIS as soon as possible. Please let me know on the meeting in Keyport on October 1, 2008. I would like to know if I can attend the meeting without being arrested, or later prosecuted, and whether I will have information about the Navy's proposals in time to review them.

Thank you for your consideration.

Sincerely

Glen Milner

Response:

6. No, the Nanoose Range activities are not affected by the Proposed Action or any of the alternatives. The Hood Canal environment is a unique testing area and the intent of the Proposed Action is not to substitute the Nanoose activities into the Hood Canal.

P12 – Nixon *(page 1 of 1)*

SHIRLEY NIXON
PO Box 178; Port Angeles, WA 98362
(360) 417-0850
shirleynixon@olympus.net

October 20, 2008

Mrs. Kimberly Kler, Environmental Planner
NAVFAC Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Re: Comments on NAVSEA NUWC Keyport Range Extension Draft EIS/OEIS

Dear Mrs. Kler,

Thank you for the opportunity to comment upon the draft EIS/OEIS noted above. I attended the October 1, 2008 public hearing, but did not offer comments at that time because the draft EIS/OEIS was not readily available. The website listed in the Federal Register notice contained a link to the 740-page document; however the electronic file was too large for me to upload and view on line. This difficulty also precluded downloading the document from the web site.

I was disappointed to find no copies of the Draft EIS/OEIS available for distribution to the public at the October 1, 2008 public hearing. I asked that night that an electronic copy be sent to me. When it did not arrive by October 8, I e-mailed the Keyport NUWC Public Information office, explaining my need, and asking that someone contact me. This did not occur. (My efforts to find an e-mail address or a phone number for you were unsuccessful, because neither the Federal Register Notice nor the hand-outs from the public hearing provided such contact information.)

To compound this lack of information and communication, the Keyport NUWC website EIS/OEIS could not be accessed for many days during the time when I was trying to discover a way to access and/or download the draft EIS/OEIS documents. When I had heard or received nothing by October 15, and the web site was still inaccessible, I contacted Congressman Norm Dicks' office for assistance. Judith Morris of Congressman Dicks' staff was helpful in putting me in touch with Keyport NUWC staff, and this morning I spoke at length with Ms. Shaari Unger and explained these difficulties.

Because it has been so difficult during the public comment period for members of the general public to access the source document(s) upon which comments are sought, I respectfully request that the public comment period for the draft EIS/OEIS be extended for the general public from October 27, 2008 to November 14, 2008. 1

Thank you for your courtesy in considering this extension request.

Sincerely,

Shirley Nixon

cc: Congressman Norm Dicks via Judith Morris, Port Angeles constituent office
Ms. Shaari Unger (via e-mail to shaari.unger@navy.mil)

Response:

1. The NAVSEA NUWC Keyport Range Extension NEPA compliance process involved a comprehensive outreach effort for the Draft EIS/OEIS. A copy of the document was sent three different times to this commenter, including one sent (with delivery confirmed) via an overnight express service. The document was also available for download via the NUWC Keyport website, and copies were sent to 11 local repositories, including a copy at a library that was added to the list of repositories as requested by this commenter.

   In order for the Navy to meet the required permit timelines with NMFS to continue activities in the NAVSEA NUWC Keyport Range Complex, the public comment period must remain at 45 days.

   The 45-day public comment period provided sufficient time for all commenters to review and comment on the Draft EIS/OEIS.

P13 – Public, Jean *(page 1 of 2)*	
faxZERO Send a fax for free Recipient Information To: us navy Fax #: 3603960857 Sender Information From: jean public Email address: jeanpublic@yahoo.com This fax was sent using the FaxZero.com free fax service. FaxZero.com has a zero tolerance policy for abuse and junk faxes. If this fax is spam or abusive, please e-mail support@faxzero.com or send a fax to 800-980-6856. Specify fax #1148311. We will add your fax number to the block list.	**Response:**

P13 – Public, Jean ***(page 2 of 2)***

navy plan to destroy. they want more land added to the land they have already destroyed to test weapons. i oppose giving the us navy, which is horribly destructive of the american environment any more land to destroy. the us navy has shown terrible destruction of the environment and does horribe things. jeanpublic@yahoo.com, this is about tne federal register notice which was on the web yesterday for the first time. 1	**Response:** 1. The Proposed Action does not include any land acquisition or expansion of existing Navy facilities. The findings of the EIS/OEIS analysis indicate that the current and proposed activities conducted by NUWC Keyport would have no significant impacts on the environment.

P14 – Rowland, Jerry *(page 1 of 1)*

NAVSEA NUWC Keyport
Range Complex Extension
Public Hearing Comment Sheet

Location: ____________________
Date: ____________________

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Public Hearing Comment Sheet

Thank you for providing your comments on the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. Please provide comments no later than October 27, 2008. They may be submitted in the following ways: 1) by filling out this comment sheet and placing it in the drop box provided at each hearing meeting; 2) by providing oral comments at one of the public hearings; and 3) by sending comments via postal service to the address below.

THE PORT OF BROWNSVILLE IS CURRENTLY IN NEGOTIATIONS WITH DNR TO EXPAND THE EXISTING MARINA APPROXIMATELY 600 FEET TO THE EAST. WILL THE PROPOSED RANGE EXPANSION IMPACT ON OUR ABILITY TO DO THIS? 1

****Please Print—Additional space is provided on back****

1. **Name** JERRY ROWLAND
2. **Address** 9790 OGLE RD NE
   BREMERTON, WA 98311
3. **Please check here** [✓] **if you would like to be on the mailing list.**
4. **Please check here** [ ] **if you would like your name/address kept private.**
5. **Would you like to receive a hard copy** [ ] **or CD** [✓] **of the *Final EIS/OEIS*?**

Please Note: Comments will be published in the Final EIS/OEIS. The name, city, and state locations of persons making comments will appear in the Final EIS/OEIS. Specific address information of commenters and meeting attendees will not be printed in the Final EIS/OEIS, but will be used to create a mailing list for the document.

Please give this form to one of the Navy Representatives, place in the drop box, or mail by October 27, 2008 to:
Mrs. Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Response:

1. The Proposed Action will not impact the Brownsville marina as is or as expanded.

P15 – Ryan, Matt *(page 1 of 1)*

NAVSEA NUWC Keyport
Range Complex Extension
Public Hearing Comment Sheet

Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Location: ____________

Date: ____________

Thank you for providing your comments on the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS. Please provide comments no later than October 27, 2008. They may be submitted in the following ways: 1) by filling out this comment sheet and placing it in the drop box provided at each hearing meeting; 2) by providing oral comments at one of the public hearings; and 3) by sending comments via postal service to the address below.

Please replace day marks South of Brownsville MARINA - It is rusting to death - off ILLAHEE Road 1

Please Print—Additional space is provided on back

1. Name MATT RYAN
2. Address 9080 Illahee Rd NE Brem 98311
3. Please check here [✓] if you would like to be on the mailing list.
4. Please check here [ ] if you would like your name/address kept private.
5. Would you like to receive a hard copy [ ] or CD [ ] of the *Final EIS/OEIS*?

Please Note: Comments will be published in the Final EIS/OEIS. The name, city, and state locations of persons making comments will appear in the Final EIS/OEIS. Specific address information of commenters and meeting attendees will not be printed in the Final EIS/OEIS, but will be used to create a mailing list for the document.

Please give this form to one of the Navy Representatives, place in the drop box, or mail by October 27, 2008 to:
Mrs. Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Public Hearing Comment Sheet

Response:

1. The day marker is outside the scope of the proposed extension.

P16 – Schwab, David and Greb, Ruth ***(page 1 of 1)***

Mrs. Kimberly Kler, Environmental Planner
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

October 16. 2008

Dear Mrs. Kler:

We wish to express our opposition to the proposed NAVSEA NUWC Keyport Range Complex Extension Draft Environmental Impact Statement (EIS/OEIS.

Our opposition to the undersea expansion includes the following:

1. The state of Washington is investing millions of dollars for the Puget Sound Clean-up especially in Hood Canal. We feel that expanding the testing range to encompass almost all of Hood Canal would be an environmental disaster for the fragile marine environment including the salmon spawning areas, the visiting Orca population and other sea mammals. 1
2. Impacting the commercial and sport fishing would be grave economic disaster for our economy in this region. 2
3. Sonar testing in our Northwest waters has caused severe damage and even death to the Orca whale populations on occasion. Whale watching has provided jobs and income for a region that has suffered from the decline of fishing and scuba diving. The expansion of the testing areas, one must assume is for testing stronger and more powerful sonar which would increase the chance for greater disruption and harm for the marine mammals and fisheries. 3

In conclusion, our area is in peril already from all the pollutions and dysfunction that has plagued our Puget Sound and now, with the Puget Sound clean up operation, why add another facet to the already huge and expensive project?

Sincerely yours,

David O. Schwab
26417 Kingsview Loop
Kingston, WA 98346

Ruth E. Greb
5425 Ponderosa Blvd NE
Hansville, WA 98340

Cc: Jay Inslee

Response:

1. The Draft EIS/OEIS included an analysis of environmental impacts found in Sections 3.1 through 3.6. This analysis indicated that no significant impacts to the environment of Hood Canal would occur. No expansion of the annual average days of use in the area is proposed.
2. The Draft EIS/OEIS included an impact assessment that indicated that no significant impacts to the economy would occur. Please refer to Section 3.11 of the Draft EIS/OEIS for additional information.
3. Extension of areas would allow the Navy to test more complex systems but acoustic energy (i.e., sonar) would not change.

   NUWC Keyport personnel take great care to detect the presence of marine mammals prior to and during our activities. Range operators are trained in marine mammal detection, and our Keyport Dabob Bay Range Complex Range sites are within shore-to-shore view of the operators. There have been no reported incidents involving marine mammals in NUWC Keyport's many decades of operation.

P17 – Sword, Carol *(page 1 of 1)*

20 October 2008

Dear Ms. Kler,

Please accept my request that the Naval Undersea Warfare operations in Dabob Bay NOT be expanded. I've watched Orca Whales in that bay and listened to them with an undersea mike. Even when they can't be seen or heard, we know that other life forms deserve some space on this planet. Support that please. Sincerely, Carol Sword 1

Response:

1. The Draft EIS/OEIS considered impacts to habitats, communities, and species, including orcas and found that no significant impacts to orcas would occur from the Proposed Action.

P18 – Veatch, John *(page 1 of 3)*

October 1, 2008

Kimberly Kler
Environmental Planner
Naval Facilities Command
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101
(360) 396-0927

Re: NAVSEA NUWC Keyport EIS of September 2008

I wish to express concern over several elements in the proposed EIS. My comments are focused on the Keyport Range portion of the EIS as that is the area for which I have the most background and am most affected. I should note that I was employed at NUWC Keyport for nearly 34 years and have a sailboat moored at the Brownsville Marina.

Timing

It seems odd that the EIS has apparently been in existence for a considerable period but was made public only yesterday, September 30, through the local newspaper, the Kitsap Sun. This, in combination with the fact that the public hearing is scheduled for today, only one day later, gives the public little or no chance to prepare for the hearing.

It is noted that in paragraph 1.4.2 (Public Scoping Process), starting on page 1-26, it would appear that the Navy got input from the most impacted people or groups beginning as far back as 2003. This does not seem consistent with the fact that, as of yesterday, managements at the Port of Brownsville and Port of Poulsbo were both unaware of the planned actions, nor is the manager of the Kalaloch Lodge or the owner of the Seabeck General Store. All of these are in the center of affected areas. 1

Paragraph 1.4.2 also states that "flyers were posted in local marinas, grocery stores, and post offices." At no time did I ever see such a flyer at the Brownsville Marina since 2003, nor did I ever see one at the Deli at Brownsville, or any of the major grocery stores in Silverdale or East Bremerton.

In the list of agencies mentioned in paragraph 1.4.4 (Regulatory Agency Briefings) there is no mention of any agency that has to do with water recreation such as boating.

I understand that before any action can be taken by the Navy, this plan must be approved by the US Coast Guard, via the Waterways Management Office. As of today, they have never heard of these proposals.

Existing Conditions (para 3.8.1.1 of EIS)

The description of the recreational boating in the Keyport area seems to focus on special events by local yacht clubs and boat races. By doing so, it underplays the heavy use of powerboat and sailboat traffic in general in the area between Poulsbo and Brownsville that is not related to races. 2

The last paragraph of 3.8.1.1 also states that "on average, testing activities on the Keyport Range Site occur about 55 days per year" and refers to Table 2-2 on page 2-8. I can say that in the nearly 34 years that I was at Keyport, we probably used the Keyport Range no more than 5 times. The range was originally installed for support during WWII and went virtually unused thereafter. In the last several years in which my wife and I have sailed in the area between Poulsbo and Brownsville, I have not observed Naval activity in that area even once. So based on my experience, I would say that claiming to use the area 55 times per year is a gross exaggeration. 3

1

Response:

1. As described in Chapter 2 of the Draft EIS/OEIS, official notification of the Navy proposal began with the publication of the Notice of Intent (NOI) on September 11, 2003, in the Federal Register. A copy of the NOI is presented in Appendix A of the Draft EIS/OEIS. Press releases were sent to several newspapers in the Washington State area announcing the NOI publication. Following this, letters outlining the Navy proposal and announcing scoping meetings were sent to Federal, state, and local agencies; Native American Indian Tribes and Nations; elected officials; and various interest groups. Scoping meetings were held in four counties adjacent to the current and proposed sites that could potentially be affected by the Proposed Action or alternatives: Keyport, Kitsap County (November 17, 2003); Belfair, Mason County (November 18, 2003); Quilcene, Jefferson County (November 19, 2003); and Hoquiam, Grays Harbor County (November 20, 2003). Advertisements describing the Proposed Action and alternatives were placed in nine local newspapers one week before the scoping meetings. The advertisements provided the times, dates, and locations of the scoping meetings. As part of the public outreach effort, flyers were also posted in local marinas, grocery stores, and post offices. Public comment was solicited in the advertisements, flyers, and the scoping meetings themselves. Input from the public obtained during the scoping process was used to further refine the alternatives that were carried forward for analysis in this Draft EIS/OEIS. Newsletters describing the status of the EIS/OEIS process were sent out from 2004 through 2007. The outreach effort implemented to provide for public comments on the Draft EIS/OEIS was as comprehensive as that conducted for the scoping process.
2. Text modified in the Final EIS/OEIS to indicate that local marinas are used on a continuous basis.
3. The level of activity described in the EIS/OEIS (55 days of use) is conservative and not an exaggeration of current use. NUWC Keyport's activities are often not obvious due to the small size and inconspicuous nature of activities, including Keyport's small craft and underwater sensors for magnetics. In addition, the Navy's underwater activities are not visible. Examples of use include: AUV Fest 2003/2005, buoy testing, magnetic sensor testing, Navy cold water training yearly, and Acoustic Test Facility activities.

P18 – Veatch, John *(page 2 of 3)*

If the Navy is going to make that claim, then it should be substantiated. That can only be done by releasing detailed reports of the dates and times and kind of activity that took place. Even if that activity did take place, it was of such a nature that it went completely unnoticed by the boating community and could have taken place even without any designation of a Naval area.

Environmental Consequences (para 3.8.1.2 of EIS)

In the Keyport Range Alternative 1, it is again claimed that operational tempo would only increase marginally (by 5 days, 55 to 60). My experience at Keyport and sailing in the area would suggest that the operational tempo would actually increase quite dramatically, from zero to 60 days. Hence, the Navy's conclusion is misleading, and to my knowledge, not based on fact. 3 (cont.)

Because in paragraph 3.8.1.1 the Navy did not acknowledge the significant amount of boat traffic that takes place in the area, the conclusion that the impact is minor is not valid.

In the same paragraph, regarding the comment that "although they [recreational boats] may be required to travel a longer distance ...", it is my opinion that the additional time to go from the Brownsville Marina northbound would take a sailboat at least an extra ½ hour, or the same for a typical powerboat that travels about 6 kts.

The primary problem is the extension of the existing range to the south, beyond the Brownsville Marina.

Other Comments

Whereas the present types of activities of the Navy may carried on without major disruption of the local community, by changing the designated boundaries the Navy may use, or shut down, a permanent change like this becomes a license for most anything in the future. 4

Recommended Changes

Abandon Alternative 1 for the Keyport Range.

Before approving the Alternative 1 for the Keyport Range, the Navy should be required to conduct a one year study of boating activity in the Poulsbo-Keyport-Brownsville area, to include the number of boats using the area for each hour of each day, along with weather data. This would not be necessary for the other alternative, "No-Action Alternative". 5

Correct paragraph 3.8.1.1 to reflect the heavy amount of recreational boat traffic that is not associated with yachting events or races. 6

Provide specific data to substantiate the claim that the Keyport Range is presently used 55 days out of the year, and reflect the correct data in 3.8.1.1 and 3.8.1.2. 7

Acknowledge in the EIS that the approval of the U.S. Coast Guard is required in order to change rules applicable to boating. 8

Conclusions

The proposed changes and the EIS were sprung on the public without reasonable time to review and comment. Key individuals and groups were not consulted with.

The existing conditions are misrepresented: Some facts cited to substantiate the proposed actions are misleading and incomplete. 9

The environmental consequences are not minor: Alternative 1 for the Keyport Range could have a serious negative impact on the boating community.

2

Response:

4. The Record of Decision for the Proposed Action will define the extent of NUWC Keyport activities at these range sites. Any future changes outside the scope of the current EIS/OEIS would require additional analysis. The Navy is required to comply with all laws and regulations such as the Clean Water Act and Clean Air Act. As described in the EIS/OEIS, only minimal change in activity is expected with the Proposed Action.
5. Sufficient data were gathered to support the EIS/OEIS analysis, which determined that no significant effects on boating, recreation, or fisheries would occur. Therefore, such a study is not warranted.
6. See response to P18-2.
7. See response to P18-3.
8. No changes applicable to the rules of boating are associated with the Proposed Action; therefore, Coast Guard approval is not required.
9. See responses P18-1through P18-8.

P18 – Veatch, John *(page 3 of 3)*	
Alternative 1 for the Keyport Range should not be pursued by the Navy. 9 (cont.) Respectfully submitted, John R. Veatch John R. Veatch 3646 NE Bahia Vista Dr Bremerton, WA 98310 jveatch@earthlink.net (360) 373-1533 home (360) 917-5244 cell 3	**Response:**

P19 – Veatch, John *(page 1 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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I would point out that one of the most dangerous and treacherous points is the point right at the end of the peninsula off of Keyport here. If you have ever sailed over in that direction, you will see the converging waters are pretty treacherous. So if your range forces people into that area, small boats, I would have a safety concern.

MS. TURNER: Thank you, Mr. Bailey.

MR. BAILEY: The rest will be submitted by letter, and thank you.

MS. TURNER: Thank you for your comment.

Mr. John Veatch?

MR. VEATCH: I may not be able to make exactly three minutes. This is pretty tough, but I will try to read fast, I guess. I think you are all fine people, you are good people, your intentions are good, and I hope that doesn't count in my time.

I wish to express concern over several elements in the proposed EIS. My comments are focused on the Keyport Range part of the EIS, as that is the area for which I have the most background and most affected. I should know, as I was employed at NUWC Keyport for nearly 34 years and have a sailboat moored at Brownsville Marina.

Three topics: First is timing. It seems odd 1

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Response:

1. Flyers were used in public scoping but did not result in additional participation, so the Navy did not repeat the effort for the Draft EIS/OEIS public hearings. Also see response to 18-1 above.

P19 – Veatch, John *(page 2 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

that the EIS has been in existence for a considerable period but was made public only yesterday, September 30th, through the local newspaper, the Kitsap Sound. This, in combination with the fact that the public hearing was scheduled for today, only one day later, gives the public little or no chance to prepare for the hearing.

As noted in paragraph 142, it would appear that the Navy got input from both impact Keyport groups starting as far back as 2003, like you said. This does not seem consistent with the fact that as of yesterday the managements of the Port of Brownsville and the Port of Poulsbo were both unaware of the planned actions, nor is the manager of the Kalaloch Lodge or the owner of the Seabeck General Store. All of these are in the center of the affected areas.

Paragraph 142 also states that fliers were posted in local marinas, grocery stores and post offices. At no time did I ever see a flier at the Brownsville Marina since 2003, nor did I ever see one in the deli at Brownsville, or any of the major grocery stores in Silverdale or East Bremerton.

In the list of the agencies mentioned in paragraph 144 of the regulations, there is no mention of any agency that has to do with water recreation such as boating. I understand that before any action can be

1 (cont.)

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Response:

P19 – Veatch, John *(page 3 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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taken by you, the Navy, this plan must be approved by the U.S. Coast Guard via the Waterways Management Office, and as of today they had never even heard of the proposals. 1 (cont.)

Second, existing conditions. The description of the recreational boating in the Keyport area seems to focus on special events by local yacht clubs and boat races. By doing so, it underplays the heavy use of powerboat and sailboat traffic in general in the area between Poulsbo and Brownsville that is not related to races. 2

The last paragraph of 3811 states that on average testing activities at the Keyport Range occur about 55 days per year, and it refers to a table. I can say that in the nearly 34 years that I was at Keyport, we probably used the Keyport Range no more than five times in 34 years. 3

The range was originally installed for -- well, the last time I knew, it was for support during World War II and went virtually unused thereafter. In the last several years, when my wife and I have sailed the area, I have not observed any naval activity at any time, not even once.

So based on my experience, I would say that the claim to use the area 55 times a year is a gross exaggeration. If the Navy is going to make that claim,

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Response:

2. See response to P18-2 above.
3. See response to P18-3 above.

P19 – Veatch, John *(page 4 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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then it should be substantiated. I will try to skip a little bit. 3 (cont.)

MS. TURNER: We are at three minutes. Thank you, Mr. Veatch. There may be additional time.

So at this time we have had two people turn in speaker comment forms. Is there anyone else that would like to speak at this time?

Please come to the microphone. If you could please give us your name and spell your last name for the court reporter.

MR. MACINTYRE: My name is MacIntyre. We live on Ordis (phonetic) Road, just off the Keyport Range. I just have four questions. Until I heard the discussion about the project itself, I wasn't sure exactly what I wanted to talk about.

My questions are, will there be any increase in noise in any communities bordering these extensions. We'd get some strange noise in the past and I am never sure whether any of it is because of projects you are running or not. That's the first thing.

The second thing, will civilian traffic ever be halted in the test areas. I'm kind of confused. If you set a test area, are there times when you physically shut that off or is that always open for boating traffic.

The third thing is, one class of underwater

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Response:

P19 – Veatch, John *(page 5 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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them out of there and on the planes headed to Asia. So it's critical that those boats be able to come and go as they need.

So that's it. The rest will be submitted in writing. Three minutes seems like a small amount of time, considering you don't have that many folks. Thank you.

MS. TURNER: Thank you, Mr. Bailey.

Mr. Veatch?

MR. VEATCH: My first point was timing. Second is environmental consequences.

In the Keyport Range Alternative 1, it is again claimed that the operational tempo will only increase marginally by 5 days to 60. My experience at Keyport, in sailing in the area, would suggest that the operational tempo would actually increase quite dramatically, from zero to 60 days. Hence, the Navy's conclusion is misleading and to my knowledge not based on fact. 3 (cont.)

Because of paragraph 3811, the Navy did not acknowledge the significant amount of boat traffic that is in the area. The conclusion that the impact is minor is not valid. Everything you showed had to do with fish in broad terms.

In the same paragraph, regarding the comment that although they, recreational boats, may be required 2 (cont.)

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Response:

P19 – Veatch, John *(page 6 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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to travel a longer distance, it is my opinion that the additional time to go from Brownsville Marina northbound would take a sailboat at least an extra half hour for the typical boat that travels at six knots. The primary problem is the extension of the existing range to the south beyond the Brownsville Marina. 2 (cont.)

Another point, whereas the present types of activities of the Navy may be carried out without major disruption to the local community, by changing the designated boundaries the Navy may use or shut down, a permanent change like this becomes license for almost anything in the future. So you may not be a problem, but by making new boundaries, it could be a huge problem five or ten years from now, when your predecessors are in power. 4

Recommended changes: I would recommend you abandon Alternative 1 for the Keyport Range. If you think about pursuing it, then the Navy should be required to conduct a one-year study of boating activity in the Poulsbo/Keyport/Brownsville area, to include the number of boats using the area for each hour of each day, along with weather data. This would not be necessary if you take the no-action alternative. 5

You need to correct paragraph 3811 to reflect the heavy amount of recreational boat traffic that is not 2 (cont.)

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Response:

4. See response to P18-4 above.
5. See response to P18-5 above.

P19 – Veatch, John *(page 7 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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associated with yachting events or racing. Provide specific data to substantiate the claim that the Keyport Range is presently used 55 days out of the year and put that data in. I don't believe it. Acknowledge in the EIS that the approval of the U.S. Coast Guard is required in order to change rules applicable to boating.

2 (cont.) 3 (cont.) 6

My conclusions: The proposed changes and the EIS were sprung on the public without reasonable time to review and comment. Key individuals and groups were not consulted. The existing conditions are misrepresented. Some facts cited to substantiate the proposed actions are misleading and they're incomplete.

The environmental consequences are not minor. Alternative 1 for the Keyport Range could have a serious negative impact on the boating community. Alternative 1 for the Keyport Range should not be pursued by the Navy.

7

I should add that the fellow next to me back there and I worked at Keyport for a long time. We, I think I can say for him, personally installed the Quinault Range. That was all done under our watch.

So we're really familiar with what you are up against, but I can't see that extending the Keyport Range is a necessity and the effects are really damaging on boating, which was not addressed. All you are addressing is environmental things, other than boating.

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Response:

6. See response to P18-8 above.
7. See responses P19-1 through P19-6.

P19 – Veatch, John *(page 8 of 8)*

Navy Base Hearing, Session 1 - Keyport, Washington

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Thank you for your time, and I will give a copy of my report to Kimberly. Thanks a lot.

MS. TURNER: Thank you, Mr. Veatch.

Mr. MacIntyre, would you like additional time?

MR. MCINTYRE: No, thank you.

MS. TURNER: Would anyone else like to make a comment this evening?

We will take a short recess. If you would like to make a comment when we come back at 8 o'clock, please turn in a speaker request card and we can take your comment at that time. Thank you.

(A break was taken.)

MS. TURNER: I would like to reconvene the hearing at this time. No one has turned in a speaker request card. I would like to open it up to see if anyone else wants to make a comment.

Okay, we will take a recess until 8:45.

(A break was taken.)

MS. TURNER: Hello. Thank you for sticking around. We have not received any additional speaker request cards.

Would anyone like to make a comment at this time? Okay, we will recess again until 8:55. Thank you.

(A break was taken.)

MS. TURNER: Hello, and thank you for staying.

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Response:

APPENDIX H: REGULATORY COMPLIANCE COMMUNICATIONS

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National Historic Preservation Act Section 106

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From: D'angelo, Fabio G CIV NAVSEA KPWA
Sent: Fri 10/9/2009 12:35 PM
To: rob.whitlam@dahp.wa.gov
Cc: Unger, Shaari M CIV NAVSEA KPWA; Kler, Kimberly H CIV NAVFAC NW, EV1; Haselman, Carl T CIV NAVSEA KPWA
Subject: NAVSEA NUWC Keyport Range Complex Extension Log No:031809-14-USN

Per your request (attachment 114549...), I am forwarding the Section 106 (NHPA/36CFR800) concurrence determinations that we received from the Tribes/Nations with U&A rights at or near the locations of our proposed action. These include: LOWER ELWHA KLALLAM TRIBE, JAMESTOWN S'KLALLAM TRIBE, SUQUAMISH TRIBE, SKOKOMISH TRIBE, QUINAULT INDIAN NATION AND PORT GAMBLE S'KLALLAM TRIBE, respectively.

Receipt of the QUILEUTE and HOH Tribe's concurrence determinations are pending. The persons that they identified as having the responsibility to provide the determinations are readily aware that I was forwarding the responses to you by this date. I will continue customary contact with the individuals and will provide their determinations when received.

Please let me know if your Department requires any additional information/action from our command.

Fabio D'Angelo
NUWC Keyport NEPA Program Manager
(360) 396-5682

STATE OF WASHINGTON

DEPARTMENT OF ARCHAEOLOGY & HISTORIC PRESERVATION

1063 S. Capitol Way, Suite 106 • Olympia, Washington 98501
Mailing address: PO Box 48343 • Olympia, Washington 98504-8343
(360) 586-3065 • Fax Number (360) 586-3067 • Website: www.dahp.wa.gov

March 18, 2009

Mr. Jeffery W. Barnick
Undersea Warfare Center
610 Dowell Street
Keyport, Washington 98345-7610

Re: NAVSEA NNUWC Keyport Range Complex Extension
Log No: 031809-14-USN

Dear Mr. Barnick:

Thank you for contacting our department. We reviewed the materials you provided for the proposed NAVSEA NNUWC Keyport Range Complex, Kitsap County, Washington.

We concur with your determination of No Historic Properties Affected.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on the behalf of the State Historic Preservation Officer in conformance with Section 106 of the National Historic Preservation Act and its implementing regulations 36CFR800. Should additional information become available, our assessment may be revised.

In the event that archaeological or historic materials are discovered during project activities, work in the immediate vicinity must stop, the area secured, and the concerned tribes and this department notified. Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 586-3080
email: rob.whitlam@dahp.wa.gov

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/216-08
September 16, 2008

Honorable Vivian Lee, Chairwoman
Hoh Tribe
2464 Lower Hoh Road
Forks, WA 98331

Dear Ms. Lee:

On November 6, 2003 the Navy had an opportunity to meet with you. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the Hoh Tribe regarding the Navy's proposed action to extend the Keyport activities at range sites adjacent to the Washington coast, Hood Canal, and Port Orchard Narrows. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Hoh Tribe has Usual and Accustomed fishing rights and jurisdiction adjacent to the Washington coast. The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:

James R. Jaimr, Hoh Tribe Executive Director
Rod Thysell, Hoh Tribe Natural Resources Director
Alvin Penn, Hoh Tribe
David Hudson, Hoh Tribe Council Member, Treasurer
Dean Kohn, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport, Environmental Branch Head, Member of Board of Directors
Kimberly Kler, Naval Facilities Command, Engineering Field Activity Northwest, Environmental Planner, EFA Project Lead
Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
Carl Haselman, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport

When we met Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Representatives of the Hoh Tribe described to Navy that they are part of the Quinault Treaty Area which is a treaty that includes the coastal tribes.

They indicated that there was no ocean fishing activities but may develop these in the future. Additionally, anything that would keep fish from coming up into the river would be cause for concern. They stressed concern about the possible impacts to any returning salmon to the Hoh River system and impacts to the tidal areas that would affect salmon. There were questions regarding the current instrumented range equipment at Quinault such as where cabling comes to shore. The Hoh representatives informed us that they have a shellfish harvest area at Kalaloch as part of Usual and Accustomed fishing rights and jurisdiction. Also important to the Tribe is any restriction of access to U&A locations.

Navy representatives had an opportunity to learn about the dynamics of the Hoh River and also to relate to the Hoh regarding a misunderstanding with the Quileute Tribe. Navy had received a letter from Ms. Katie Krueger representing the Quileute Tribe concerned that Navy had not included the Quileute in our effort to begin Government to Government consultations with Native American Indian Tribes and Nation as part of the National Environmental Policy Act (NEPA) process. Our practice is to initiate Government to Government consultation with potentially affected federally recognized tribes as soon as possible prior to the scoping meetings. We reviewed various maps from the Boldt litigation and it did not appear that the Navy's proposed action would take place in the usual and accustomed fishing rights and jurisdiction of the Quileute Tribe. Based on our review of these maps, we initially scheduled meetings with the Hoh Tribe and the Quinault Indian Nation. Failure to include the Quileute Tribe was an oversight on our part. We were able to respond to the Quileute letter and we were about to go to them for Government to Government consultation. The members of the Hoh were empathetic and called ahead to the Quileute to let them know about their impression of the Navy proposal and to help with communication. When we met with the Quileute it was apparent they were calmed. The Navy appreciated the opportunity to have this face to face talk with the Hoh on your land. The additional help to improve communication is very much appreciated.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean and shoreline in the Draft EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We understand the importance of continued good relations. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your other concerns including but not limited to shore access, fisheries, cultural and natural resources. We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

During the next step in the EIS process we will be able to have the EIS Draft analysis for your review and will ask for your availability for Government to Government consultations. We have provided the document under separate cover and asked for your recommendation on the day and location for the consultation. The public and regulatory agencies have 45 days from that date for the Navy to provide hearings, briefings, and presentations. We hope you will understand if the day you prefer for the consultation follows another group. It will be accommodated as best we can. The order of consultations, briefings, and hearings may not follow the level of importance of the group being met with; it may be based on availability.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultations with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

5090
Ser 172/216-08
September 16, 2008

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/208-08
September 12, 2008

Honorable Vivian Lee, Chairwoman
Hoh Tribe
2464 Lower Hoh Road
Forks, WA 98331

Dear Ms. Lee:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

We request your availability for Government to Government consultations and ask for your recommendation on the day and location for a formal consultation. Since the logistic of such tasking is unpredictable, the order of consultations, briefings, and hearings may not follow the level of importance of the group being met with, but instead based on availability. We will try to accommodate your schedule as best we can.

The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

a. Keyport, Naval Undersea Museum, 610 Dowell Street on October 1, 2008

W 2008-09 100-7 114468

5090
Ser 172/208-08
September 12, 2008

b. Belfair, North Mason Senior High School, 200 E. Campus Drive on October 2, 2008

c. Pacific Beach, Gray's Harbor Fire District #8, 4 1st Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J. A. Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

JAMESTOWN S'KLALLAM TRIBE

1033 Old Blyn Highway, Sequim, WA 98382 360/683-1109 FAX 360/681-4643

March 19, 2009

S.E. Iwanowicz, Captain, U. S. Navy Commander
Department Of The Navy
Navel Undersea Warfare Center Division
610 Dowell Street
Keyport, WA 98345-7610

Dear Captain Iwanowicz,

SUBJECT: U. S. Navy Extending Activities within, Dabob Bay Range Complex and Hood Canal

Thank you for the letter and information of the above referenced extension.

It is understood that there will be little or no ground disturbance with the extended activities by the U. S. Navy in Dabob Bay and Hood Canal. The Jamestown S'Klallam Tribe would ask that when the Navy does work or testing within the shoreline of Dabob Bay and Hood Canal that caution be used. From the changes to shorelines by earthquake, tsunami, ocean water levels, there have been found archaeological evidence and human remains recovered in near shore levels.

Please have navy personnel involved in the extended activities of Dabob Bay and Hood Canal trained in the U. S. Navy inadvertent discovery plan.

Should you have any questions, please feel free to contact me at 360.681.4638 or by email at kduncan@jamestowntribe.org.

Sincerely,

Kathleen Duncan
Enrollment Officer/Cultural Resource Spec.
Jamestown S'Klallam Tribe

W 2009-03 200-4 114552

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/212-08
September 16, 2008

Honorable W. Ron Allen, Chairman
Jamestown S'Klallam Tribe
1033 Old Blyn Highway
Sequim, Washington 98382

Dear Mr. Allen:

On November 5, 2003 the Navy had an opportunity to meet with a member of Jamestown S'Klallam Tribe together with the Point No Point Treaty council and members of the Port Gamble S'Klallam and Lower Elwha Klallam Tribes. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the representatives of the Jamestown S'Klallam Tribe together with the Point No Point Treaty council and members of the Port Gamble S'Klallam and Lower Elwha Klallam Tribes regarding the Navy's proposed action to extend the Keyport activities in the Hood Canal. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Jamestown S'Klallam Tribe has Usual and Accustomed fishing rights and jurisdiction in the current and proposed operational area. The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:
Scott Chitwood, Jamestown S'Klallam, Natural Resources
Randy Harder, Point No Point Treaty Council Director
Lauren Rasmussen, Point No Point Treaty Council, Legal Counsel
Nick Lampsalis, Point No Point Treaty Council Member
Laura Hanlon, Point No Point Treaty Council Member
Randy Hatch, Point No Point Treaty Council, Shellfish
Doug Morrill, Lower Elwha Klallam, Fisheries
Tamera Gage, Port Gamble S'Klallam
Kimberly Kler, Naval Facilities Command, Engineering Field Activity Northwest, Environmental Planner, EFA Project Lead
Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
Carl Haselman, NUWC Division Keyport, Environmental Branch Representative
Martin Prehm, NUWC Division Keyport Range Activities

W 2008-09 100-11 114472

5090
Ser 172/212-08
September 16, 2008

Amy Monaco, EFA Northwest

When we met the Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Since that time there may have been changes in the dynamics of the Point No Point Treaty Council and the Tribes with Usual and Accustomed fishing rights and jurisdiction in the Hood Canal. We appreciated the invitation to begin Government to Government consultations in a group setting and hope to move forward with the Jamestown S'Klallam Tribe. We hope to learn more about the dynamics of the Tribal activities in the Hood Canal. At that meeting the concerns expressed were several. There was a concern about the potential to restrict access to resources. We had a good discussion about notification of Navy actions in the Hood Canal which Keyport had already started and has continued to good success. We were asked to make sure the alternative description explains the shoreline boundaries. At the time the description of the proposed action was still vague and so the questions regarded how the vehicles would be addressed, to ask the Navy to quantify the number of activities and distinguishing the number of activities between Dabob Bay and the rest of the Hood Canal. In this letter to you I would like to assure you that the concerns voiced during the meeting were considered.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean, and associated shorelines in the EIS/OEIS. The name of the EIS/OEIS was also changed from the Northwest Range Complex Extension EIS/OEIS to the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We are happy to be able to communicate with your members weekly during the year concerning our activities in the Hood Canal and also especially to receive information from you regarding fishing activity. We appreciate that you can call us at any time if there is a concern regarding Keyport activities on the Hood Canal. We feel that this working level communication is very important and hope that it continues.

5090
Ser 172/212-08
September 16, 2008

We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

We understand the importance of continued good relations. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources.

During the next step in this EIS process you will have the Draft EIS/OEIS analysis for your review and we request your availability for Government to Government consultations. We provided the document under separate cover and asked for your recommendation on the day and location for a formal consultation. The public and regulatory agencies have 45 days to provide comments from the Notice of Public Hearing. During this timeframe the Navy will be providing numerous consultations, public hearings, briefings, and presentations. Since the logistics of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but may instead be based on availability. We will try to accommodate your schedule as best we can.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Division Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/220-08
September 12, 2008

Honorable W. Ron Allen, Chairman
Jamestown S'Klallam Tribe
1033 Old Blyn Highway
Sequim, WA 98382

Dear Mr. Allen:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

We request your availability for Government to Government consultations and ask for your recommendation on the day and location for a formal consultation. Since the logistic of such tasking is unpredictable, the order of consultations, briefings, and hearings may not follow the level of importance of the group being met with, but instead based on availability. We will try to accommodate your schedule as best we can.

The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

a. Keyport, Naval Undersea Museum, 610 Dowell Street on October 1, 2008

b. Belfair, North Mason Senior High School, 200 E. Campus Drive on October 2, 2008

c. Pacific Beach, Gray's Harbor Fire District #8, 4 1st Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Rec'd 19 Mar 09
EJones

LOWER ELWHA KLALLAM TRIBE

ʔəʔɬx̣ʷə nəxʷsƛ̕ay̕ əm "Strong People"

2851 Lower Elwha Road
Port Angeles, WA 98363

(360) 452-8471
Fax: (360) 452-3428

March 18, 2009

S. E. Iwanowitz
Captain, U. S. Navy
Department of the Navy
Naval Undersea Warfare Center Division
610 Dowell Street
Keyport, Washington 98345-7610

Re: Section 106 Consultation under the National Historic Preservation Act (NHPA)
Naval Activities at Dabob Bay Range Complex and Hood Canal

Dear Captain Iwanowitz:

Thank you for your recent inquiry acknowledging our interest regarding the Navy's proposed undertaking of extending NUWC Keyport activities in Hood Canal. The proposed activities have been identified at the Dabob Bay Range Complex and in Hood Canal. After reviewing this Federal undertaking under the National Historic Preservation Act of 1966 as amended we concur with your determination of "no effect" on Historic Properties.

In the Treaty of Point No Point the Lower Elwha Klallam Tribe allowed non-Klallam settlement within its ancestral lands, but retained important rights. Among the retained rights are those relating to the cultural and spiritual practices of Klallam members. Several Federal mandates and Tribal resolution 28-07 allow the Lower Elwha Klallam Tribe to actively manage significant cultural resources that may be subject to a project's potential effect. Federal & Tribal requirements for cultural resource management include identification, evaluation, preservation, protection, and annual review. The Lower Elwha Klallam Tribe strongly supports this Federal legislation and has passed Tribal Resolution 28-07 for the protection of its archaeological and cultural resources. The primary goal in protecting these properties has been one of assessing all land holdings in terms of the cultural and archaeological resources they contain and monitoring any impacts project activities will have on these irreplaceable resources of the Lower Elwha Klallam Tribe.

W 2009-03 200-2 114546

Should archaeological or cultural resources be inadvertently discovered during this project the Lower Elwha Klallam Tribe will exercise its subsequent legal rights under the National Historic Preservation Act's Section 106 process to participate as a consulting party and provide direction and comment on this undertaking.

Sincerely,

William S. White

William S. White
Archaeologist, MA
Cultural Resources
Lower Elwha Klallam Tribe

cc: Frances Charles, Tribal Chairwoman, Lower Elwha Klallam Tribe
Business Committee
Sonya Tetnowski, Tribal Administrator
File

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/213-08
September 16, 2008

Honorable Frances Charles, Chairman
Lower Elwha Klallam Tribe
2851 Lower Elwha Rd.
Port Angeles, Washington 98363

Dear Mr. Charles:

On November 5, 2003 the Navy had an opportunity to meet with a member of the Lower Elwha Klallam Tribe together with the Point No Point Treaty council and members of the Port Gamble S'Klallam and Jamestown S'Klallam Tribes. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the representatives of the Lower Elwha Klallam Tribe together with the Point No Point Treaty council and members of the Port Gamble S'Klallam and Jamestown S'Klallam Tribes regarding the Navy's proposed action to extend the Keyport activities in the Hood Canal. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Lower Elwha Klallam Tribe has Usual and Accustomed fishing rights and jurisdiction in the current and proposed operational area. The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:

Doug Morrill, Lower Elwha Klallam, Fisheries
Randy Harder, Point No Point Treaty Council Director
Lauren Rasmussen, Point No Point Treaty Council, Legal Counsel
Nick Lampsalis, Point No Point Treaty Council Member
Laura Hanlon, Point No Point Treaty Council Member
Randy Hatch, Point No Point Treaty Council, Shellfish
Scott Chitwood, Jamestown S'Klallam, Natural Resources
Tamera Gage, Port Gamble S'Klallam
Kimberly Kler, Naval Facilities Command, Engineering Field Activity Northwest, Environmental Planner, EFA Project Lead
Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
Carl Haselman, NUWC Division Keyport, Environmental Branch Representative
Martin Prehm, NUWC Division Keyport Range Activities

Amy Monaco, EFA NW

When we met the Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Since that time there may have been changes in the dynamics of the Point No Point Treaty Council and the Tribes with Usual and Accustomed fishing rights and jurisdiction in the Hood Canal. We appreciated the invitation to begin Government to Government consultations in a group setting and hope to move forward with the Lower Elwha Klallam Tribe. We hope to learn more about the dynamics of the Tribal activities in the Hood Canal. At that meeting the concerns expressed were several. There was a concern about the potential to restrict access to resources. We had a good discussion about notification of Navy actions in the Hood Canal which Keyport had already started and has continued to good success. We were asked to make sure the alternative description explains the shoreline boundaries. At the time the description of the proposed action was still vague and so the questions regarded how the vehicles would be addressed, to ask the Navy to quantify the number of activities and distinguishing the number of activities between Dabob Bay and the rest of the Hood Canal.

In this letter to you I would like to assure you that the concerns voiced during the meeting were considered.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean, and associated shorelines in the Draft EIS/OEIS. The name of the EIS/OEIS was also changed from the Northwest Range Complex Extension EIS/OEIS to the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We are happy to be able to communicate with your members weekly during the year concerning our activities in the Hood Canal and also especially to receive information from you regarding fishing activity. We appreciate that you can call us at any time if there is a concern regarding Keyport activities on the Hood Canal. We feel this working level communication is very important and hope that it continues.

We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

We understand the importance of continued good relations. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources.

During the next step in this EIS process you will have the Draft EIS/OEIS analysis for your review and we request your availability for Government to Government consultations. We have provided the document under separate cover and asked for your recommendation on the day and location for a formal consultation. The public and regulatory agencies have 45 days to provide comments from the Notice of Public Hearing. During this timeframe the Navy will be providing numerous consultations, public hearings, briefings, and presentations. Since the logistics of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but may instead be based on availability. We will try to accommodate your schedule as best we can.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Division Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

5090
Ser 172/213-08
September 16, 2008

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J A Dowell

J. A. DOWELL
Commander, U.S. Navy

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/203-08
September 12, 2008

Honorable Frances Charles, Chairman
Lower Elwha Klallam Tribe
2851 Lower Elwha Rd.
Port Angeles, WA 98363

Dear Mr. Charles:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

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The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

a. Keyport, at the Naval Undersea Museum, 610 Dowell Street, on October 1, 2008

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b. Belfair, at the North Mason Senior High School, 200 E. Campus Drive, on October 2, 2008

c. Pacific Beach, at the Gray's Harbor Fire District #8, 4 1st Street North, on October 6, 2008

d. Quilcene, at the Quilcene Public School Multi-Purpose Building, 294715 Hwy 101, on October 7, 2008

Please contact Mrs. Shaari Unger at (360) 315-2258 or by email shaari.unger@navy.mil with the specifics for scheduling the formal consultation. We respectfully request that the consultation be schedule during the month of October.

Sincerely,

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Department of the Navy
Navel Undersea Warfare Center Division
610 Dowell Street
Keyport, Washington 98345-7610
ATTN: Fabio D'Angelo, NUWC Keyport, C/172 NEPA Program Manager
Bldg. 206 Environmental Branch

Dear Fabio,

I would like to apologize for the time it has taken for my response for the Keyport/Navy project at Keyport and south of Hood Canal Bridge.

When I spoke on the telephone with you, you first mentioned that the project was at Keyport, which is Suquamish territory and they would be your contact tribe. Then you mentioned that there would be a different project - south of the Hood Canal Bridge, which is in our Usual and Accustomed Areas.

I asked questions about the project possibly having impacts on the sea-life and your reply was that you had already talked with the Natural Resources Director – Paul McCollum regarding this issue. I would like to reiterate that shellfish, and other sea-life is very much a part of our culture! It isn't uncommon for tribes to be concerned with what happens to the various types of sea life – we use so many different types for subsistence, that it could be a concern if the impacts are unfavorable.

As long as there are no impacts to the sealife, we are okay with this but if this project harms or has negative impacts than we will be very concerned.

I am requesting to be kept updated on this project and am interested in what it is you will be doing.

Respectfully,

Marie Hebert
Cultural Resources Director
Port Gamble S'Klallam Tribe
31912 Little Boston Road, N.E.
Kingston, WA 98346
360-297-6241

Received via the following Email

From: Marie Hebert [mailto:marieh@pgst.nsn.us]
Sent: Thursday, July 16, 2009 13:59
To: D'angelo, Fabio G CIV NAVSEA KPWA
Subject: letter

I hope this will be satisfactory for you. If not, give me a call! :)

Marie

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/210-08
September 16, 2008

Honorable Ron Charles
Port Gamble S'Klallam Tribe
31912 Little Boston Rd NE
Kingston, WA 98346

Dear Mr. Charles:

On November 5, 2003 the Navy had an opportunity to meet with a member of Port Gamble S'Klallam Tribe together with the Point No Point Treaty council and members of the Jamestown S'Klallam and Lower Elwha Klallam Tribes. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command Naval (NAVSEA) Undersea Warfare Center Division, (NUWC) Keyport and the representative of the Port Gamble S'Klallam Tribe together with the Point No Point Treaty council and members of the Jamestown S'Klallam and Lower Elwha Klallam Tribes regarding the Navy's proposed action to extend the Keyport activities in the Hood Canal. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Port Gamble S'Klallam Tribe has Usual and Accustomed fishing rights and jurisdiction in the current and proposed operational area. The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:

- Tamera Gage, Port Gamble S'Klallam
- Randy Harder, Point No Point Treaty Council Director
- Lauren Rasmussen, Point No Point Treaty Council, Legal Counsel
- Nick Lampsalis, Point No Point Treaty Council Member
- Laura Hanlon, Point No Point Treaty Council Member
- Randy Hatch, Point No Point Treaty Council, Shellfish
- Scott Chitwood, Jamestown S'Klallam, Natural Resources
- Doug Morrill, Lower Elwha Klallam, Fisheries
- Kimberly Kler, Naval Facilities Command, Engineering Field Activity Northwest, Environmental Planner, EFA Project Lead
- Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
- Carl Haselman, NUWC Division Keyport, Environmental Branch representative
- Martin Prehm, NUWC Division Keyport Range Activities

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Amy Monaco, EFA NW

When we met the Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Since that time there may have been changes in the dynamics of the Point No Point Treaty Council and the Tribes with Usual and Accustomed fishing rights and jurisdiction in the Hood Canal. We appreciated the invitation to begin Government to Government consultations in a group setting and hope to move forward with the Port Gamble S'Klallam Tribe. We hope to learn more about the dynamics of the Tribal activities in the Hood Canal. At that meeting the concerns expressed were several. There was a concern about the potential to restrict access to resources. We had a good discussion about notification of Navy actions in the Hood Canal which Keyport had already started and has continued to good success. We were asked to make sure the alternative description explains the shoreline boundaries. At the time the description of the proposed action was still vague and so the questions regarded how the vehicles would be addressed, to ask the Navy to quantify the number of activities and distinguishing the number of activities between Dabob Bay and the rest of the Hood Canal.

In this letter to you I would like to assure you that the concerns voiced during the meeting were considered.

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We are happy to be able to communicate with your members weekly during the year concerning our activities in the Hood Canal and also especially to receive information from you regarding fishing activity. We appreciate that you can call us at any time if there is a concern regarding Keyport activities on the Hood Canal. We feel that this working level communication is very important and hope that it continues.

We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

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During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Division Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/221-08
September 12, 2008

Honorable Ron Charles
Port Gamble S'Klallam Tribe
31912 Little Boston Road Northeast
Kingston, WA 98346

Dear Mr. Charles:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

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c. Pacific Beach, Gray's Harbor Fire District #8, 4 1^{st} Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J. A. Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/217-08
September 16, 2008

Honorable Carol Hatch, Chairperson
Quileute Tribe
PO Box 279
La Push, Washington 98350

Dear Ms. Hatch:

On November 12, 2003 the Navy had an opportunity to meet with you. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the Quileute Tribe regarding the Navy's proposed action to extend Keyport activities at the range sites adjacent to the Washington coast, Hood Canal, and Port Orchard Narrows. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Quileute Tribe has Usual and Accustomed fishing rights and jurisdiction adjacent to the Washington coast.

Prior to meeting, Navy received a letter from Katie Krueger representing the Quileute concerned that Navy had not included Quileute in our effort to begin Government to Government consultations with Native American Indian Tribes and Nation as part of the National Environmental Policy Act (NEPA) process. Our practice is to initiate Government to Government consultation with potentially affected federally recognized tribes as soon as possible prior to the scoping meetings. We reviewed various maps from the Boldt litigation and it did not appear that the Navy's proposed action would take place in the usual and accustomed fishing rights and jurisdiction of the Quileute Tribe. Based on our review of these maps, we initially scheduled meetings with the Hoh Indian Nation and the Quinault Indian Nation. Failure to include the Quileute Tribe was an oversight on our part. We were able to respond to your letter and we did get a chance to meet officially. We appreciate your being aware and alerting us to this.

The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:
Russell Woodruff, Quileute Tribe, Council Chairman

Mel Moon, Quileute Tribe, Natural Resources
Katie Krueger, Quileute Tribe, Legal Counsel
Leo Williams, Quileute Tribe
Chris Penn, Sr., Quileute Tribe, Natural Resources Committee
Lonnie Foster, Quileute Tribe, Natural Resources Committee
Willert Sampson, Quileute Tribe, Natural Resources
Karsten Boyer, Quileute Tribe
Kimberly Kler, Naval Facilities Command, Engineering Field Activity Northwest, Environmental Planner, EFA Project Lead
Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
Carl Haselman, NUWC Division Keyport, Environmental Branch Representative
Nancy Glazier, Naval Facilities Command, Engineering Field Activity Northwest, (EFA NW), Assistant Counsel
Richard Stoll, EFA NW, Natural Resources
Amy Monaco, EFA NW

Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Some of the concerns voiced by the representatives of the Quileute Tribe included questions regarding whether there would be activity exclusions in the extended areas; whether the Navy would attempt to expand activities again in the future; the potential presence of depleted uranium in the Usual and Accustomed fishing rights and jurisdiction of the tribe; whether Navy equipment would interfere with navigation; the use and effect of Navy sonar on marine mammals and fish; whether the tribe could have access to unclassified Navy information about coastal conditions, specifically detail bathymetric data, and how the parties would communicate in the future. The Quileute representatives suggested the Navy should try to avoid taking action in the Usual and Accustomed fishing rights and jurisdiction of any tribe and should consider the area south of Westport.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean and shoreline in the Draft

EIS/OEIS. The name of the EIS/OEIS was changed from the Northwest Range Complex Extension EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We understand the importance of continued good relations. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources. We have come to the point of the NEPA process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. We are at that point in the process in which we feel we have addressed everything but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know what parts you may have more information for us to use. Let us know what we may have inadvertently left out. Let us know if you have questions about this document or this process and we will meet with you on these concerns. Please also point out anything you think is especially helpful.

During the next step in the EIS process we will be able to have the EIS Draft analysis for your review and will ask for your availability for Government to Government consultations. We have provided the document under separate cover and asked for your recommendation on the day and location for the consultation. The public and regulatory agencies have 45 days from that date for the Navy to provide hearings, briefings, and presentations. We hope you will understand if the day you prefer for the consultation follows another group. It will be accommodated as best we can. The order of consultations, briefings, and hearings may not follow the level of importance of the group being met with; it may be based on availability.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

In consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/222-08
September 12, 2008

Honorable Carol Hatch, Chairwoman
Quileute Tribe
PO Box 279
La Push, WA 98350

Dear Ms. Hatch:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

We request your availability for Government to Government consultations and ask for your recommendation on the day and location for a formal consultation. Since the logistic of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but instead based on availability. We will try to accommodate your schedule as best we can.

The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

a. Keyport, Naval Undersea Museum, 610 Dowell Street on October 1, 2008

5090
Ser 172/222-08
September 12, 2008

b. Belfair, North Mason Senior High School, 200 E. Campus Drive on October 2, 2008

c. Pacific Beach, Gray's Harbor Fire District #8, 4 1st Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Environmental Protection Division
Cultural Resources

April 13, 2009

Department of the Navy
Navel Undersea Warfare Center Division
610 Dowell Street
Keyport, Washington 98345-7610
ATTN: Fabio D'Angelo, NUWC Keyport, NEPA Program Manager

Subject:
NUWC Keyport activities on the Washington coast in Quinault Usual and Accustomed Area

Greetings,

Thank you for the opportunity to review the proposed activities to be conducted in the Quinault Usual and Accustomed area in the vicinity of Pacific Beach.

The Quinault Indian Nation (QIN) concurs with the findings of no effect to current documented historic properties. QIN agrees with the precaution of implementing the Integrated Cultural Resources Management Plan (ICRMP) for Inadvertent Discoveries.

As mentioned earlier, much of this marine environment is largely unexplored and a concern is the possibility of disturbing unknown/undetected underwater archaeology sites. So we are anticipating that the ICRMP will establish protective measures for those types of sites.

Respectfully,
Justine James

Justine E. James, Jr.
Cultural Resource Specialist
Quinault Indian Nation

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/218-08
September 16, 2008

Honorable Fawn Sharp, Chairwoman
Quinault Indian Nation
1214 Aalis Drive
PO Box 189
Taholah, WA 98587

Dear Ms. Sharp:

On November 10, 2003 the Navy had an opportunity to meet with you. The reason for the meeting was to begin Government to Government consultation between Naval Undersea Warfare Center Division, (NUWC) Keyport and the Quinault Indian Nation regarding the Navy's proposed action to extend Keyport activities at range sites adjacent to the Washington coast, Hood Canal and Port Orchard Narrows. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We met with you because the Quinault Indian Nation has Usual and Accustomed fishing rights and jurisdiction adjacent to the Washington coast and on the initially proposed shoreline extension.

The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:
Pearl Capoeman-Buller, Quinault Indian Nation, Tribal Chair
Fawn Sharp, Quinault Indian Nation, Legal Counsel
Joe Schumacker, Quinault Indian Nation, Fisheries
Bruce Jones, Quinault Indian Nation, Natural Resources
Robert Jusko, Naval Sea Systems Command (NAVSEA), NUWC Division Keyport, Office of General Counsel, Attorney, Member of Board of Directors
Kimberly Kler, Naval Facilities Command, Engineering Field Activity (EFA) Northwest, Environmental Planner, EFA Project Lead
Shaari Unger, NAVSEA, NUWC Division Keyport, Keyport Project Lead
Carl Haselman, NAVSEA NUWC Division Keyport, Environmental Branch Representative

When we met, the Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. Some of the concerns voiced by the representatives of the Quinault Indian Nation included the location of the surf zone access during seasons of crabbing, long line fishing, and beach clamming. Quinault representatives voiced an interest in sharing data regarding bathymetry of the coastal region. There was a discussion of a possible Memorandum of Understanding (MOU) for access to the beach or the possibility of moving the beach access. There was an opinion voiced which said to make sure the EIS analysis examines impacts associated with any thing left behind and also sonar use. Additionally, Quinault Indian Nation representatives shared concern that the Navy has not notified the Quinault Indian Nation as to when activities are conducted. Keyport personnel described the active/not active weekly notifications being done for the Hood Canal area to the Tribes with associated Usual and Accustomed fishing rights and jurisdiction as a possible solution to the concern. The Navy appreciated the opportunity to have this face to face talk.

Following the meeting, the Navy received a letter from the Quinault Indian Nation dated December 1, 2003. The letter communicated the importance to the Quinault Indian Nation that the Nation is a respected sovereign jurisdiction and that the guaranteed treaty rights in the proposed extension area would ensure protection of the natural resources in the ocean and beaches bordering the Quinault reservation and protection of its important sustenance and fisheries. The area encompasses a large portion of the Quinault Indian Nation adjudicated with Usual and Accustomed fishing rights and jurisdiction. A stated concern was that the Navy's proposed action must not interfere with, diminish or otherwise alter any of the Quinault Indian Nation fisheries that occur in the Usual and Accustomed fishing rights and jurisdiction. The letter asked that the proposed shore-landing site be moved off the Quinault reservation lands and preferably outside the Usual and Accustomed fishing rights and jurisdiction. Additionally, the letter stated that there was disappointment regarding the manner in which the proposal was put forth. First the proposal was briefed to the Olympic Coast National Marine Sanctuary Advisory Council before presenting it to the Quinault Indian Nation. The final concern was that the Quinault Indian Nation wanted to ensure there were policy level individuals from the Navy to fulfill our responsibilities for this Government to Government consultation process. This is an important point with regard to protocol and we appreciate your pointing this out. We will endeavor to ensure this particular mistake is not repeated on this project.

In this letter to you I would like to assure the Quinault Indian Nation that all of your concerns both those voiced during the meeting and in your letter were considered.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean, and associated shorelines in the Draft EIS/OEIS. The name of the EIS/OEIS was also changed from the Northwest Range Complex Extension EIS/OEIS to the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put your knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

We understand the importance of continued good relations and understand the need to negotiate any use of reservation land. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources.

During the next step in this EIS process you will have the Draft EIS/OEIS analysis for your review and we request your availability for Government to Government consultations. We have provided the document under separate cover and asked for your recommendation on the day and location for a formal consultation. The public and regulatory agencies have 45 days to provide comments from the Notice of Public Hearing. During this timeframe the Navy will be providing numerous consultations, public hearings, briefings, and presentations. Since the logistics of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but may instead be based on availability. We will try to accommodate your schedule as best we can.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Division Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/223-08
September 12, 2008

Honorable Fawn Sharp, Chairwoman
Quinault Indian Nation
1214 Aalis Drive
PO Box 189
Taholah, WA 98587

Dear Ms. Sharp:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

We request your availability for Government to Government consultations and ask for your recommendation on the day and location for a formal consultation. Since the logistic of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but instead based on availability. We will try to accommodate your schedule as best we can.

The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

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5090
Ser 172/223-08
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c. Pacific Beach, Gray's Harbor Fire District #8, 4 1st Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Skokomish Indian Tribe
Tribal Center (360) 426-4232
N. 80 Tribal Center Road FAX (360) 877-5943 Skokomish Nation, WA 98584

April 6, 2009

Fabio D'Angelo
NEPA Program Manager

RE: Naval Sea Systems Command Naval Undersea Warfare Center (NUWC) proposed extension in Hood Canal.

Dear, Mr. D'Angelo

Thank you for the opportunity to comment on the proposed extension of the NUWC in Hood Canal. The Skokomish Tribe THPO is in concurrence that there is no potential effect to historic properties. I have reviewed the integrated cultural resources management plan and would like to make note that the Skokomish Tribe is the primary affected Tribe and should be consulted with should any inadvertent discovery occur. I would also like to note that the department of Natural Resources for the Skokomish Tribe should be commenting on the proposed extensions as I had mentioned in our phone conversation due to Treaty fisheries related concerns. I called and gave them your phone number so that they may contact you directly.

Thank you,

Kris Miller
Tribal Historic Preservation Officer
80 North Tribal Center Road
Shelton, WA 98584
(360)426-4232x215
shlanay1@skokomish.org

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/215-08
September 16, 2008

Honorable Joseph Pavel
Skokomish Tribe Chairman
North 80 Tribal Center Road
Shelton, WA 98584

Dear Mr. Pavel:

In the October 2003 timeframe the Navy contacted the Skokomish Tribe by letter to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the Skokomish Tribe regarding the Navy proposed action to extend Keyport activities at range sites adjacent to the Washington coast, Hood Canal and Port Orchard Narrows. The intent is to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We came to you because the Skokomish Tribe has Usual and Accustomed fishing rights and jurisdiction in the current and proposed operational area. No Government to Government consultation meeting resulted at that time.

Since then we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles as well as the ocean and shoreline in the Draft EIS/OEIS. The name of the EIS/OEIS was changed from the Northwest Range Complex Extension EIS/OEIS. Additionally, we have sent you our newsletters during this time period and have from time to time sent unofficial e-mail. We are happy to be able to communicate with your members weekly throughout the year concerning our activities in the Hood Canal and also especially to receive information from you regarding fishing activity. We appreciate that you can call us at any time if there is a concern regarding Keyport activities on the Hood Canal. We feel that this working level communication is very important and hope that it continues.

We understand the importance of continued good relations. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources. We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS is ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

During the next step in the EIS process we will be able to have the EIS Draft analysis for your review and will ask for your availability for Government to Government consultations. We have provided the document under separate cover and asked for your recommendation on the day and location for a consultation. The public and regulatory agencies have 45 days from that date for the Navy to provide hearings, briefings, and presentations. We hope you will understand if the day you prefer for the consultation follows another group. It will be accommodated as best we can. The order of consultations, briefings, and hearings may not follow the level of importance of the group being met with; it may be based on availability.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

In consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/224-08
September 12, 2008

Honorable Joseph Pavel, Chairman
Skokomish Tribe
North 80 Tribal Center Road
Skokomish, Washington 98584

Dear Mr. Pavel:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

We request your availability for Government to Government consultations and ask for your recommendation on the day and location for a formal consultation. Since the logistic of such tasking is unpredictable, the order of consultations, briefings, and hearings may not follow the level of importance of the group being met with, but instead based on availability. We will try to accommodate your schedule as best we can.

The Navy is also holding four public hearings on the NAVSEA NUWC Keyport Draft EIS/OEIS. At each, an open house will be held 5:00-6:30 p.m. and the formal hearing will be held 7:00 - 9:00 p.m. The locations are:

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c. Pacific Beach, Gray's Harbor Fire District #8, 4 1st Street N., on October 6, 2008

d. Quilcene, Quilcene Public School, 294715 Hwy 101 on October 7, 2008

Please contact Mrs. Shaari Unger (shaari.unger@navy.mil or phone number (360) 315-2258) with the specifics for scheduling the formal consultation. We respectfully request that the consultation be scheduled during the month of October.

Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Tribal Historic Preservation Officer
Fisheries Department
360/394-8529
Fax 360/598-4666

THE SUQUAMISH TRIBE
P.O. Box 498 Suquamish, Washington 98392

March 19, 2009

Captain S. E. Iwanowicz
Commander, Naval Undersea Warfare Center Division, Keyport
Department of the Navy
610 Dowell Street
Keyport, WA 98345-7610

RE: Section 106 Concurrence of No Effect to Historic Properties
Expansion of Keyport Range Site, Port Orchard Reach
Keyport, Kitsap County, Washington
Suquamish Tribe Reference: 09-03-16-03

Dear Captain Iwanowicz:

Thank you for your letter of March 4, 2009 to the Suquamish Tribe requesting concurrence with the U.S. Navy determination that expansion of the Naval Undersea Warfare Center Division, Keyport, Keyport Range Site in Port Orchard Reach, Kitsap County, Washington, will have no effect to historic properties. The U.S. Navy based its determination on information gathered from government-to-government consultation with the Suquamish Tribe, with the Tribe participating as a consulting party in the Section 106 process.

Based on review of cultural resources data held by the Suquamish Tribe and consultation with the U.S. Navy, I concur with the U.S. Navy determination of no effect to historic properties.

Thank you for consulting the Suquamish Tribe. Please contact me at 360-394-8529 if you have questions regarding the Suquamish Tribe comments.

Sincerely,

Dennis E. Lewarch
Tribal Historic Preservation Officer

Cc: Leonard A. Forsman, Chairman, Suquamish Tribe
Rob Purser, Director, Fisheries Department, Suquamish Tribe
Rich Brooks, Environmental Program Manager, Fisheries Department, Suquamish Tribe
Tom Ostrom, Biologist, Fisheries Department, Suquamish Tribe
Dr. Robert C. Whitlam, State Archaeologist, DAHP
Melody Allen, Tribal Attorney, Suquamish Tribe, Office of Tribal Attorney
Fabio D'Angelo, Naval Undersea Warfare Center Division, Keyport

W 2009-03 200-5 114553

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/207-08
September 16, 2008

Honorable Leonard Forsman, Chairman
Suquamish Tribe
18490 Suquamish Way Northeast
PO Box 498
Suquamish, WA 98392-0498

Dear Mr. Forsman:

On November 5, 2003 the Navy had an opportunity to meet with you. The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport and the Suquamish Tribe regarding the Navy's proposed action to extend the Keyport activities at the range adjacent to Liberty Bay and Port Orchard Narrows. The intent was to evaluate the proposed action and alternatives in an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We met to you because the Suquamish Tribe has Usual and Accustomed fishing rights and jurisdiction in the current and proposed operational area. The people who signed in as attending this meeting are listed here with each individual's respective position at the time.

Attendees:

Rob Purser, Suquamish Tribe, Fisheries Director
Merle Hayes, Suquamish Tribe, Elder, Fisheries Program
Alisin O'Sullivan, Suquamish Tribe, Legal Counsel
Charlie Sigo, Suquamish Tribe, Cultural Resources Manager
Jay Ziske, Suquamish Tribe, Finfish Program Coordinator
Dean Kohn, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport, Environmental Branch Head, Member of Board of Directors
Kimberly Kler, Naval Facilities Command, Engineering Field Activity (EFA) Northwest, Environmental Planner, Project Lead
Shaari Unger, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport Project Lead
Carl Haselman, Naval Sea Systems Command, Naval Undersea Warfare Center Division Keyport
Amy Monaco, EFA NW

W 2008-09 100-6 114467

5090
Ser 172/207-08
September 16, 2008

The reason for the meeting was to begin Government to Government consultation between Naval Sea Systems Command Naval Undersea Warfare Center Division Keyport and the Suquamish Tribe because the Suquamish Tribe has Usual and Accustomed fishing rights and jurisdiction on the existing and proposed range activity extension area.

When we met the Navy presented the goals and alternatives that we developed up to that point. This was prior to beginning the analysis for the existing and proposed extensions. We came to you to get your insight on this matter. During the meeting the Suquamish representatives voiced several concerns and points of interest. There is a concern regarding whether there will be restrictions to access in the area. You said gill nets are used in the area and there is a concern regarding the proposed action encroaching on these activities. There is a concern regarding entanglement of nets on anything on the bottom and wanting information about items on the bottom is disseminated. Asking for a guarantee that in future this will not be made an exclusionary zone. We discussed the ability to share information, would vehicles disturb the bottom impacts to sea life in the area and were gracious in offering any references and resource information you have if needed. We appreciated the offer to share references.

In this letter to you I would like to assure the Suquamish Tribe that all of your concerns voiced during the meeting were considered.

Since we spoke to you on this subject we have clarified the scope of Keyport activities in the analysis, evaluated the effect of these activities on the fish, mammals, birds and turtles, as well as the ocean and associated shorelines in the Draft EIS/OEIS. The name of the EIS/OEIS was also changed from the Northwest Range Complex Extension EIS/OEIS to the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS. We have sent you our newsletters during this time period and have from time to time sent unofficial e-mail.

We have come to the point of the National Environmental Policy Act (NEPA) process in which the Draft EIS/OEIS will be ready for your review. We have divided the very large document into sections specific to geographic areas and hope this helps you pick out the areas of most interest to you. At this point in the process we feel we have addressed your initial concerns but understand that you come with a different perspective and ask that you put that knowledge to the review of this analysis. Let us know if you have questions about this document or this process.

We understand the importance of continued good relations and understand the need to negotiate any use of reservation land. When you receive the NAVSEA NUWC Keyport Range Complex Extension Draft EIS/OEIS you will see how we have addressed your concerns including but not limited to shore access, fisheries, cultural and natural resources.

There may be separate Navy - Suquamish negotiations on-going outside of this project. Although these may be a separate issue there may be times when both subjects interact and we hope to ensure that all goes smoothly. Our common point of contact at the in the Region working level is Mr. Bill Kalina and of course at the Senior Uniform level it is Rear Admiral James A. Symonds Commander, Navy Region Northwest.

During the next step in this EIS process you will have the Draft EIS/OEIS analysis for your review and we request your availability for Government to Government consultations. We provided the document under separate cover and asked for your recommendation on the day and location for a formal consultation. The public and regulatory agencies have 45 days to provide comments from the Notice of Public Hearing. During this timeframe the Navy will be providing numerous consultations, public hearings, briefings, and presentations. Since the logistics of such tasking is unpredictable, the order of consultations, briefings and hearings may not follow the level of importance of the group being met with, but may instead be based on availability. We will try to accommodate your schedule as best we can.

During this process I will be retiring from military service. My relief for Command of NAVSEA NUWC Division Keyport will be Captain Stephen Iwanowicz. He will provide Command level representation.

During our consultation with you we may all decide it would be good to have working level meetings to go over any details and then meet again with higher levels of participants from both organizations as we reach concurrence.

The Keyport point of contact for this effort is Mrs. Shaari Unger. Her phone number is (360) 315-2258 and her e-mail is shaari.unger@navy.mil.

Sincerely,

J. A. DOWELL
Captain, U.S. Navy
Commander

DEPARTMENT OF THE NAVY

NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/211-08
September 12, 2008

Honorable Leonard Forsman, Chairman
Suquamish Tribe
15838 Sandy Hook Road Northeast
PO Box 498
Suquamish, WA 98392-0498

Dear Mr. Forsman:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT REVIEW

The attached Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review (EIS/OEIS) outlines Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center Division, (NUWC) Keyport's proposed action which involves the extension of the range sites at the NUWC, Keyport Range Complex. The range complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively.

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W 2008-09 100-10 114471

5090
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Sincerely,

J A Dowell

J. A. DOWELL
Captain, U.S. Navy
Commander

Enclosure: 1. Draft Environmental Impact Statement/Overseas Environmental Impact Statement Review

Marine Mammal Protection Act

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Federal Register

Tuesday,
July 7, 2009

Part III

Department of Commerce

National Oceanic and Atmospheric Administration

50 CFR Part 218
Taking and Importing Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

RIN 0648–AX11

Taking and Importing Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to the Navy's Research, Development, Test, and Evaluation (RDT&E) activities within the Naval Sea System Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex and the associated proposed extensions for the period of September 2009 through September 2014. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take and requesting information, suggestions, and comments on these proposed regulations.

DATES: Comments and information must be received no later than August 6, 2009.

ADDRESSES: You may submit comments, identified by 0648–AX11, by any one of the following methods:

- *Electronic Submissions:* Submit all electronic public comments via the Federal eRulemaking Portal *http://www.regulations.gov*
- *Hand delivery or mailing of paper, disk, or CD–ROM:* Comments should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.regulations.gov* without change. All personal identifying information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information.

NMFS will accept anonymous comments (enter N/A in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, WordPerfect, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Shane Guan, Office of Protected Resources, NMFS, (301) 713–2289, ext. 137.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application may be obtained by writing to the address specified above (see **ADDRESSES**), telephoning the contact listed above (*see* **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* The Navy's Draft Environmental Impact Statement (DEIS) for the Keyport Range Complex RDT&E and range extension activities was published on September 12, 2008, and may be viewed at *http://www-keyport.kpt.nuwc.navy.mil.* NMFS participated in the development of the Navy's DEIS as a cooperating agency under the National Environmental Policy Act (NEPA).

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) during periods of not more than five consecutive years each if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as:

> An impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The National Defense Authorization Act of 2004 (NDAA) (Public Law 108–136) removed the ''small numbers'' and ''specified geographical region'' limitations in sections 101(a)(5)(A) and (D) and amended the definition of ''harassment'' as it applies to a ''military readiness activity'' to read as follows (Section 3(18)(B) of the MMPA):

> (i) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Summary of Request

On May 15, 2008, NMFS received an application from the Navy requesting authorization for the take of 5 species of marine mammals incidental to the RDT&E activities within the NAVSEA NUWC Keyport Range Complex Extension over the course of 5 years. These RDT&E activities are classified as military readiness activities. On April 29, 2009, NMFS received additional information and clarification on the Navy's proposed NAVSEA NUWC Keyport Range Complex Extension RDT&E activities. The Navy states that these RDT&E activities may cause various impacts to marine mammal species in the proposed action area. The Navy requests an authorization to take individuals of these marine mammals by Level B Harassment. Please refer to Tables 6–23, 6–24, 6–25, and 6–26 of the Navy's Letter of Authorization (LOA) application for detailed information of the potential marine mammal exposures from the RDT&E activities in the Keyport Range Complex Extension per year. However, due to the proposed mitigation and monitoring measures and standard range operating procedures in place, NMFS estimates that the take of marine mammals is likely to be lower than the amount requested. NMFS does not expect any marine mammals to be killed or injured as a result of the Navy's proposed activities, and NMFS is not proposing to authorize any injury or mortality incidental to the Navy's proposed RDT&E activities within the Keyport Range Complex Extension.

Background of Navy Request

The Navy proposes to extend the NAVSEA NUWC Keyport Range Complex in Washington State. The NAVSEA NUWC Keyport Range Complex has the infrastructure to support RDT&E activities. Centrally located within Washington State, the

NAVSEA NUWC Keyport Range Complex has extensive existing range assets and capabilities. The NAVSEA NUWC Keyport Range Complex is composed of Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site (*see* Figure 1–1 of the Navy's LOA application).

The goal of the Proposed Action is to extend the operational areas of each range site. Extending the Range Complex operating areas outside existing range boundaries will allow the Navy to support existing and future range activities including evolving manned and unmanned vehicle program needs in multiple marine environments. With the proposed extension of the Keyport and QUTR range sites, the range sites could support more activities, which include increases in the numbers of tests and days of testing. No additional operational tempo is proposed for the DBRC Site. Existing and evolving range activities applied for in this LOA application include RDT&E and training of system capabilities such as guidance, control, and sensor accuracy of manned and unmanned vehicles in multiple marine environments (*e.g.,* differing depths, salinity levels, temperatures, sea states, etc.).

The range extension is necessary to provide adequate testing area and volume (*i.e.,* surface area and water depth) in multiple marine environments. The extension enables the NUWC Keyport to fulfill its mission of providing test and evaluation services in both surrogate and simulated war-fighting environments for emerging manned and unmanned vehicle program activities. Within the NAVSEA NUWC Keyport Range Complex Extension, the NUWC Keyport activities include testing, training, and evaluation of systems capabilities such as guidance, control, and sensor accuracy of manned and unmanned vehicles in multiple marine environments (*e.g.,* differing depths, salinity levels, temperatures, sea states, etc.).

NUWC Keyport consists of 340 acres (138 hectares [ha]) on the shores of Liberty Bay and Port Orchard Reach (a.k.a. Port Orchard Narrows), and is located adjacent to the town of Keyport, due west of Seattle. NUWC Keyport, a part of NAVSEA, is the center for integrated undersea warfare systems dependability, integrated mine and undersea warfare supportability, and undersea vehicle maintenance and engineering. It provides test and evaluation, in-service engineering, maintenance, Fleet readiness, and industrial-based support for undersea warfare systems, including RDT&E of torpedoes, unmanned vehicles, sensors, targets, countermeasure systems, and acoustic systems.

The NAVSEA NUWC Keyport Range Complex is divided into open ocean/offshore areas and in shore areas:

- *Open Ocean Area*—air, surface, and subsurface areas of the NAVSEA NUWC Keyport Range Complex that lie outside of 12 nautical miles (nm) from land.
- *Offshore Area*—air, surface, and subsurface ocean areas within 12 nm of the Pacific Coast.
- *Inshore*—air, surface, and subsurface areas within the Puget Sound, Port Orchard Reach, Hood Canal, and Dabob Bay.

Keyport Range Site

Located adjacent to NUWC Keyport, this range provides approximately 1.5 square nautical miles (nm^2) (5.1 square kilometers [km^2]) of shallow underwater testing, including in-shore shallow water sites and a shallow lagoon to support integrated undersea warfare systems and vehicle maintenance and engineering activities (see Figures 1–2 and 1–3 of the Navy's LOA application). The Navy has conducted underwater testing at the Keyport Range Site since 1914. Underwater tracking of test activities is accomplished by using temporary or portable range equipment. The range is currently used an average of 6 times per year for vehicle testing and a variety of boat and diver training activities, each lasting 1–30 days. There may be several activities in 1 day. The range site also supports: (1) Detection, classification, and localization of test objectives and (2) magnetics measurement programs. Explosive warheads are not placed on test units or tested within the Keyport Range Site.

DBRC Site

Currently, the DBRC Site assets include the Dabob Bay Military Operating Area (MOA), the Hood Canal North and South MOAs adjacent to Submarine Base (SUBASE) Bangor, and the Connecting Waters (*see* Figures 1–2 and 1–4 of the Navy's LOA application). The DBRC Site is the Navy's premier location within the U.S. for RDT&E of underwater systems such as torpedoes, countermeasures, targets, and ship systems. Primary activities at the DBRC Site support proofing of underwater systems, research and development test support, and Fleet training and tactical evaluations involving aircraft, submarines, and surface ships. Tests and evaluations of underwater systems, from the first prototype and pre-production stages up through Fleet activities (inception to deployment), ensure reliability and availability of underwater systems and their Fleet components. As with the Keyport Range Site, there are no explosive warheads tested or placed on test units.

The DBRC Site also supports acoustic/magnetic measurement programs. These programs include underwater vehicle/ship noise/magnetic signature recording, radiated sound investigations, and other acoustic evaluations. In the course of these activities, various combinations of aircraft, submarines, and surface ships are used as launch platforms. Test equipment may also be launched or deployed from shore off a pier or placed in the water by hand. NUWC Keyport currently conducts activities within four underwater testing areas in the DBRC Site. These areas are:

- *Dabob Bay MOA*—a deep-water range in Jefferson County approximately 14.5 nm^2 (49.9 km^2) in size. The acoustic tracking space within the range is approximately 7.3 by 1.3 nm (13.5 by 2.4 km) (9.5 nm^2 [32.4 km^2]) with a maximum depth of 600 ft (183 m). The Dabob Bay MOA is the principal range and the only component of the DBRC Site with extensive acoustic monitoring instrumentation installed on the seafloor, allowing for object tracking, communications, passive sensing, and target simulation.
- *Hood Canal MOAs*—There are two deep-water operating areas adjacent to SUBASE Bangor in Hood Canal: Hood Canal MOA South, which is approximately 4.5 nm^2 (15.4 km^2) in size, and Hood Canal MOA North, which is approximately 7.9 nm^2 (27.0 km^2) in size. Both areas have an average depth of 200 ft (61 m). The Hood Canal MOAs are used for vessel sensor accuracy tests and launch and recovery of test systems where tracking is optional.
- *Connecting Waters*—the portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs. The shortest distance between the Dabob Bay MOA and Hood Canal MOA South by water is approximately 5.8 nm^2 (19.8 km^2). Water depth in the Connecting Waters is typically greater than 300 ft (91 m).

QUTR Site

The Navy has conducted underwater testing at the QUTR Site since 1981 and maintains a control center at the Kalaloch Ranger Station. As at the other range sites, no explosive warheads are used at the QUTR Site. The QUTR Site is a rectangular-shaped test area of about 48.3 nm^2 (165.5 km^2), located approximately 6.5 nm (12 km) off the Pacific Coast at Kalaloch, Washington. It lies within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS).

The QUTR Site is instrumented to track surface vessels, submarines, and various undersea vehicles. Bottom sensors are permanently mounted on the sea floor for tracking and are maintained and configured by the Navy. The sensors are connected to the shore via cables, which extend under the beach to the bluffs and end at a Navy trailer in Kalaloch (National Park Service [NPS] property). In addition, portable range equipment may be set up prior to conducting various activities on the range and removed after it is no longer needed. All communications are sent back to NUWC Keyport for monitoring.

This range underlies a small portion (W–237A) of the larger airspace unit W–237. This airspace complex comprises the northern portion of the Pacific Northwest Ocean Surface/Subsurface Operating Area (OPAREA), NOAA chart number 18500 (NOAA, 2006). Activities in this airspace are scheduled and coordinated with Naval Air Station (NAS) Whidbey Island and Commander Submarine Force, U.S. Pacific Fleet (COMSUBPAC).

All range areas in the NAVSEA NUWC Keyport Range Complex Extension include areas where marine mammals may be found. Range activities will be conducted in the Keyport Site, the DBRC, and the QUTR Site. The proposed annual usage at each site is listed in Table 1. This includes tracking sonar systems, side-scan, and thermal propulsion systems.

TABLE 1—PROJECTED ANNUAL DAYS OF USE BY RANGE SITE

	Keyport range site	DBRC site	QUTR site—offshore	QUTR site—surf zone
Current	55	200	14	0
Proposed	60	200	16	30

Description of the Specified Activities

Typical activities conducted in the NAVSEA NUWC Keyport Range Complex Extension on the three existing range sites primarily support undersea warfare RDT&E program requirements, but they also support general equipment test and military personnel training needs, including Fleet activities. These activities involve mid- and high-frequency acoustic sources with the potential to affect marine mammals that may be present within the NAVSEA NUWC Keyport Range Complex Extension. Current and proposed activities within the Keyport Range Complex Extension are listed below:

Range Activities: Testing That Involves Active Acoustic Devices

A list of the primary active acoustic sources used within the NAVSEA NUWC Keyport Range Complex with information on the frequency bands is shown in Table 2. In this document, low frequency is defined as below 1 kiloHertz (kHz), mid frequency is defined as between 1 kHz and 10 kHz, and high frequency is defined as above 10 kHz.

TABLE 2—PRIMARY ACOUSTIC SOURCES COMMONLY USED WITHIN THE NAVSEA NUWC KEYPORT RANGE COMPLEX

Source	Frequency (kHz)	Maximum source level (dB re 1 μPa-m)
Sonar:		
General range tracking (at Keyport Range Site)	10–100	195
General range tracking (at DBRC and QUTR Sites)	10–100	203
UUV tracking	10–100	195
Torpedoes	10–100	233
Range targets and special tests (at Keyport Range Site)	5–100	195
Range targets and special tests (at DBRC and QUTR Sites)	5–100	238
Special sonars (*e.g.,* UUV payload)	100–2,500	235
Fleet aircraft—active sonobuoys and helo-dipping sonars	2–20	225
Side-scan	100–700	235
Other Acoustic Sources:		
Acoustic modems	10–300	210
Target simulator	0.1–10	170
Aid to navigation (range equipment)	70–80	210
Sub-bottom profiler	2–7	210
	35–45	220
Engine noise (surface vessels, submarines, torpedoes, UUVs)	0.05–10	170

(1) General Range Tracking

General range tracking on the instrumented ranges and portable range sites have active output in relatively wide frequency bands. Operating frequencies are 10 to 100 kHz. At the Keyport Range Site the sound pressure level (SPL) of the source (source level) is a maximum of 195 dB re 1 μPa-m. At the DBRC and QUTR sites, the source level for general range tracking is a maximum of 203 dB re 1 μPa-m.

(2) UUV Tracking Systems

UUV tracking systems operate at frequencies of 10 to 100 kHz with maximum source levels of 195 dB re 1 μPa-m at all range sites.

(3) Torpedo Sonars

Torpedo sonars are used for several purposes including detection, classification, and location and vary in frequency from 10 to 100 kHz. The maximum source level of a torpedo sonar is 233 dB re 1 μPa-m.

(4) Range Targets and Special Tests

Range targets and special test systems are within the 5 to 100 kHz frequency range at the Keyport Range Site with a maximum source level of 195 dB re 1 μPa-m. At the DBRC and QUTR sites, the maximum source level is 238 dB re 1 μPa-m.

(5) Special Sonars

Special sonars can be carried as a payload on a UUV, suspended from a range craft, or set on or above the sea floor. These can vary widely from 100 kHz to a very high frequency of 2,500 kHz for very short range detection and classification. The maximum source level of these acoustic sources is 235 dB re 1 μPa-m.

(6) Sonobuoys and Helicopter Dipping Sonar

Sonobuoys and helicopter dipping sonars are deployed from Fleet aircraft and operate at frequencies of 2 to 20 kHz with maximum source levels of 225 dB re 1 μPa-m. Dipping sonars are active or passive devices that are lowered on cable by helicopters or surface vessels to detect or maintain contact with underwater targets.

(7) Side Scan Sonar

Side-scan sonar is used for mapping, detection, classification, and localization of items on the sea floor such as cabling, shipwrecks, and mine shapes. It is high frequency typically 100 to 700 kHz using multiple frequencies at one time with a very directional focus. The maximum source level is 235 dB re 1 μPa-m. Side-scan and multibeam sonar systems are towed or mounted on a test vehicle or ship.

(8) Other Acoustic Sources

Other acoustic sources may include acoustic modems, targets, aids to navigation, subbottom profilers, and engine noise.

- An acoustic modem is a communication device that transmits an acoustically encoded signal from a source to a receiver. Acoustic modems emit pulses from 10 to 300 kHz at source levels less than 210 dB re 1 μPa-m.
- Target simulators operate at frequencies of 100 Hertz (Hz) (0.1 kHz) to 10 kHz at source levels of less than 170 dB re 1 μPa-m.
- Aids to navigation transmit location data from ship to shore and back to ship so the crew can have real-time detailed location information. This is typical of the range equipment used in support of testing. New aids to navigation can also be deployed and tested using 70 to 80 kHz at source levels less than 210 dB re 1 μPa-m.
- Subbottom profilers are often commercial off-the-shelf sonars used to determine characteristics of the sea bottom and subbottom such as mud above bedrock or other rocky substrate. These operate at 2 to 7 kHz at source levels less than 210 dB re 1 μPa-m, and 35 to 45 kHz at less than 220 dB re 1 μPa-m.
- There are many sources of engine noise including but not limited to surface vessels, submarines, torpedoes, and other UUVs. The acoustic energy generally ranges from 50 Hz to 10 kHz at source levels less than 170 dB re 1 μPa-m. Targets, both mobile and stationary, may simulate engine noise at these same frequencies.

Additionally, a variety of surface vessels operate active acoustic depth sensors (fathometers) within the range sites, including Navy, private, and commercial vessels. In some cases, one or more frequencies are projected underwater. Bottom type, depth contours, and objects (*e.g.,* cables, sunken ships) can be located using this equipment. The depth sensors used by NUWC Keyport are the same fathometers used by commercial and recreational vessels for navigational safety. Because these instruments are widely used and are not found to adversely impact the human or natural environment, they are not analyzed further.

Range Activities: Testing That Involves Non-Acoustic Activities

(1) Magnetic

There are two types: (a) Magnetic sensors, and (b) magnetic sources. Magnetic sensors are passive and do not have a magnetic field associated with them. The sensors are bottom mounted, over the side (stationary or towed) or can be integrated into a UUV. They are used to sense the magnetic field of an object such as a surface vessel, a submarine, or a buried target. Magnetic sources are used to represent magnetic targets or are energized items such as power cables for energy generators (*e.g.* tidal). Magnetic sources generate electromagnetic fields (EMF). Evaluation of EMF (Navy 2008a) has shown that sources (*e.g.* Organic Airborne and Surface Influence Sweep (OASIS)) used are typically below 23 gauss (G) and are considered relatively minute strength.

(2) Oceanographic Sensor

These sensors have been used historically to determine marine characteristics such as conductivity, temperature, and pressure of water to determine sound velocity in water. This provides information about how sound will travel through the water. These sensors can be deployed over the side from a surface craft, suspended in water, or carried on a UUV.

(3) Laser Imaging Detection and Ranging (LIDAR)

Also known as light detection and ranging, LIDAR is used to measure distance, speed, rotation, and chemical composition and concentration of remote solid objects such as a ship or submerged object. LIDAR uses the same principle as radar. The LIDAR instrument transmits short pulses of laser light towards the target. The transmitted light interacts with and is changed by the target. Some of this light is reflected back to the instrument where it is analyzed. The change in the properties of the light enables some property of the target to be determined. The time it takes the light to travel to the target and back to the LIDAR can be used to determine the distance to the target. Since light attenuates rapidly in water, underwater LIDAR uses light in the blue-green part of the spectrum as it attenuates the least. Common civilian uses of LIDAR in the ocean include seabed mapping and fish detection. All safety issues associated with the use of lasers are evaluated for all applicable test activities within the range sites according to Navy and Federal regulations. This bounds the intensity of LIDAR used pursuant to this request to those systems that meet human safety standards.

(4) Inert Mine Hunting and Inert Mine Clearing Exercises

Associated with testing, a series of inert mine shapes are set out in a uniform or random pattern to test the detection, classification and localization capability of the system under test. They are made from plastic, metal, and concrete and vary in shape. An inert mine shape can measure about 10 by 1.75 ft (3 by 0.5 m) and weigh about 800 lbs (362 kg). Inert mine shapes either sit on the bottom or are tethered by an anchor to the bottom at various depths. Inert mine shapes can be placed approximately 200–300 yards (183–274 m) apart using a support craft and remain on the bottom until they need to be removed. All major components of all inert mine systems used as 'targets' for inert mine hunting systems are removed within 2 years.

NMFS does not believe that those Range activities that involve non-acoustic testing will have adverse impacts to marine mammals, therefore, they are not analyzed further and will not be covered under the proposed rule.

Increased Activities Due to Range Extension

The proposed range extension would expand the geographic area for all three range sites and increase the tempo of activities in the Keyport and QUTR ranges sites. A detailed list of the proposed annual range is provided in Table 3.

(1) Keyport Range Site

Range boundaries of the Keyport Range Site would be extended to the north, east and south, increasing the size of the range from 1.5 nm^2 to 3.2 nm^2 (5.1 km^2 to 11.0 km^2). The average annual days of use of the Keyport Range Site would increase from the current 55 days to 60 days.

(2) DBRC Site

The southern boundary of DBRC Site would be extended to the Hamma Hamma River and its northern boundary would be extended to 1 nm (2 km) south of the Hood Canal Bridge (Highway 104). This extension would increase the size of the current operating area from approximately 32.7 nm^2 (112.1 km^2) to approximately 45.7 nm^2 (150.8 km^2) and would afford a straight run of approximately 27.5 nm (50.9 km). There would be no change in the number and types of activities from the existing range activities at DBRC Site, and no increase in average annual days of use due to the range extension at this site.

(3) QUTR Site

Range boundaries of QUTR Site would be extended to coincide with the overlying special use airspace of W–237A plus a 7.8 nm^2 (26.6 km^2) surf zone at Pacific Beach. The total range area would increase from approximately 48.3 nm^2 (165.5 km^2) to approximately 1,839.8 nm^2 (6,310.2 km^2). The average annual number of days of use for offshore activities would increase from 14 days/year to 16 days/year in the offshore area. The average annual days of use for surf-zone activities would increase from 0 days/year to 30 days/year.

Table 3. Proposed Annual Range Activities and Operations

		Proposed Number of Activities/Year*		
Range Activity	Platform/System Used	Keyport Range Site	DBRC Site	QUTR Site
Test Vehicle Propulsion	Thermal propulsion systems	5	130	30
	Electric/Chemical propulsion systems	55	140	30
Other Testing Systems and Activities	Submarine testing	0	45	15
	Inert mine detection, classification and localization	5	20	10
	Non-Navy testing	5	5	5
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	20	10	5
	Countermeasure test	5	50	5
	Impact testing	0	10	5
	Static in-water testing	10	10	6
	UUV test	45	120	40
	Unmanned Aerial System (UAS) test	0	2	2
Fleet Activities** (excluding RDT&E)	Surface Ship activities	1	10	10
	Aircraft activities	0	10	10
	Submarine activities	0	30	30
	Diver activities	45	5	15
Deployment Systems (RDT&E)	Range support vessels:			
	Surface launch craft	35	180	30
	Special purpose barges	25	75	0
	Fleet vessels***	15	20	20
	Aircraft (rotary and fixed wing)	0	10	20
	Shore and pier	45	30	30

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.
** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.
*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

Description of Marine Mammals in the Area of the Specified Activities

The information on marine mammals and their distribution and density are based on the data gathered from NMFS, United States Fish and Wildlife Service (USFWS) and recent references, literature searches of search engines, peer review journals, and other technical reports, to provide a regional context for each species. The data were compiled from available sighting records, literature, satellite tracking, and stranding and by-catch data.

A total of 24 cetacean species and subspecies and 5 pinniped species are known to occur in Washington State waters; however, several are seen only rarely. Seven of these marine mammal species are listed as Federally-endangered under the Endangered Species Act (ESA) occur or have the potential to occur in the proposed action area: blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), Sei whale (*B. borealis*), humpback whale (*Megaptera novaengliae*), north Pacific right whale (*Eubalaena japonica*), sperm whale (*Physeter macrocephalus*), and the southern resident population of killer whales (*Orcinus orca*). The species, Steller sea lion (*Eumetopias jubatus*), is listed as threatened under the ESA.

Survey data concerning the inland waters of Puget Sound are sparse. There have been few comprehensive studies of marine mammals in inland waters, and those that have occurred have focused on inland waters farther north (Strait of Juan de Fuca, San Juan/Gulf Islands, Strait of Georgia) (Osmek *et al.,* 1998). Most published information focuses on single species (*e.g.,* harbor seals, Jeffries *et al.,* 2003) or are stock assessment reports published by NMFS (*e.g.,* Carretta *et al.,* 2008).

Survey data for the offshore waters of Washington State, including the area of the QUTR Site, are somewhat better, particularly for cetaceans. The NMFS conducted vessel surveys in the region in 1996 and 2001, which are summarized in Barlow (2003) and Appler *et al.* (2004). Vessel surveys were again conducted by NMFS in summer 2005, and included finer-scale survey lines within the OCNMS (Forney, 2007). Cetacean densities from this most recent effort were used wherever possible; older density values (2001 or 1996) were used when more recent values were not available. Some cetacean densities (gray and killer whale, harbor porpoise) were obtained from sources other than the broad scale surveys indicated above and the methodologies of deriving the densities are included in the Navy's LOA application.

Pinniped at-sea density is not often available because pinniped abundance is most often obtained via shore counts of animals at known rookeries and haulouts. Therefore, densities of pinnipeds were derived differently from those of cetaceans. Several parameters were identified from the literature, including area of stock occurrence, number of animals (which may vary seasonally) and season, and those parameters were then used to calculate density. Determining density in this manner is risky as the parameters used usually contain error (*e.g.,* geographic range is not exactly known and needs to be estimated, abundance estimates usually have large variances) and, as is true of all density estimates, they assume that animals are always distributed evenly within an area, which is likely rarely true. However, this remains one of the few means available to determine at-sea density for pinnipeds.

Sea otters occur along the northern Washington coast. Density of sea otters was published as animals/km, which was modified to provide density per area. Since sea otters are under the U.S. Fish and Wildlife Service jurisdiction, they are not considered in this document.

The following are brief descriptions of the temporal and spatial distribution and abundance of marine mammals throughout the NAVSEA NUWC Keyport Range Complex Extension.

Keyport Range Site

A total of five cetaceans and three pinnipeds are known to occur within central Puget Sound, which encompasses the Keyport action area, but several of these species have never been observed in Port Orchard Narrows or in the action area (Table 4). Humpback whales, minke whales, killer whales, and Steller sea lions are expected to be uncommon to rare in southern Puget Sound and have never been seen in the Keyport action area. Density estimates for these species are available for Puget Sound as a whole, but since these species have never been recorded or observed in the action area, the densities for the action area are shown as ''0'' to reflect this. The proposed extension area of the Keyport Range Site is listed as critical habitat for Southern Resident killer whales. The current Keyport Range Site is outside the critical habitat area.

Table 4. Marine Mammal Known to Occur or Potentially Occur within the Keyport Action Area

Species		ESA/MMP Status	Occurrence in Keyport Action Area	Density Estimate (km^3)	
				Warm Season	Cold Season
CETACEAN					
Mysticetes					
Minke whale		- / -	Very rare, year round.	0[(a)]	0[(a)]
Humpback whale		E/D	Very rare, warm season; has never been recorded in action area.	0[(a)]	0[(a)]
Gray whale		- / -	Very rare, migrant and summer/fall resident population in primarily northern Puget Sound	0[(a)]	0[(a)]
Odontocetes					
Killer whale	Transient	- / -	Very rare, year round; has never been recorded in action area	0[(a)]	0[(a)]
	S. Resident	E, CH/D	Very rare, summer/fall season; has never been recorded in action area.	0[(a)]	0[(a)]
Dall's porpoise		- / -	Rare, year round.	0[(a)]	0[(a)]
PINNIPEDS					
Harbor seal		- / -	Common year-round resident.	0.55	0.55
California sea lion		- / -	Rare, cold season.	0[(a)]	0[(a)]
Steller sea lion		T/D	Rare, cold season; has never been recorded in action area	0[(a)]	0[(a)]

Notes: D = Depleted, E = Endangered, CH = Critical Habitat, T = Threatened.
Warm season = May-October, Cold season = November-April.
abundant = the species is expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; common = the species is expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; uncommon = the species is expected to be encountered at most a few times a year; rare = the species is not expected to be encountered more than once in several years; very rare = not expected to be encountered more than once in 10 years.
[(a)] Density estimates for these species were calculated for Puget Sound as a whole, but these species have never been recorded or observed in the action area. Thus the densities for the action area are shown as "0" to reflect this.

DBRC Site

Six cetaceans and three pinnipeds are known to occur or potentially occur within the DBRC action area (Table 5). Density estimates for these species are available for Puget Sound as a whole, but since these species have never been recorded or observed in the action area, the densities for the action area are shown as ''0'' to reflect this. There is no designated or proposed critical habitat for marine mammals within the DBRC action area.

Table 5. Marine Mammal Known to Occur or Potentially Occur within the DBRC Action Area

Species		ESA/MMP Status	Occurrence in Keyport Action Area	Density Estimate (km³)	
				Warm Season	Cold Season
CETACEAN					
Mysticetes					
Minke whale		- / -	Very rare, year round; has never been recorded in action area.	0[a]	0[a]
Humpback whale		E/D	Very rare, warm season; has never been recorded in action area.	0[a]	0[a]
Gray whale		- / -	Very rare, spring/fall migrant and summer/fall resident population in primarily northern Puget Sound	0[a]	0[a]
Odontocetes					
Killer whale	Transient	- / -	Uncommon, spring/summer	Jan-Jun: 0.038	Jul-Dec: 0
	S. Resident	E/D	Very rare, no recorded occurrence in Hood Canal.	0[a]	0[a]
Dall's porpoise		- / -	Very rare, year round.	0	0
PINNIPEDS					
Harbor seal		- / -	Common year-round resident.	1.31	1.31
California sea lion		- / -	Common resident and seasonal migrant.	0[a]	0.052
Steller sea lion		T/D	Very rare, cold season; has never been recorded in action area	0[a]	0[a]

Notes: D = Depleted, E = Endangered, CH = Critical Habitat, T = Threatened.
Warm season = May-October, Cold season = November-April.
abundant = the species is expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; common = the species is expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; uncommon = the species is expected to be encountered at most a few times a year; rare = the species is not expected to be encountered more than once in several years; very rare = not expected to be encountered more than once in 10 years.
[a] These species have never been recorded or observed in the action area. Thus the densities for the action area are shown as "0" to reflect this.

3.2.3 QUTR Site

The diversity of marine mammals that occur in QUTR is greater than that in the Puget Sound ranges and is listed in Table 6.

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Table 6. Marine Mammal Known to Occur or Potentially Occur within the QUTR Action Area

Species		ESA/MMP Status	Occurrence in Keyport Action Area	Density Estimate (km³)	
				Warm Season	Cold Season
CETACEAN					
Mysticetes					
Blue whale		E/D	Rare, warm season	0.0003	0
Fin whale		E/D	Rare, year-round	0.0012	0.0012
Gray whale	Resident	- / -	Uncommon, year-round	0.003	0.003
Gray whale	Migratory	- / -	Abundant briefly during cold season migration	0	NA
Humpback whale		E/D	Uncommon, warm season	0.0237	0
Minke whale		- / -	Rare, year-round	0.0004	0.0004
North Pacific right Whale		E/D	Very rare, warm season	0[(a)]	0[(a)]
Sei whale		E/D	Very rare, year-round	0.0002	0.0002
Odontocetes					
Baird's beaked whale		- / -	Uncommon, year-round	0.0027	0.0027
Hubb's & Stejneger's beaked whale		- / -	Uncommon, year-round	0.0027	0.0027
Dall's porpoise		- / -	Abundant, year-round	0.1718	0.1718
Harbor porpoise		- / -	Abundant, year-round	2.86	2.86
Northern right whale dolphin		- / -	Common, year-round	0.0419	0.0419
Pacific white-sided dolphin		- / -	Abundant, warm season	0.1929	0
Risso's dolphin		- / -	Uncommon, year-round	0.002	0.002
Short-beaked common dolphin		- / -	Uncommon, warm season	0.0012	0
Striped dolphin		- / -	Very rare, year-round	0.0002	0
Dwarf & pygmy sperm whales		- / -	Uncommon, warm season	0.0015	0
Sperm whale		E/D	Uncommon, warm season	0.0011	0.0011
Killer whale	N. Resident	- / -	Rare, year-round	0.0028	0.0028
Killer whale	S. Resident	E/D	Rare, year-round		
Killer whale	Offshore	- / -	Uncommon, year-round		
Killer whale	Transient	- / -	Uncommon, cold season		
PINNIPEDS					
Phocids					
Harbor seal		- / -	Abundant, year-round	0.44	0.44
Northern elephant seal		- / -	Uncommon, year-round	Dec-Feb: 0.019 Mar-Apr: 0.026 May-Jul: 0.038 Aug-Nov: 0.047	
Otariids					
California sea lion		- / -	Common, year-round except May-July.	Aug-Apr: 0.283 May-Jul: 0	
Northern fur seal		- /D	Common, year-round	0.091	0.117
Steller sea lion		T/D	Uncommon, year-round	0.0096	0.0096

MUSTELIDS				
Sea otter	- / -	Does not presently occur within the action area	0[(a)]	0[(a)]

Notes: D = Depleted, E = Endangered, CH = Critical Habitat, T = Threatened.
Warm season = May-October, Cold season = November-April.
abundant = the species is expected to be encountered during a single visit to the area and the number of individuals encountered during an average visit may be as many as hundreds or more; common = the species is expected to be encountered once or more during 2-3 visits to the area and the number of individuals encountered during an average visit is unlikely to be more than a few 10s; uncommon = the species is expected to be encountered at most a few times a year; rare = the species is not expected to be encountered more than once in several years; very rare = not expected to be encountered more than once in 10 years.
[(a)] These species have never been recorded or observed in the action area. Thus the densities for the action area are shown as "0" to reflect this.

More detailed description of marine mammal density estimates within the NAVSEA NUWC Keyport Range Complex Extension is provided in the Navy's LOA application.

A Brief Background on Sound

An understanding of the basic properties of underwater sound is necessary to comprehend many of the concepts and analyses presented in this document. A summary is included below.

Sound is a wave of pressure variations propagating through a medium (for the sonar considered in this proposed rule, the medium is marine water). Pressure variations are created by compressing and relaxing the medium. Sound measurements can be expressed in two forms: intensity and pressure. Acoustic intensity is the average rate of energy transmitted through a unit area in a specified direction and is expressed in watts per square meter (W/m^2). Acoustic intensity is rarely measured directly, it is derived from ratios of pressures; the standard reference pressure for underwater sound is 1 microPascal (microPa); for airborne sound, the standard reference pressure is 20 microPa (Urick, 1983).

Acousticians have adopted a logarithmic scale for sound intensities, which is denoted in decibels (dB). Decibel measurements represent the ratio between a measured pressure value and a reference pressure value (in this case 1 microPa or, for airborne sound, 20 microPa). The logarithmic nature of the scale means that each 10 dB increase is a tenfold increase in power (*e.g.,* 20 dB is a 100-fold increase, 30 dB is a 1,000-fold increase). Humans perceive a 10-dB increase in noise as a doubling of sound level, or a 10 dB decrease in noise as a halving of sound level. The term ''sound pressure level'' implies a decibel measure and a reference pressure that is used as the denominator of the ratio. Throughout this document, NMFS uses 1 microPa as a standard reference pressure unless noted otherwise.

It is important to note that decibels underwater and decibels in air are not the same and cannot be directly compared. To estimate a comparison between sound in air and underwater, because of the different densities of air and water and the different decibel standards (*i.e.,* reference pressures) in water and air, a sound with the same intensity (*i.e.,* power) in air and in water would be approximately 61.5 dB lower in air. Thus, a sound that is 160 dB loud underwater would have the same approximate effective intensity as a sound that is 98.5 dB loud in air.

Sound frequency is measured in cycles per second, or Hertz (abbreviated Hz), and is analogous to musical pitch; high-pitched sounds contain high frequencies and low-pitched sounds contain low frequencies. Natural sounds in the ocean span a huge range of frequencies: from earthquake noise at 5 Hz to harbor porpoise clicks at 150,000 Hz (150 kHz). These sounds are so low or so high in pitch that humans cannot even hear them; acousticians call these infrasonic and ultrasonic sounds, respectively. A single sound may be made up of many different frequencies together. Sounds made up of only a small range of frequencies are called ''narrowband'', and sounds with a broad range of frequencies are called ''broadband''; airguns are an example of a broadband sound source and tactical sonars are an example of a narrowband sound source.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms derived using auditory evoked potential, anatomical modeling, and other data, Southall *et al.* (2007) designated ''functional hearing groups'' and estimated the lower and upper frequencies of functional hearing of the groups. Further, the frequency range in which each group's hearing is estimated as being most sensitive is represented in the flat part of the M-weighting functions developed for each group. The functional groups and the associated frequencies are indicated below:

- Low frequency cetaceans (13 species of mysticetes): Functional hearing is estimated to occur between approximately 7 Hz and 22 kHz.
- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): Functional hearing is estimated to occur between approximately 150 Hz and 160 kHz.
- High frequency cetaceans (eight species of true porpoises, six species of river dolphins, *Kogia,* the franciscana, and four species of cephalorhynchids): Functional hearing is estimated to occur between approximately 200 Hz and 180 kHz.
- Pinnipeds in Water: Functional hearing is estimated to occur between approximately 75 Hz and 75 kHz, with the greatest sensitivity between approximately 700 Hz and 20 kHz.
- Pinnipeds in Air: Functional hearing is estimated to occur between approximately 75 Hz and 30 kHz.

Because ears adapted to function underwater are physiologically different from human ears, comparisons using decibel measurements in air would still not be adequate to describe the effects of a sound on a cetacean. When sound travels away from its source, its loudness decreases as the distance from the source increases (propagation). Thus, the loudness of a sound at its source is higher than the loudness of that same sound a kilometer distant. Acousticians often refer to the loudness of a sound at its source (typically measured one meter from the source) as the source level and the loudness of sound elsewhere as the received level. For example, a humpback whale three kilometers from an airgun that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound propagates. As a result, it is important not to confuse source levels and received levels when discussing the loudness of sound in the ocean.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Metrics Used in This Document

This section includes a brief explanation of the two sound measurements (sound pressure level (SPL) and sound exposure level (SEL)) frequently used in the discussions of acoustic effects in this document.

SPL

Sound pressure is the sound force per unit area, and is usually measured in microPa, where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter. SPL is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in underwater acoustics is 1 microPa, and the units for SPLs are dB re: 1 microPa.

SPL (in dB) = 20 log (pressure/ reference pressure)

SPL is an instantaneous measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates. All references to SPL in this document refer to the root mean square. SPL does not take the duration of a sound into account. SPL is the applicable metric used in the risk continuum, which is used to estimate behavioral harassment takes (*see* Level B Harassment Risk Function (Behavioral Harassment) Section).

SEL

SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 $microPa^2$-s.

SEL = SPL + 10log (duration in seconds)

As applied to tactical sonar, the SEL includes both the SPL of a sonar ping and the total duration. Longer duration pings and/or pings with higher SPLs will have a higher SEL. Surface-ship hull-mounted sonars, known as tactical sonars, are not used by NAVSEA NUWC Keyport. If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the total SEL. The total SEL depends on the SPL, duration, and number of pings received. The thresholds that NMFS uses to indicate the received levels at which the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing are likely to occur are expressed in SEL.

Potential Impacts to Marine Mammal Species

The following sections discuss the potential effects from noise related to active acoustic devices that would be used in the proposed Keyport Range Complex Extension.

For activities involving active acoustic sources such as tactical sonar, NMFS's analysis identifies the probability of lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), behavioral disturbance (that rises to the level of harassment), and social responses that would be classified as behavioral harassment or injury and/or would be likely to adversely affect the species or stock through effects on annual rates of recruitment or survival. It should be noted that the description below is based on more powerful mid-frequency active sonar (MFAS) used on surface ships. The NAVSEA NUWC Keyport Range does not utilize these sources in RDT&E activities. Many of these severe effects (*e.g.,* mortality, acoustically mediated bubble growth, and stranding) are not likely to occur for acoustic sources used in the proposed Keyport Range activities, as shown in Estimated Takes of Marine Mammals section.

Direct Physiological Effects

Based on the literature, there are two basic ways that MFAS might directly result in physical trauma or damage: Noise-induced loss of hearing sensitivity (more commonly-called ''threshold shift'') and acoustically mediated bubble growth. Separately, an animal's behavioral reaction to an acoustic exposure might lead to physiological effects that might ultimately lead to injury or death, which is discussed later in the Stranding section.

Threshold Shift (Noise-Induced Loss of Hearing)

When animals exhibit reduced hearing sensitivity (*i.e.,* sounds must be louder for an animal to recognize them) following exposure to a sufficiently intense sound, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (*i.e.,* there is recovery), occurs in specific frequency ranges (*i.e.,* an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz)), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced by only 6 dB or reduced by 30 dB). PTS is permanent (*i.e.,* there is no recovery), but as with TTS occurs in a specific frequency range and amount.

The following physiological mechanisms are thought to play a role in inducing auditory TSs: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output (Southall *et al.,* 2007). The amplitude, duration, frequency, temporal pattern, and energy distribution of sound exposure all affect the amount of associated TS and the frequency range in which it occurs. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS. For continuous sounds, exposures of equal energy (the same SEL) will lead to approximately equal effects. For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur between exposures) (Kryter *et al.,* 1966; Ward, 1997). For example, one short but loud (higher SPL) sound exposure may induce the same impairment as one longer but softer sound, which in turn may cause more impairment than a series of several intermittent softer sounds with the same total energy (Ward, 1997). Additionally, though TTS is temporary, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985) (although in the case of MFAS, animals are not expected to be exposed to levels high enough or durations long enough to result in PTS).

PTS is considered auditory injury (Southall *et al.,* 2007). Irreparable damage to the inner or outer cochlear hair cells may cause PTS, however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007).

Although the published body of scientific literature contains numerous theoretical studies and discussion papers on hearing impairments that can occur with exposure to a loud sound, only a few studies provide empirical information on the levels at which noise-induced loss in hearing sensitivity occurs in nonhuman animals. For cetaceans, published data are limited to a captive bottlenose dolphin and beluga whale (Finneran *et al.,* 2000, 2002b, 2005a; Schlundt *et al.,* 2000; Nachtigall *et al.,* 2003, 2004).

Marine mammal hearing plays a critical role in communication with conspecific, and interpreting environmental cues for purposes such as predator avoidance and prey capture. Depending on the frequency range of TTS degree (dB), duration, and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present.

Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. Also, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a long term condition. Of note, reduced hearing sensitivity as a simple function of development and aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost. There is no empirical evidence that exposure to MFAS can cause PTS in any marine mammals; instead the probability of PTS has been inferred from studies of TTS (see Richardson *et al.,* 1995).

Acoustically Mediated Bubble Growth

One theoretical cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process could be facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The deeper and longer dives of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser *et al.,* 2001b). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness.

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. Recent work conducted by Crum *et al.* (2005) demonstrated the possibility of rectified diffusion for short duration signals, but at sound exposure levels and tissue saturation levels that are improbable to occur in a diving marine mammal. However, an alternative but related hypothesis has also been suggested: Stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. Yet another hypothesis (decompression sickness) has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson *et al.,* 2003; Fernandez *et al.,* 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Collectively, these hypotheses can be referred to as ''hypotheses of acoustically mediated bubble growth.''

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Crum and Mao (1996) hypothesized that received levels would have to exceed 190 dB in order for there to be the possibility of significant bubble growth due to supersaturation of gases in the blood (*i.e.,* rectified diffusion). More recent work conducted by Crum *et al.* (2005) demonstrated the possibility of rectified diffusion for short duration signals, but at SELs and tissue saturation levels that are highly improbable to occur in diving marine mammals. To date, Energy Levels (ELs) predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Although it has been argued that traumas from some recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.,* 2003), there is no conclusive evidence of this. However, Jepson *et al.* (2003, 2005) and Fernandez *et al.* (2004, 2005) concluded that in vivo bubble formation, which may be exacerbated by deep, long duration, repetitive dives may explain why beaked whales appear to be particularly vulnerable to sonar exposures. Further investigation is needed to further assess the potential validity of these hypotheses. More information regarding hypotheses that attempt to explain how behavioral responses to MFAS can lead to strandings is included in the Behaviorally Mediated Bubble Growth section, after the summary of strandings.

Acoustic Masking

Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication between individuals, navigation, foraging, reproduction, and learning about their environment (Erbe and Farmer, 2000; Tyack, 2000). Masking, or auditory interference, generally occurs when sounds in the environment are louder than and of a similar frequency to, auditory signals an animal is trying to receive. Masking is a phenomenon that affects animals that are trying to receive acoustic information about their environment, including sounds from other members of their species, predators, prey, and sounds that allow them to orient in their environment. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations.

The extent of the masking interference depends on the spectral, temporal, and spatial relationships between the signals an animal is trying to receive and the masking noise, in addition to other factors. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa.

Richardson *et al.* (1995) argued that the maximum radius of influence of an industrial noise (including broadband low frequency sound transmission) on a marine mammal is the distance from the source to the point at which the noise can barely be heard. This range is determined by either the hearing sensitivity of the animal or the background noise level present. Industrial masking is most likely to affect some species' ability to detect communication calls and natural sounds (*i.e.,* surf noise, prey noise, etc.; Richardson *et al.,* 1995).

The echolocation calls of odontocetes (toothed whales) are subject to masking by high frequency sound. Human data indicate low frequency sound can mask high frequency sounds (*i.e.,* upward masking). Studies on captive odontocetes by Au *et al.* (1974, 1985, 1993) indicate that some species may use various processes to reduce masking effects (*e.g.,* adjustments in echolocation call intensity or frequency as a function of background noise conditions). There is also evidence that the directional hearing abilities of odontocetes are useful in reducing masking at the high frequencies these cetaceans use to echolocate, but not at the low-to moderate frequencies they use to communicate (Zaitseva *et al.,* 1980).

As mentioned previously, the functional hearing ranges of marine mammals all encompass the frequencies of the active acoustic sources used in the Navy's Keyport Range activities. Additionally, almost all species' vocal repertoires span across the frequencies of the sources used by the Navy. The closer the characteristics of the masking signal to the signal of interest, the more likely masking is to occur. However, because the pulse length and duty cycle of source signals are of short duration and would not be continuous, masking is unlikely to occur as a result of exposure to active acoustic sources during the RDT&E activities in the Keyport Range Complex Extension Study Area.

Impaired Communication

In addition to making it more difficult for animals to perceive acoustic cues in their environment, anthropogenic sound presents separate challenges for animals that are vocalizing. When they vocalize, animals are aware of environmental conditions that affect the "active space" of their vocalizations, which is the maximum area within which their vocalizations can be detected before it drops to the level of ambient noise (Brenowitz, 2004; Brumm *et al.,* 2004; Lohr *et al.,* 2003). Animals are also aware of environmental conditions that affect whether listeners can discriminate and recognize their vocalizations from other sounds, which are more important than detecting a vocalization (Brenowitz, 1982; Brumm *et al.,* 2004; Dooling, 2004; Marten and Marler, 1977; Patricelli *et al.,* 2006). Most animals that vocalize have evolved an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability of their vocalizations in the face of temporary changes in background noise (Brumm *et al.,* 2004; Patricelli *et al.,* 2006). Vocalizing animals will make one or more of the following adjustments to their vocalizations: Adjust the frequency structure; adjust the amplitude; adjust temporal structure; or adjust temporal delivery.

Many animals will combine several of these strategies to compensate for high levels of background noise. Anthropogenic sounds that reduce the signal-to-noise ratio of animal vocalizations, increase the masked auditory thresholds of animals listening for such vocalizations, or reduce the active space of an animal's vocalizations impair communication between animals. Most animals that vocalize have evolved strategies to compensate for the effects of short-term or temporary increases in background or ambient noise on their songs or calls. Although the fitness consequences of these vocal adjustments remain unknown, like most other trade-offs animals must make, some of these strategies probably come at a cost (Patricelli *et al.,* 2006). For example, vocalizing more loudly in noisy environments may have energetic costs that decrease the net benefits of vocal adjustment and alter a bird's energy budget (Brumm, 2004; Wood and Yezerinac, 2006). Shifting songs and calls to higher frequencies may also impose energetic costs (Lambrechts, 1996).

Stress Responses

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg, 2000; Sapolsky *et al.,* 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: Behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune response.

In the case of many stressors, an animal's first and most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the autonomic nervous system and the classical "fight or flight" response which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with "stress." These responses have a relatively short duration and may or may not have significant long-term effects on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine or sympathetic nervous systems; the system that has received the most study has been the hypothalmus-pituitary-adrenal system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg, 1987; Rivier, 1995) and altered metabolism (Elasser *et al.,* 2000), reduced immune competence (Blecha, 2000) and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; Romano *et al.,* 2004) have been equated with stress for many years.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose a risk to the animal's welfare. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic functions, which impair those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called ''distress'' (sensu Seyle, 1950) or ''allostatic loading'' (sensu McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiments; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005; Reneerkens *et al.,* 2002; Thompson and Hamer, 2000). Although no information has been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds, studies of other marine animals and terrestrial animals would lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to mid-frequency and low frequency sounds.

For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (for example, elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b) identified noise induced physiological transient stress responses in hearing-specialist fish that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses cetaceans use to gather information about their environment and to communicate with conspecifics. Although empirical information on the relationship between sensory impairment (TTS, PTS, and acoustic masking) on cetaceans remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC, 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg, 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

Behavioral Disturbance

Behavioral responses to sound are highly variable and context-specific. Exposure of marine mammals to sound sources can result in (but is not limited to) the following observable responses: Increased alertness; orientation or attraction to a sound source; vocal modifications; cessation of feeding; cessation of social interaction; alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and, in severe cases, panic, flight, stampede, or stranding, potentially resulting in death (Southall *et al.,* 2007).

Many different variables can influence an animal's perception of and response to (nature and magnitude) an acoustic event. An animal's prior experience with a sound type affects whether it is less likely (habituation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately pre-disposed to respond to certain sounds in certain ways) (Southall *et al.,* 2007). Related to the sound itself, the perceived nearness of the sound, bearing of the sound (approaching vs. retreating), similarity of a sound to biologically relevant sounds in the animal's environment (*i.e.,* calls of predators, prey, or conspecifics), and familiarity of the sound may affect the way an animal responds to the sound (Southall *et al.,* 2007). Individuals (of different age, gender, reproductive status, etc.) among most populations will have variable hearing capabilities, and differing behavioral sensitivities to sounds that will be affected by prior conditioning, experience, and current activities of those individuals. Often, specific acoustic features of the sound and contextual variables (*i.e.,* proximity, duration, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone.

There are few empirical studies of avoidance responses of free-living cetaceans to mid-frequency sonars. Much more information is available on the avoidance responses of free-living cetaceans to other acoustic sources, like seismic airguns and low frequency sonar, than mid-frequency active sonar. Richardson *et al.,* (1995) noted that avoidance reactions are the most obvious manifestations of disturbance in marine mammals.

Behavioral Responses (Southall et al. (2007))

Southall *et al.,* (2007) reports the results of the efforts of experts in acoustic research from behavioral, physiological, and physical disciplines that convened and reviewed the available literature on marine mammal hearing and physiological and behavioral responses to anthropogenic sound with the goal of proposing exposure criteria for certain effects. This compilation of literature is very valuable, though Southall *et al.* notes that not all data is equal: Some have poor statistical power, insufficient controls, and/or limited information on received levels, background noise, and other potentially important contextual variables; such data were reviewed and sometimes used for qualitative illustration, but were not included in the quantitative analysis for the criteria recommendations.

In the Southall *et al.,* (2007) report, for the purposes of analyzing responses of marine mammals to anthropogenic sound and developing criteria, the authors differentiate between single pulse sounds, multiple pulse sounds, and non-pulse sounds. Sonar signal is considered a non-pulse sound. Southall *et al.,* (2007) summarize the reports associated with low, mid, and high frequency cetacean responses to non-pulse sounds in Appendix C of their report (incorporated by reference and summarized in the three paragraphs below).

The reports that address responses of low frequency cetaceans to non-pulse sounds include data gathered in the field and related to several types of sound sources (of varying similarity to sonar signals) including: Vessel noise, drilling and machinery playback, low frequency M-sequences (sine wave with multiple phase reversals) playback, low frequency active sonar playback, drill vessels, Acoustic Thermometry of Ocean Climate (ATOC) source, and non-pulse playbacks. These reports generally indicate no (or very limited) responses to received levels in the 90 to 120 dB re 1 micro Pa range and an increasing likelihood of avoidance and other behavioral effects in the 120 to 160 dB range. As mentioned earlier, however, contextual variables play a very important role in the reported responses, and the severity of effects are not linear when compared to received level. Also, few of the laboratory or field datasets had common conditions, behavioral contexts or sound sources, so it is not surprising that responses differ.

The reports that address responses of mid-frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to sonar signals) including: Pingers, drilling playbacks, vessel and ice-breaking noise, vessel noise, Acoustic Harassment Devices (AHDs), Acoustic Deterrent Devices (ADDs), HFAS/MFAS, and non-pulse bands and tones. Southall *et al.* were unable to come to a clear conclusion regarding these reports. In some cases, animals in the field showed significant responses to received levels between 90 and 120 dB, while in other cases these responses were not seen in the 120 to 150 dB range. The disparity in results was likely due to contextual variation and the differences between the results in the field and laboratory data (animals responded at lower levels in the field).

The reports that address the responses of high frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to sonar signals) including: Acoustic harassment devices, Acoustical Telemetry of Ocean Climate (ATOC), wind turbine, vessel noise, and construction noise. However, no conclusive results are available from these reports. In some cases, high frequency cetaceans (harbor porpoises) are observed to be quite sensitive to a wide range of human sounds at very low exposure RLs (90 to 120 dB). All recorded exposures exceeding 140 dB produced profound and sustained avoidance behavior in wild harbor porpoises (Southall *et al.,* 2007).

In addition to summarizing the available data, the authors of Southall *et al.* (2007) developed a severity scaling system with the intent of ultimately being able to assign some level of biological significance to a response. Following is a summary of their scoring system: A comprehensive list of the behaviors associated with each score may be found in the report:

- 0–3 (Minor and/or brief behaviors) includes, but is not limited to: No response; minor changes in speed or locomotion (but with no avoidance); individual alert behavior; minor cessation in vocal behavior; minor changes in response to trained behaviors (in laboratory).
- 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival) includes, but is not limited to: Moderate changes in speed, direction, or dive profile; brief shift in group distribution; prolonged cessation or modification of vocal behavior (duration > duration of sound), minor or moderate individual and/or group avoidance of sound; brief cessation of reproductive behavior; or refusal to initiate trained tasks (in laboratory).
- 7–9 (Behaviors considered likely to affect the aforementioned vital rates) includes, but are not limited to: Extensive of prolonged aggressive behavior; moderate, prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms; long-term avoidance of an area; outright panic, stampede, stranding; threatening or attacking sound source (in laboratory).

In Table 7 we have summarized the scores that Southall *et al.* (2007) assigned to the papers that reported behavioral responses of low frequency cetaceans, mid-frequency cetaceans, and high frequency cetaceans to non-pulse sounds.

TABLE 7—DATA COMPILED FROM THREE TABLES FROM SOUTHALL ET AL. (2007) INDICATING WHEN MARINE MAMMALS (LOW-FREQUENCY CETACEAN = L, MID-FREQUENCY CETACEAN = M, AND HIGH-FREQUENCY CETACEAN = H) WERE REPORTED AS HAVING A BEHAVIORAL RESPONSE OF THE INDICATED SEVERITY TO A NON-PULSE SOUND OF THE INDICATED RECEIVED LEVEL

[As discussed in the text, responses are highly variable and context specific]

Received RMS sound pressure level (dB re 1 microPa)	Response Score											
	80 to <90	90 to < 100	100 to < 110	110 to <120	120 to < 130	130 to < 140	140 to < 150	150 to < 160	160 to < 170	170 to < 180	180 to < 190	190 to < 200
9												
8		M	M		M		M				M	M
7						L	L					
6	H	L/H	L/H	L/M/H	L/M/H	L	L/H	H	M/H	M		
5					M							
4			H	L/M/H	L/M		L					
3		M	L/M	L/M	M							
2			L	L/M	L	L	L					
1			M	M	M							
0	L/H	L/H	L/M/H	L/M/H	L/M/H	L	M				M	M

Potential Effects of Behavioral Disturbance

The different ways that marine mammals respond to sound are sometimes indicators of the ultimate effect that exposure to a given stimulus will have on the well-being (survival, reproduction, etc.) of an animal. There is little marine mammal data quantitatively relating the exposure of marine mammals to sound to effects on reproduction or survival, though data exist for terrestrial species from which we can draw comparisons for marine mammals.

Attention is the cognitive process of selectively concentrating on one aspect of an animal's environment while ignoring other things (Posner, 1994). Because animals (including humans) have limited cognitive resources, there is a limit to how much sensory information they can process at any time. The phenomenon called ''attentional capture'' occurs when a stimulus (such as a stimulus that an animal is not concentrating on or attending to) ''captures'' an animal's attention. This shift in attention can occur consciously or unconsciously (for example, when an animal hears sounds that it associates with the approach of a predator) and the shift in attention can be sudden (Dukas, 2002; van Rij, 2007). Once a stimulus has captured an animal's attention, the animal can respond by ignoring the stimulus, assuming a ''watch and wait'' posture, or treat the stimulus as a disturbance and respond accordingly, which includes scanning for the source of the stimulus or ''vigilance'' (Cowlishaw *et al.,* 2004).

Vigilance is normally an adaptive behavior that helps animals determine the presence or absence of predators, assess their distance from conspecifics, or to attend cues from prey (Bednekoff and Lima, 1998; Treves, 2000). Despite those benefits, however, vigilance has a cost of time: When animals focus their attention on specific environmental cues, they are not attending to other activities such as foraging. These costs have been documented best in foraging animals, where vigilance has been shown to substantially reduce feeding rates (Saino, 1994; Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002).

Animals will spend more time being vigilant, which may translate to less time foraging or resting, when disturbance stimuli approach them more directly, remain at closer distances, have a greater group size (for example, multiple surface vessels), or when they co-occur with times that an animal perceives increased risk (for example, when they are giving birth or accompanied by a calf). Most of the published literature, however, suggests that direct approaches will increase the amount of time animals will dedicate to being vigilant. For example, bighorn sheep and Dall's sheep dedicated more time being vigilant, and less time resting or foraging, when aircraft made direct approaches over them (Frid, 2001; Stockwell *et al.,* 1991).

Several authors have established that long-term and intense disturbance stimuli can cause population declines by reducing the body condition of individuals that have been disturbed, followed by reduced reproductive success, reduced survival, or both (Daan *et al.,* 1996; Madsen, 1994; White, 1983). For example, Madsen (1994) reported that pink-footed geese (*Anser brachyrhynchus*) in undisturbed habitat gained body mass and had about a 46-percent reproductive success compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and had a 17 percent reproductive success. Similar reductions in reproductive success have been reported for mule deer (*Odocoileus hemionus*) disturbed by all-terrain vehicles (Yarmoloy *et al.,* 1988), caribou disturbed by seismic exploration blasts (Bradshaw *et al.,* 1998), caribou disturbed by low-elevation military jetfights (Luick *et al.,* 1996), and caribou disturbed by low-elevation jet flights (Harrington and Veitch, 1992). Similarly, a study of elk (*Cervus elaphus*) that were disturbed experimentally by pedestrians concluded that the ratio of young to mothers was inversely related to disturbance rate (Phillips and Alldredge, 2000).

The primary mechanism by which increased vigilance and disturbance appear to affect the fitness of individual animals is by disrupting an animal's time budget and, as a result, reducing the time they might spend foraging and resting (which increases an animal's activity rate and energy demand). For example, a study of grizzly bears (*Ursus horribilis*) reported that bears disturbed by hikers reduced their energy intake by an average of 12 kcal/min (50.2×103 kJ/min), and spent energy fleeing or acting aggressively toward hikers (White *et al.,* 1999).

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hr cycle). Substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007).

Stranding and Mortality

When a live or dead marine mammal swims or floats onto shore and becomes ''beached'' or incapable of returning to sea, the event is termed a ''stranding'' (Geraci *et al.,* 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; NMFS, 2007). The legal definition for a stranding within the United States is that ''(A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.'' (16 U.S.C. 1421h).

Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most stranding are unknown (Geraci *et al.,* 1976; Eaton, 1979, Odell *et al.,* 1980; Best, 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might pre-dispose them to strand when exposed to these phenomena. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Chroussos, 2000; Creel, 2005; DeVries *et al.,* 2003; Fair and Becker, 2000; Foley *et al.,* 2001; Moberg, 2000; Relyea, 2005a; 2005b, Romero, 2004; Sih *et al.,* 2004).

Several sources have published lists of mass stranding events of cetaceans during attempts to identify relationships between those stranding events and military sonar (Hildebrand, 2004; IWC, 2005; Taylor *et al.,* 2004). For example, based on a review of stranding records between 1960 and 1995, the International Whaling Commission (IWC, 2005) identified ten mass stranding events of Cuvier's beaked whales that had been reported and one mass stranding of four Baird's beaked whales (*Berardius bairdii*). The IWC concluded that, out of eight stranding events reported from the mid-1980s to the summer of 2003, seven had been associated with the use of mid-frequency sonar, one of those seven had been associated with the use of low frequency sonar, and the remaining stranding event had been associated with the use of seismic airguns.

Most of the stranding events reviewed by the IWC involved beaked whales. A mass stranding of Cuvier's beaked whales in the eastern Mediterranean Sea occurred in 1996 (Frantzis, 1998) and mass stranding events involving Gervais' beaked whales, Blainville's beaked whales, and Cuvier's beaked whales occurred off the coast of the Canary Islands in the late 1980s (Simmonds and Lopez-Jurado, 1991). The stranding events that occurred in the Canary Islands and Kyparissiakos Gulf in the late 1990s and the Bahamas in 2000 have been the most intensively studied mass stranding events and have been associated with naval maneuvers that were using sonar.

Between 1960 and 2006, 48 strandings (68 percent) involved beaked whales, 3 (4 percent) involved dolphins, and 14 (20 percent) involved other whale species. Cuvier's beaked whales were involved in the greatest number of these events (48 strandings or 68 percent), followed by sperm whales (7 strandings or 10 percent), and Blainville's and Gervais' beaked whales (4 each or 6 percent). Naval activities that might have involved active sonar are reported to have coincided with 9 (13 percent) or 10 (14 percent) of those stranding events. Between the mid-1980s and 2003 (the period reported by the IWC), we identified reports of 44 mass cetacean stranding events of which at least 7 were coincident with naval exercises that were using mid-frequency sonar. A list of stranding events that are considered to be associated with MFAS is presented in the proposed rulemaking for the Navy's training in the Hawaii Range Complex (73 FR 35510; June 23, 2008).

Association Between Mass Stranding Events and Exposure to MFAS

Several authors have noted similarities between some of these mass stranding incidents: They occurred in islands or archipelagoes with deep water nearby, several appeared to have been associated with acoustic waveguides like surface ducting, and the sound fields created by vessels transmitting mid-frequency sonar (Cox *et al.,* 2006, D'Spain *et al.,* 2006). However, only low intensity sonars and low intensity acoustic sources are proposed for the Keyport Range Complex RDT&E and range extension activities, and no powerful MFAS such as the 53C series tactical sonar would be used for these activities; therefore, their zones of influence are much smaller compared to these highest powered surface vessel sources, and animals can be more easily detected in these smaller areas, thereby increasing the probability that sonar operations can be modified to reduce the risk of injury to marine mammals. In addition, the proposed test events differ significantly from major Navy exercises and training, which involve multi-vessel training scenarios using the AN/SQS–53/56 source that have been associated with past strandings. Therefore, their zones of influence are much smaller and are less likely to affect marine mammals. Although Cuvier's beaked whales have been the most common species involved in these stranding events (81 percent of the total number of stranded animals), other beaked whales (including *Mesoplodon europeaus, M. densirostris,* and *Hyperoodon ampullatus*) comprise 14 percent of the total. Other species (*Stenella coeruleoalba, Kogia breviceps* and *Balaenoptera acutorostrata*) have stranded, but in much lower numbers and less consistently than beaked whales.

Based on the available evidence, however, we cannot determine whether (a) Cuvier's beaked whale is more prone to injury from high-intensity sound than other species, (b) their behavioral responses to sound make them more likely to strand, or (c) they are more likely to be exposed to mid-frequency active sonar than other cetaceans (for reasons that remain unknown). Because the association between active sonar (mid-frequency) exposures and marine mammal mass stranding events is not consistent—some marine mammals strand without being exposed to sonar and some sonar transmissions are not associated with marine mammal stranding events despite their co-occurrence—other risk factors or a grouping of risk factors probably contribute to these stranding events.

Behaviorally Mediated Responses to HFAS/MFAS That May Lead to Stranding

Although the confluence of Navy mid-frequency active tactical sonar with the other contributory factors noted in the report was identified as the cause of the 2000 Bahamas stranding event, the specific mechanisms that led to that stranding (or the others) are not understood, and there is uncertainty regarding the ordering of effects that led to the stranding. It is unclear whether beaked whales were directly injured by sound (acoustically mediated bubble growth, addressed above) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to strand and be injured.

Although causal relationships between beaked whale stranding events and active sonar remain unknown, several authors have hypothesized that stranding events involving these species in the Bahamas and Canary Islands may have been triggered when the whales changed their dive behavior in a startle response to exposure to active sonar or to further avoid exposure (Cox *et al.,* 2006, Rommel *et al.,* 2006). These authors proposed three mechanisms by which the behavioral responses of beaked whales upon being exposed to active sonar might result in a stranding event. These include: Gas bubble formation caused by excessively fast surfacing; remaining at the surface too long when tissues are supersaturated with nitrogen; or diving prematurely when extended time at the surface is necessary to eliminate excess nitrogen. More specifically, beaked whales that occur in deep waters that are in close proximity to shallow waters (for example, the ''canyon areas'' that are cited in the Bahamas stranding event; see D'Spain and D'Amico, 2006), may respond to active sonar by swimming into shallow waters to avoid further exposures and strand if they were not able to swim back to deeper waters. Second, beaked whales exposed to active sonar might alter their dive behavior. Changes in their dive behavior might cause them to remain at the surface or at depth for extended periods of time, which could lead to hypoxia directly by increasing their oxygen demands or indirectly by increasing their energy expenditures (to remain at depth) and increase their oxygen demands as a result. If beaked whales are at depth when they detect a ping from an active sonar transmission and change their dive profile, this could lead to the formation of significant gas bubbles, which could damage multiple organs or interfere with normal physiological function (Cox *et al.,* 2006; Rommel *et al.,* 2006; Zimmer and Tyack, 2007). Baird *et al.* (2005) found that slow ascent rates from deep dives and long periods of time spent within 50 m of the surface were typical for both Cuvier's and Blainville's beaked whales, the two species involved in mass strandings related to naval sonar. These two behavioral mechanisms may be necessary to purge excessive dissolved nitrogen concentrated in their tissues during their frequent long dives (Baird *et al.,* 2005). Baird *et al.* (2005) further suggests that abnormally rapid ascents or premature dives in response to high intensity sonar could indirectly result in physical harm to the beaked whales, through the mechanisms described above (gas bubble formation or non-elimination of excess nitrogen).

Because many species of marine mammals make repetitive and prolonged dives to great depths, it has long been assumed that marine mammals have evolved physiological mechanisms to protect against the effects of rapid and repeated decompressions. Although several investigators have identified physiological adaptations that may protect marine mammals against nitrogen gas supersaturation (alveolar collapse and elective circulation; Kooyman *et al.,* 1972; Ridgway and Howard, 1979), Ridgway and Howard (1979) reported that bottlenose dolphins that were trained to dive repeatedly had muscle tissues that were substantially supersaturated with nitrogen gas. Houser *et al.* (2001) used these data to model the accumulation of nitrogen gas within the muscle tissue of other marine mammal species and concluded that cetaceans that dive deep and have slow ascent or descent speeds would have tissues that are more supersaturated with nitrogen gas than other marine mammals. Based on these data, Cox *et al.* (2006) hypothesized that a critical dive sequence might make beaked whales more prone to stranding in response to acoustic exposures. The sequence began with (1) very deep (to depths as deep as 2 kilometers) and long (as long as 90 minutes) foraging dives with (2) relatively slow, controlled ascents, followed by (3) a series of ''bounce'' dives between 100 and 400 m (328 and 1,323 ft) in depth (also see Zimmer and Tyack, 2007). They concluded that acoustic exposures that disrupted any part of this dive sequence (for example, causing beaked whales to spend more time at surface without the bounce dives that are necessary to recover from the deep dive) could produce excessive levels of nitrogen supersaturation in their tissues, leading to gas bubble and emboli formation that produces pathologies similar to decompression sickness.

Recently, Zimmer and Tyack (2007) modeled nitrogen tension and bubble growth in several tissue compartments for several hypothetical dive profiles and concluded that repetitive shallow dives (defined as a dive where depth does not exceed the depth of alveolar collapse, approximately 72 m (236 ft) for *Ziphius*), perhaps as a consequence of an extended avoidance reaction to sonar sound, could pose a risk for decompression sickness and that this risk should increase with the duration of the response. Their models also suggested that unrealistically more rapid ascent rates from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected. Tyack *et al.* (2006) suggested that emboli observed in animals exposed to midfrequency range sonar (Jepson *et al.,* 2003; Fernandez *et al.,* 2005) could stem from a behavioral response that involves repeated dives shallower than the depth of lung collapse. Given that nitrogen gas accumulation is a passive process (*i.e.,* nitrogen is metabolically inert), a bottlenose dolphin was trained to repetitively dive a profile predicted to elevate nitrogen saturation to the point that nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of asymptomatic nitrogen gas bubbles (Houser *et al.,* 2007).

If marine mammals respond to a Navy vessel that is transmitting active sonar in the same way that they might respond to a predator, their probability of flight responses should increase when they perceive that Navy vessels are approaching them directly, because a direct approach may convey detection and intent to capture (Burger and Gochfeld, 1981; 1990; Cooper, 1997; 1998). The probability of flight responses should also increase as received levels of active sonar increase (and the vessel is, therefore, closer) and as vessel speeds increase (that is, as approach speeds increase). For example, the probability of flight responses in Dall's sheep (*Ovis dalli dalli*) (Frid, 2001a, b), ringed seals (*Phoca hispida*) (Born *et al.,* 1999), Pacific brant (*Branta bernic nigricans*) and Canada geese (*B. canadensis*) increased as a helicopter or fixed-wing aircraft approached groups of these animals more directly (Ward *et al.,* 1999). Bald eagles (*Haliaeetus leucocephalus*) perched on trees alongside a river were also more likely to flee from a paddle raft when their perches were closer to the river or were closer to the ground (Steidl and Anthony, 1996).

Despite the many theories involving bubble formation (both as a direct cause of injury (see Acoustically Mediated Bubble Growth Section) and an indirect cause of stranding (see Behaviorally Mediated Bubble Growth Section), Southall *et al.,* (2007) summarizes that scientific disagreement or complete lack of information exists regarding the following important points: (1) Received acoustical exposure conditions for animals involved in stranding events; (2) pathological interpretation of observed lesions in stranded marine mammals; (3) acoustic exposure conditions required to induce such physical trauma directly; (4) whether noise exposure may cause behavioral reactions (such as atypical diving behavior) that secondarily cause bubble formation and tissue damage; and (5) the extent to which the post mortem artifacts introduced by decomposition before sampling, handling, freezing, or necropsy procedures affect interpretation of observed lesions.

Unlike those past stranding events that were coincident with military mid-frequency sonar use and were speculated to most likely have been caused by exposure to the sonar, those naval exercises involved multiple vessels in waters with steep bathymetry where deep channeling of sonar signals was more likely. The proposed RDT&E activities within the Keyport Range Complex Extension would not involve multi-vessel operations, would not use powerful sonar such as the AN/SQQ–53C/56 MFAS, and the bathymetry bears no similarity to where those mass strandings occurred (*e.g.,* Greece (1996); the Bahamas (2000); Madeira (2000); Canary Islands (2002); Hanalei Bay, Kaua'i, Hawaii (2004); and Spain (2006)). Consequently, because of the nature of the Keyport Range operations (which involve less powerful active sonar (MFAS/HFAS) and other sound sources, and no high-speed, multi-vessel training scenarios) and the fact that the Keyport Range Complex Extension has none of the bathymetric features that have been associated with mass strandings in the past, NMFS concludes it is unlikely that sonar use would result in a stranding event in the Keyport Range Complex region.

Estimated Take of Marine Mammals

With respect to the MMPA, NMFS's effects assessment serves four primary purposes: (1) To prescribe the permissible methods of taking (*i.e.,* Level B Harassment (behavioral harassment), Level A harassment (injury), or mortality, including an identification of the number and types of take that could occur by Level A or B harassment or mortality) and to prescribe other means of effecting the least practicable adverse impact on such species or stock and its habitat (*i.e.,* mitigation); (2) to determine whether the specified activity will have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity will adversely affect the species or stock through effects on annual rates of recruitment or survival); (3) to determine whether the specified activity will have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (however, there are no subsistence communities that would be affected in the Keyport Range Complex Study Area, so this determination is inapplicable for this rulemaking); and (4) to prescribe requirements pertaining to monitoring and reporting.

In the Potential Impacts to Marine Mammal Species section, NMFS identifies the lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), and behavioral responses that could potentially result from exposure to active acoustic sources (*e.g.,* powerful sonar). In this section, we will relate the potential effects to marine mammals from active acoustic sources to the MMPA regulatory definitions of Level A and Level B Harassment and attempt to quantify the effects that might occur from the specific RDT&E activities that the Navy is proposing in the Keyport Range Complex.

Definition of Harassment

As mentioned previously, with respect to military readiness activities, Section 3(18)(B) of the MMPA defines ''harassment'' as: (i) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Level B Harassment

Of the potential effects that were described in the Potential Impacts to Marine Mammals Species section, the following are the types of effects that fall into the Level B Harassment category:

Behavioral Harassment—Behavioral disturbance that rises to the level described in the definition above, when resulting from exposures to active acoustic sources, is considered Level B Harassment. Some of the lower level physiological stress responses will also likely co-occur with the predicted harassments, although these responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. When Level B Harassment is predicted based on estimated behavioral responses, those takes may have a stress-related physiological component as well.

In the effects section above, we described the Southall *et al.,* (2007) severity scaling system and listed some examples of the three broad categories of behaviors: (0–3: Minor and/or brief behaviors); 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival); 7–9 (Behaviors considered likely to affect the aforementioned vital rates). Generally speaking, MMPA Level B Harassment, as defined in this document, would include the behaviors described in the 7–9 category, and a subset, dependent on context and other considerations, of the behaviors described in the 4–6 categories. Behavioral harassment generally does not include behaviors ranked 0–3 in Southall *et al.,* (2007).

Acoustic Masking and Communication Impairment—Acoustic masking is considered Level B Harassment, as it can disrupt natural behavioral patterns by interrupting or limiting the marine mammal's receipt or transmittal of important information or environmental cues.

TTS—As discussed previously, TTS can affect how an animal behaves in response to the environment, including conspecifics, predators, and prey. The following physiological mechanisms are thought to play a role in inducing auditory fatigue: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output. Ward (1997) suggested that when these effects result in TTS rather than PTS, they are within the normal bounds of physiological variability and tolerance and do not represent a physical injury. Additionally, Southall *et al.* (2007) indicate that although PTS is a tissue injury, TTS is not because the reduced hearing sensitivity following exposure to intense sound results primarily from fatigue, not loss, of cochlear hair cells and supporting structures and is reversible. Accordingly, NMFS classifies TTS (when resulting from exposure to active acoustic sources) as Level B Harassment, not Level A Harassment (injury).

Level A Harassment

Of the potential effects that were described in the Potential Impacts to Marine Mammal Species section, following are the types of effects that fall into the Level A Harassment category:

PTS—PTS (resulting either from exposure to active acoustic sources) is irreversible and considered an injury. PTS results from exposure to intense sounds that cause a permanent loss of inner or outer cochlear hair cells or exceed the elastic limits of certain tissues and membranes in the middle and inner ears and results in changes in the chemical composition of the inner ear fluids.

Acoustically Mediated Bubble Growth—A few theories suggest ways in which gas bubbles become enlarged through exposure to intense sounds (HFAS/MFAS) to the point where tissue damage results. In rectified diffusion, exposure to a sound field would cause bubbles to increase in size. Alternately, bubbles could be destabilized by high level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. Tissue damage from either of these processes would be considered an injury.

Behaviorally Mediated Bubble Growth—Several authors suggest mechanisms in which marine mammals could behaviorally respond to exposure to HFAS/MFAS by altering their dive patterns in a manner (unusually rapid ascent, unusually long series of surface dives, etc.) that might result in unusual bubble formation or growth ultimately resulting in tissue damage (emboli, etc.).

Acoustic Take Criteria for Naval Sonar

For the purposes of an MMPA incidental take authorization, three types of take are identified: Level B harassment; Level A harassment; and mortality (or serious injury leading to mortality). The categories of marine mammal responses (physiological and behavioral) that fall into the two harassment categories were described in the previous section.

Because the physiological and behavioral responses of the majority of the marine mammals exposed to HFAS/

MFAS cannot be detected or measured, a method is needed to estimate the number of individuals that will be taken, pursuant to the MMPA, based on the proposed action. To this end, NMFS uses acoustic criteria that estimate the received level (when exposed to HFAS/MFAS) at which Level B or Level A harassment would occur. The acoustic criteria for HFAS/MFAS are discussed below.

Because relatively few applicable data exist to support acoustic criteria specifically for HFAS, and it is suspected that the majority of the adverse effects are from the MFAS due to their larger impact ranges, NMFS will apply the criteria developed for the MFAS to the HFAS as well.

NMFS utilizes three acoustic criteria for HFAS/MFAS: PTS (injury—Level A Harassment), behavioral harassment from TTS, and sub-TTS (Level B Harassment). Because the TTS and PTS criteria are derived similarly and the PTS criteria was extrapolated from the TTS data, the TTS and PTS acoustic criteria will be presented first, before the behavioral criteria. For more information regarding these criteria, please see the Navy's LOA application for the Keyport Range Complex RDT&E and range extension activities.

Level B Harassment Threshold (TTS)

As mentioned above, behavioral disturbance, acoustic masking, and TTS are all considered Level B Harassment. Marine mammals would usually be behaviorally disturbed at lower received levels than those at which they would likely sustain TTS, so the levels at which behavioral disturbance is likely to occur are considered the onset of Level B Harassment. The behavioral responses of marine mammals to sound are variable, context specific, and, therefore, difficult to quantify (see Risk Function section, below). TTS is a physiological effect that has been studied and quantified in laboratory conditions. NMFS also uses an acoustic criteria to estimate the number of marine mammals that might sustain TTS incidental to a specific activity (in addition to the behavioral criteria).

A number of investigators have measured TTS in marine mammals. These studies measured hearing thresholds in trained marine mammals before and after exposure to intense sounds. The existing cetacean TTS data are summarized in the following bullets.

- Schlundt *et al.* (2000) reported the results of TTS experiments conducted with 5 bottlenose dolphins and 2 belugas exposed to 1-second tones. This paper also includes a reanalysis of preliminary TTS data released in a technical report by Ridgway *et al.* (1997). At frequencies of 3, 10, and 20 kHz, sound pressure levels (SPLs) necessary to induce measurable amounts (6 dB or more) of TTS were between 192 and 201 dB re 1 microPa (EL = 192 to 201 dB re 1 microPa^2-s). The mean exposure SPL and EL for onset-TTS were 195 dB re 1 microPa and 195 dB re 1 microPa^2-s, respectively.
- Finneran *et al.* (2001, 2003, 2005) described TTS experiments conducted with bottlenose dolphins exposed to 3-kHz tones with durations of 1, 2, 4, and 8 seconds. Small amounts of TTS (3 to 6 dB) were observed in one dolphin after exposure to ELs between 190 and 204 dB re 1 microPa^2-s. These results were consistent with the data of Schlundt *et al.* (2000) and showed that the Schlundt *et al.* (2000) data were not significantly affected by the masking sound used. These results also confirmed that, for tones with different durations, the amount of TTS is best correlated with the exposure EL rather than the exposure SPL.
- Nachtigall *et al.* (2003) measured TTS in a bottlenose dolphin exposed to octave-band sound centered at 7.5 kHz. Nachtigall *et al.* (2003a) reported TTSs of about 11 dB measured 10 to 15 minutes after exposure to 30 to 50 minutes of sound with SPL 179 dB re 1 microPa (EL about 213 dB re microPa^2-s). No TTS was observed after exposure to the same sound at 165 and 171 dB re 1 microPa. Nachtigall *et al.* (2004) reported TTSs of around 4 to 8 dB 5 minutes after exposure to 30 to 50 minutes of sound with SPL 160 dB re 1 microPa (EL about 193 to 195 dB re 1 microPa^2-s). The difference in results was attributed to faster post exposure threshold measurement—TTS may have recovered before being detected by Nachtigall *et al.* (2003). These studies showed that, for long duration exposures, lower sound pressures are required to induce TTS than are required for short-duration tones.
- Finneran *et al.* (2000, 2002) conducted TTS experiments with dolphins and belugas exposed to impulsive sounds similar to those produced by distant underwater explosions and seismic waterguns. These studies showed that, for very short-duration impulsive sounds, higher sound pressures were required to induce TTS than for longer-duration tones.
- Mooney *et al.* (2009) exposed a bottlenose dolphin with a ''typical'' mid-frequency naval sonar signal (two down sweeps of 0.5 s each separated by a 0.5 s gap, fundamental frequency approximately 3–4 kHz with multiple harmonics) recorded within the Puget Sound, Washington. Successive three-ping blocks, each block spaced 24 s apart, were used to simulate a ''typical'' mid-frequency sonar application. To evaluate TTS, hearing thresholds for a 5.6 kHz tone were measured before and after noise exposure using the physiological method of auditory evoked potentials. Sonar SPLs were gradually increased up to 203 dB SPL (rms) (measured at the location of the dolphin's ear) for individual pings. The ping number was then increased over multiple exposure sessions until a threshold shift was induced. Results showed that only the five blocks of sonar pings, presenting an SPL of 203 dB (SEL of 214 dB re 1 microPa^2-s), reliably induced shifts for three consecutive research sessions.
- Kastak *et al.* (1999a, 2005) conducted TTS experiments with three species of pinnipeds, California sea lion, northern elephant seal and a Pacific harbor seal, exposed to continuous underwater sounds at levels of 80 and 95 dB sensation level (the level above its hearing threshold) at 2.5 and 3.5 kHz for up to 50 minutes. Mean TTS shifts of up to 12.2 dB occurred with the harbor seals showing the largest shift of 28.1 dB. Increasing the sound duration had a greater effect on TTS than increasing the sound level from 80 to 95 dB.

Some of the more important data obtained from these studies are onset-TTS levels (exposure levels sufficient to cause a just-measurable amount of TTS) often defined as 6 dB of TTS (for example, Schlundt *et al.,* 2000) and the fact that energy metrics (sound exposure levels (SEL), which include a duration component) better predict when an animal will sustain TTS than pressure (SPL) alone. NMFS' TTS criteria (which indicate the received level at which onset TTS (<6dB) is induced, expressed in SELs) for HFAS/MFAS are as follows:

- Cetaceans—195 dB re 1 microPa^2-s (based on mid-frequency cetaceans—no published data exist on auditory effects of noise in low or high frequency cetaceans (Southall *et al.,* 2007)).
- Pinnipeds:
  —Harbor Seals (and closely related species)—183 dB re 1 microPa^2-s
  —Northern Elephant Seals (and closely related species)—204 dB re 1 microPa^2-s
  —California Sea Lions (and closely related species)—206 dB re 1 microPa^2-s

A detailed description of how TTS criteria were derived from the results of the above studies may be found in Chapter 3 of Southall *et al.* (2007), as well as the Navy's Keyport Range Complex LOA application.

Level A Harassment Threshold (PTS)

For acoustic effects, because the tissues of the ear appear to be the most susceptible to the physiological effects of sound, and because threshold shifts tend to occur at lower exposures than other more serious auditory effects, NMFS has determined that PTS is the best indicator for the smallest degree of injury that can be measured. Therefore, the acoustic exposure associated with onset-PTS is used to define the lower limit of the Level A harassment.

PTS data do not currently exist for marine mammals and are unlikely to be obtained due to ethical concerns. However, PTS levels for these animals may be estimated using TTS data from marine mammals and relationships between TTS and PTS that have been discovered through study of terrestrial mammals. NMFS uses the following acoustic criteria for injury (expressed in SELs):

- Cetaceans—215 dB re 1 microPa^2-s (based on mid-frequency cetaceans—no published data exist on auditory effects of noise in low or high frequency cetaceans (Southall *et al.,* 2007)).
- Pinnipeds:

—Harbor Seals (and closely related species)—203 dB re 1 microPa^2-s
—Northern Elephant Seals (and closely related species)—224 dB re 1 microPa^2-s
—California Sea Lions (and closely related species)—226 dB re 1 microPa^2-s

These criteria are based on a 20 dB increase in SEL over that required for onset-TTS. Extrapolations from terrestrial mammal data indicate that PTS occurs at 40 dB or more of TS, and that TS growth occurs at a rate of approximately 1.6 dB TS per dB increase in EL. There is a 34-dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). Therefore, an animal would require approximately 20-dB of additional exposure (34 dB divided by 1.6 dB) above onset-TTS to reach PTS. A detailed description of how TTS criteria were derived from the results of the above studies may be found in Chapter 3 of Southall *et al.* (2007), as well as the Navy's Keyport Range Complex LOA application. Southall *et al.* (2007) recommend a precautionary dual criteria for TTS (230 dB re 1 microPa (SPL) in addition to 215 re 1 microPa^2-s (SEL)) to account for the potentially damaging transients embedded within non-pulse exposures. However, in the case of HFAS/MFAS, the distance at which an animal would receive 215 (SEL) is farther from the source than the distance at which they would receive 230 (SPL) and therefore, it is not necessary to consider 230 dB.

We note here that behaviorally mediated injuries (such as those that have been hypothesized as the cause of some beaked whale strandings) could potentially occur in response to received levels lower than those believed to directly result in tissue damage. As mentioned previously, data to support a quantitative estimate of these potential effects (for which the exact mechanism is not known and in which factors other than received level may play a significant role) do not exist.

Level B Harassment Risk Function (Behavioral Harassment)

The first MMPA authorization for take of marine mammals incidental to tactical active sonar was issued in 2006 for Navy Rim of the Pacific training exercises in Hawaii. For that authorization, NMFS used 173 dB SEL as the criterion for the onset of behavioral harassment (Level B Harassment). This type of single number criterion is referred to as a step function, in which (in this example) all animals estimated to be exposed to received levels above 173 dB SEL would be predicted to be taken by Level B Harassment and all animals exposed to less than 173 dB SEL would not be taken by Level B Harassment. As mentioned previously, marine mammal behavioral responses to sound are highly variable and context specific (affected by differences in acoustic conditions; differences between species and populations; differences in gender, age, reproductive status, or social behavior; or the prior experience of the individuals), which does not support the use of a step function to estimate behavioral harassment.

Unlike step functions, acoustic risk continuum functions (which are also called ''exposure-response functions,'' ''dose-response functions,'' or ''stress response functions'' in other risk assessment contexts) allow for probability of a response that NMFS would classify as harassment to occur over a range of possible received levels (instead of one number) and assume that the probability of a response depends first on the ''dose'' (in this case, the received level of sound) and that the probability of a response increases as the ''dose'' increases. The Navy and NMFS have previously used acoustic risk functions to estimate the probable responses of marine mammals to acoustic exposures in the Navy FEISs on SURTASS LFA sonar (DoN, 2001c) and the North Pacific Acoustic Laboratory experiments conducted off the Island of Kauai (ONR, 2001). The specific risk functions used here were also used in the MMPA regulations and FEIS for Hawaii Range Complex (HRC), Southern California Range Complex (SOCAL), Atlantic Fleet Active Sonar Testing (AFAST), and the Naval Surface Warfare Center Panama City Division (NSWC PCD) mission activities. As discussed in the Effects section, factors other than received level (such as distance from or bearing to the sound source) can affect the way that marine mammals respond; however, data to support a quantitative analysis of those (and other factors) do not currently exist. NMFS will continue to modify these criteria as new data become available.

The methodology described below is based on surface ship acoustic sources. The NAVSEA NUWC Keyport Range does not utilize these sources in RDT&E activities. It should be noted though, that the sources methodology described below is utilized for the modeling of potential exposures to mid- and high-frequency active sonar.

To assess the potential effects on marine mammals associated with active sonar used during training activity the Navy and NMFS applied a risk function that estimates the probability of behavioral responses that NMFS would classify as harassment for the purposes of the MMPA given exposure to specific received levels of MFA sonar. The mathematical function is derived from a solution in Feller (1968) as defined in the SURTASS LFA Sonar Final OEIS/EIS (DoN, 2001), and relied on in the Supplemental SURTASS LFA Sonar EIS (DoN, 2007a), for the probability of MFA sonar risk for Level B behavioral harassment with input parameters modified by NMFS for MFA sonar for mysticetes and odontocetes (NMFS, 2008). The same risk function and input parameters will be applied to high frequency active (HFA) (<10 kHz) sources until applicable data become available for high frequency sources.

In order to represent a probability of risk, the function should have a value near zero at very low exposures, and a value near one for very high exposures. One class of functions that satisfies this criterion is cumulative probability distributions, a type of cumulative distribution function. In selecting a particular functional expression for risk, several criteria were identified:

- The function must use parameters to focus discussion on areas of uncertainty;
- The function should contain a limited number of parameters;
- The function should be capable of accurately fitting experimental data; and
- The function should be reasonably convenient for algebraic manipulations.

As described in U.S. Department of the Navy (2001), the mathematical function below is adapted from a solution in Feller (1968).

$$R = \frac{1-\left(\frac{L-B}{K}\right)^{-A}}{1-\left(\frac{L-B}{K}\right)^{-2A}}$$

Where:

R = Risk (0–1.0)
L = Received level (dB re: 1 µPa)
B = Basement received level = 120 dB re: 1 µPa
K = Received level increment above B where 50 percent risk = 45 dB re: 1 µPa
A = Risk transition sharpness parameter = 10 (odontocetes) or 8 (mysticetes)

In order to use this function to estimate the percentage of an exposed population that would respond in a manner that NMFS classifies as Level B harassment, based on a given received level, the values for B, K and A need to be identified.

B Parameter (Basement)—The B parameter is the estimated received level below which the probability of disruption of natural behavioral patterns, such as migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered approaches zero for the HFAS/MFAS risk assessment. At this received level, the curve would predict that the percentage of the exposed population that would be taken by Level B Harassment approaches zero. For HFAS/MFAS, NMFS has determined that B = 120 dB re 1 µPa (SPL). This level is based on a broad overview of the levels at which many species have been reported responding to a variety of sound sources.

K Parameter (Representing the 50-Percent Risk Point)—The K parameter is based on the received level that corresponds to 50 percent risk, or the received level at which we believe 50 percent of the animals exposed to the designated received level will respond in a manner that NMFS classifies as Level B Harassment. The K parameter (K = 45 dB) is based on three datasets in which marine mammals exposed to mid-frequency sound sources were reported to respond in a manner that NMFS would classify as Level B Harassment. There is widespread consensus that marine mammal responses to HFA/MFA sound signals need to be better defined using controlled exposure experiments (Cox *et al.,* 2006; Southall *et al.,* 2007). The Navy is contributing to an ongoing behavioral response study in the Bahamas that is expected to provide some initial information on beaked whales, the species identified as the most sensitive to MFAS. NMFS is leading this international effort with scientists from various academic institutions and research organizations to conduct studies on how marine mammals respond to underwater sound exposures. Until additional data are available, however, NMFS and the Navy have determined that the following three data sets are most applicable for direct use in establishing the K parameter for the HFAS/MFAS risk function. These data sets, summarized below, represent the only known data that specifically relate altered behavioral responses (that NMFS would consider Level B Harassment) to exposure to HFAS/MFAS sources.

Even though these data are considered the most representative of the proposed specified activities, and therefore the most appropriate on which to base the K parameter (which basically determines the midpoint) of the risk function, these data have limitations, which are discussed in Appendix C of the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS.

1. Controlled Laboratory Experiments with Odontocetes (SSC Dataset)—Most of the observations of the behavioral responses of toothed whales resulted from a series of controlled experiments on bottlenose dolphins and beluga whales conducted by researchers at SSC's facility in San Diego, California (Finneran *et al.,* 2001, 2003, 2005; Finneran and Schlundt, 2004; Schlundt *et al.,* 2000). In experimental trials (designed to measure TTS) with marine mammals trained to perform tasks when prompted, scientists evaluated whether the marine mammals performed these tasks when exposed to mid-frequency tones. Altered behavior during experimental trials usually involved refusal of animals to return to the site of the sound stimulus, but also included attempts to avoid an exposure in progress, aggressive behavior, or refusal to further participate in tests.

Finneran and Schlundt (2004) examined behavioral observations recorded by the trainers or test coordinators during the Schlundt *et al.* (2000) and Finneran *et al.* (2001, 2003, 2005) experiments. These included observations from 193 exposure sessions (fatiguing stimulus level > 141 dB re 1microPa) conducted by Schlundt *et al.* (2000) and 21 exposure sessions conducted by Finneran et al. (2001, 2003, 2005). The TTS experiments that supported Finneran and Schlundt (2004) are further explained below:

- Schlundt *et al.* (2000) provided a detailed summary of the behavioral responses of trained marine mammals during TTS tests conducted at SSC San Diego with 1-sec tones and exposure frequencies of 0.4 kHz, 3 kHz, 10 kHz, 20 kHz and 75 kHz. Schlundt *et al.* (2000) reported eight individual TTS experiments. The experiments were conducted in San Diego Bay. Because of the variable ambient noise in the bay, low-level broadband masking noise was used to keep hearing thresholds consistent despite fluctuations in the ambient noise. Schlundt *et al.* (2000) reported that ''behavioral alterations,'' or deviations from the behaviors the animals being tested had been trained to exhibit, occurred as the animals were exposed to increasing fatiguing stimulus levels.
- Finneran *et al.* (2001, 2003, 2005) conducted two separate TTS experiments using 1-sec tones at 3 kHz. The test methods were similar to that of Schlundt *et al.* (2000) except the tests were conducted in a pool with very low ambient noise level (below 50 dB re 1 microPa^2/Hz), and no masking noise was used. In the first, fatiguing sound levels were increased from 160 to 201 dB SPL. In the second experiment, fatiguing sound levels between 180 and 200 dB SPL were randomly presented.

Bottlenose dolphins exposed to 1-sec intense tones exhibited short-term changes in behavior above received sound levels of 178 to 193 dB re 1 microPa (rms), and beluga whales did so at received levels of 180 to 196 dB and above.

2. Mysticete Field Study (Nowacek *et al.,* 2004)—The only available and applicable data relating mysticete responses to exposure to mid-frequency sound sources are from Nowacek *et al.* (2004). Nowacek *et al.* (2004) documented observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components in the Bay of Fundy. Investigators used archival digital acoustic recording tags (DTAG) to record the behavior (by measuring pitch, roll, heading, and depth) of right whales in the presence of an alert signal, and to calibrate received sound levels. The alert signal was 18 minutes of exposure consisting of three 2-minute signals played sequentially three times over. The three signals had a 60 percent duty cycle and consisted of: (1) Alternating 1-sec pure tones at 500 Hz and 850 Hz; (2) a 2-sec logarithmic down-sweep from 4,500 Hz to 500 Hz; and (3) a pair of low (1,500 Hz)-high (2,000 Hz) sine wave tones amplitude modulated at 120 Hz and each 1 sec long. The purposes of the

alert signal were (a) to pique the mammalian auditory system with disharmonic signals that cover the whales' estimated hearing range; (b) to maximize the signal to noise ratio (obtain the largest difference between background noise) and (c) to provide localization cues for the whale. The maximum source level used was 173 dB SPL.

Nowacek *et al.* (2004) reported that five out of six whales exposed to the alert signal with maximum received levels ranging from 133 to 148 dB re 1 microPa significantly altered their regular behavior and did so in identical fashion. Each of these five whales: (i) Abandoned their current foraging dive prematurely as evidenced by curtailing their 'bottom time'; (ii) executed a shallow-angled, high power (*i.e.*, significantly increased fluke stroke rate) ascent; (iii) remained at or near the surface for the duration of the exposure, an abnormally long surface interval; and (iv) spent significantly more time at subsurface depths (1–10 m) compared with normal surfacing periods, when whales normally stay within 1 m (1.1 yd) of the surface.

3. Odontocete Field Data (Haro Strait—USS SHOUP)—In May 2003, killer whales were observed exhibiting behavioral responses generally described as avoidance behavior while the U.S. Ship (USS) SHOUP was engaged in MFAS in the Haro Strait in the vicinity of Puget Sound, Washington. Those observations have been documented in three reports developed by Navy and NMFS (NMFS, 2005a; Fromm, 2004a, 2004b; DON, 2003). Although these observations were made in an uncontrolled environment, the sound field that may have been associated with the sonar operations was estimated using standard acoustic propagation models that were verified (for some but not all signals) based on calibrated in situ measurements from an independent researcher who recorded the sounds during the event. Behavioral observations were reported for the group of whales during the event by an experienced marine mammal biologist who happened to be on the water studying them at the time. The observations associated with the USS SHOUP provide the only data set available of the behavioral responses of wild, non-captive animals upon actual exposure to AN/SQS–53 sonar.

U.S. Department of Commerce (NMFS, 2005a); U.S. Department of the Navy (2004b); Fromm (2004a, 2004b) documented reconstruction of sound fields produced by USS SHOUP associated with the behavioral response of killer whales observed in Haro Strait. Observations from this reconstruction included an approximate closest approach time which was correlated to a reconstructed estimate of received level (which ranged from 150 to 180 dB) at an approximate whale location with a mean value of 169.3 dB SPL.

Calculation of K Parameter—NMFS and the Navy used the mean of the following values to define the midpoint of the function: (1) The mean of the lowest received levels (185.3 dB) at which individuals responded with altered behavior to 3 kHz tones in the SSC data set; (2) the estimated mean received level value of 169.3 dB produced by the reconstruction of the USS SHOUP incident in which killer whales exposed to MFA sonar (range modeled possible received levels: 150 to 180 dB); and (3) the mean of the 5 maximum received levels at which Nowacek *et al.* (2004) observed significantly altered responses of right whales to the alert stimuli than to the control (no input signal) is 139.2 dB SPL. The arithmetic mean of these three mean values is 165 dB SPL. The value of K is the difference between the value of B (120 dB SPL) and the 50 percent value of 165 dB SPL; therefore, K=45.

A Parameter (Steepness)—NMFS determined that a steepness parameter (A)=10 is appropriate for odontocetes (except harbor porpoises) and pinnipeds and A=8 is appropriate for mysticetes.

The use of a steepness parameter of A=10 for odontocetes (except harbor porpoises) for the HFAS/MFAS risk function was based on the use of the same value for the SURTASS LFA risk continuum, which was supported by a sensitivity analysis of the parameter presented in Appendix D of the SURTASS/LFA FEIS (DoN, 2001c). As concluded in the SURTASS FEIS/EIS, the value of A=10 produces a curve that has a more gradual transition than the curves developed by the analyses of migratory gray whale studies (Malme *et al.,* 1984; Buck and Tyack, 2000; and SURTASS LFA Sonar EIS, Subchapters 1.43, 4.2.4.3 and Appendix D, and NMFS, 2008).

NMFS determined that a lower steepness parameter (A=8), resulting in a shallower curve, was appropriate for use with mysticetes and HFAS/MFAS. The Nowacek *et al.* (2004) dataset contains the only data illustrating mysticete behavioral responses to a mid-frequency sound source. A shallower curve (achieved by using A=8) better reflects the risk of behavioral response at the relatively low received levels at which behavioral responses of right whales were reported in the Nowacek *et al.* (2004) data. Compared to the odontocete curve, this adjustment results in an increase in the proportion of the exposed population of mysticetes being classified as behaviorally harassed at lower RLs, such as those reported here and is supported by the only dataset currently available.

Basic Application of the Risk Function—The risk function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors that would qualify as harassment (as that term is defined by the MMPA applicable to military readiness activities, such as the Navy's testing and research activities with HFA/MFA sonar) at a given received level of sound. For example, at 165 dB SPL (dB re 1 Pa rms), the risk (or probability) of harassment is defined according to this function as 50 percent, and Navy/NMFS applies that by estimating that 50 percent of the individuals exposed at that received level are likely to respond by exhibiting behavior that NMFS would classify as behavioral harassment. The risk function is not applied to individual animals, only to exposed populations.

The data primarily used to produce the risk function (the K parameter) were compiled from four species that had been exposed to sound sources in a variety of different circumstances. As a result, the risk function represents a general relationship between acoustic exposures and behavioral responses that is then applied to specific circumstances. That is, the risk function represents a relationship that is deemed to be generally true, based on the limited, best-available science, but may not be true in specific circumstances. In particular, the risk function, as currently derived, treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, we know that many other variables—the marine mammal's gender, age, and prior experience, the activity it is engaged in during an exposure event, its distance from a sound source, the number of sound sources, and whether the sound sources are approaching or moving away from the animal—can be critically important in determining whether and how a marine mammal will respond to a sound source (Southall *et al.,* 2007). The data that are currently available do not allow for incorporation of these other variables in the current risk functions; however, the risk function represents the best use of the data that are available (Figure 1).

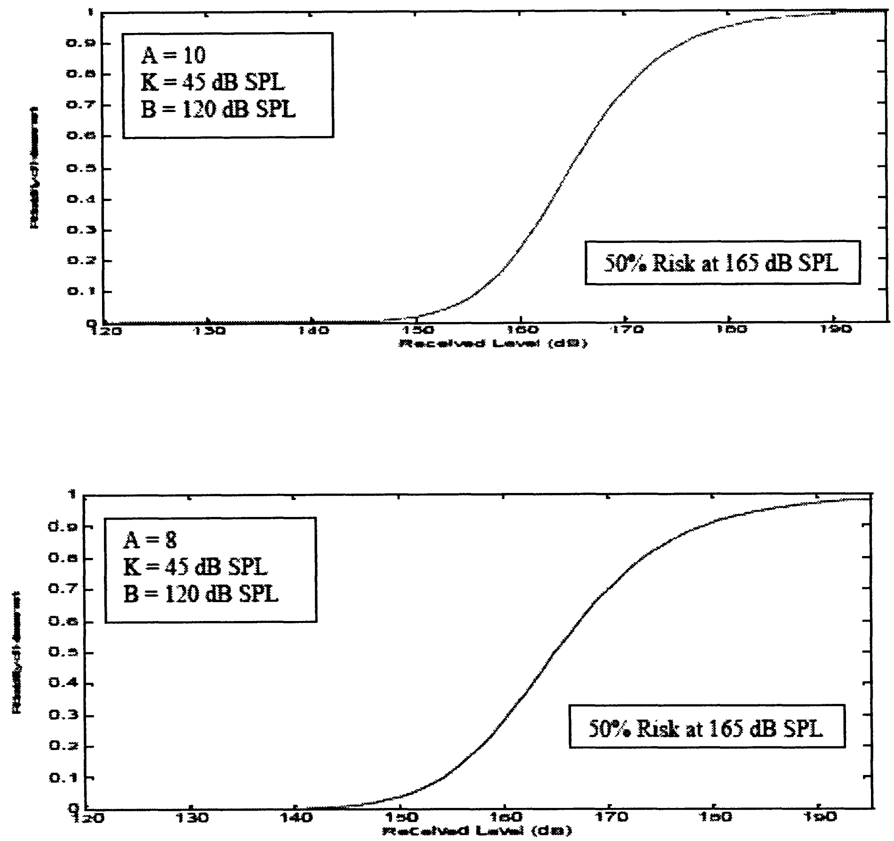

Figure 1. Risk Functions for Odontocetes (above) and Mysticetes (below).

As more specific and applicable data become available for HFAS/MFAS sources, NMFS can use these data to modify the outputs generated by the risk function to make them more realistic. Ultimately, data may exist to justify the use of additional, alternate, or multivariate functions. For example, as mentioned previously, the distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok *et al.,* 2003).

Specific Consideration for Harbor Porpoises

The information currently available regarding these inshore species that inhabit shallow and coastal waters suggests a very low threshold level of response for both captive and wild animals. Threshold levels at which both captive (*e.g.,* Kastelein *et al.,* 2000; 2005a; 2006) and wild harbor porpoises (*e.g.,* Johnston, 2002) responded to sound (*e.g.,* acoustic harassment devices (ADHs), acoustic deterrent devices (ADDs), or other non-pulsed sound sources) is very low (*e.g.,* ~120 dB SPL), although the biological significance of the disturbance is uncertain. Therefore, the risk function curve as presented is not used. Instead, a step function threshold of 120 dB SPL is used to estimate take of harbor porpoises (*i.e.,* assumes that all harbor porpoises exposed to 120 dB or higher MFAS/HFAS will respond in a way NMFS considers behavioral harassment).

Modeling Acoustic Effects

The methodology for analyzing potential impacts from mid- and high-frequency acoustic sources is presented in this section, which defines the model process in detail, describes how the impact threshold derived from Navy-NMFS consultations are derived, and discusses relative potential impact based on species biology.

Modeling methods applied herein were originally developed for mid-frequency (1–10 kHz) active (MFA) sonars (*e.g.,* surface-ship hull-mounted sonars, which are not used in the NAVSEA NUWC Keyport Range Complex). Nevertheless, the methods and thresholds are agreed upon by the U.S. Navy and NMFS as the best available science with which to determine the extent of physiological or behavioral effects on marine mammals that would result from the use of mid-frequency active (MFA) and high frequency active (HFA) acoustic sources for this proposed action. Detailed descriptions of the modeling process and results are provided in LOA Application.

The Navy acoustic exposure model process uses a number of inter-related software tools to assess potential exposure of marine mammals to Navy generated underwater sound. For sonar, these tools estimate potential impact volumes and areas over a range of thresholds for sonar specific operating modes. Results are based upon extensive pre-computations over the range of acoustic environments that might be encountered in the operating area.

The process includes four steps used to calculate potential exposures:

• Identify unique acoustic environments that encompass the operating area. Parameters include depth and seafloor geography, bottom characteristics and sediment type, wind and surface roughness, sound velocity profile, surface duct, sound channel, and convergence zones.

• Compute transmission loss (TL) data appropriate for each sensor type in each of these acoustic environments.

Propagation can be complex depending on a number of environmental parameters listed in step one, as well as sonar operating parameters such as directivity, source level, ping rate, and ping length. The Navy standard CASS–GRAB acoustic propagation model is used to resolve these complexities for underwater propagation prediction.

- Use that TL to estimate the total sound energy received at each point in the acoustic environment.
- Apply this energy to predicted animal density for that area to estimate potential acoustic exposure, with animals distributed in 3–D based on best available science on animal dive profiles.

The primary potential impact to marine mammals from underwater acoustics is Level B harassment from noise. A certain proportion of marine mammals are expected to experience behavioral disturbance at different received sound pressure levels and are counted as Level B harassment exposures. A detailed discussion of the modeling is provided in the Navy's LOA application.

Step 1. Acoustic Sources

For modeling purposes, acoustic source parameters were based on records from previous RDT&E activities, to reflect the underwater sound use expected to occur during activities in the NAVSEA NUWC Keyport Range Complex. The actual acoustic source parameters in many cases are classified, however, modeling used to calculate exposures to marine mammals employed actual and preferred parameters which have in the past been used during RDT&E activities in the NAVSEA NUWC Keyport Range Complex.

Every use of underwater acoustic energy includes the potential to harass marine animals in the vicinity of the source. The number of animals exposed to potential harassment in any such action is dictated by the propagation field and the manner in which the acoustic source is operated (*i.e.,* source level, depth, frequency, pulse length, directivity, platform speed, repetition rate). A wide variety of systems/equipment that utilize narrowband acoustic sources are employed at the NAVSEA NUWC Keyport Range Complex. Eight have been selected as representative of the types of operating in this range and are described in Table 8. Take estimates for these sources are calculated and reported on a per-run basis.

TABLE 8—MID- AND HIGH-FREQUENCY ACOUSTIC SOURCES EMPLOYED IN THE KEYPORT RANGE COMPLEX

Source designation	Acoustic source description	Frequency class	Takes reported
S1	Sub-bottom profiler	Mid-frequency	Per 4-hour run.
S2	UUV source	High-frequency	Per 2-hour run.
S3	REMUS Modem	Mid-frequency	Per 2-hour run.
S4	REMUS–SAS–HF	High-frequency	Per 2-hour run.
S5	Range Target	Mid-frequency	Per 20-minute run.
S6	Test Vehicle 1	High-frequency	Per 10-minute run.
S7	Test Vehicle 2	High-frequency	Per 10-minute run.
S8	Test Vehicle 3	High-frequency	Per 10-minute run.

The acoustic modeling that is necessary to support the take estimates for each of these sources relies upon a generalized description of the manner of the operating modes. This description includes the following:

- ''Effective'' energy source level—The total energy across the band of the source, scaled by the pulse length (10 log10 [pulse length]).
- Source depth—Depth of the source in meters. Each source was modeled in the middle of the water column.
- Nominal frequency—Typically the center band of the source emission. These are frequencies that have been reported in open literature and are used to avoid classification issues. Differences between these nominal values and actual source frequencies are small enough to be of little consequence to the output impact volumes.
- Source directivity—The source beam is modeled as the product of a horizontal beam pattern and a vertical beam pattern. Two parameters define the horizontal beam pattern:
- Horizontal beam width—Width of the source beam (degrees) in the horizontal plane (assumed constant for all horizontal steer directions).
- Horizontal steer direction—Direction in the horizontal in which the beam is steered relative to the direction in which the platform is heading.

The horizontal beam has constant response across the width of the beam and with flat, 20-dB down sidelobes. (Note that steer directions φ, −φ, 180o − φ, and 180o + φ all produce equal impact volumes.)

Similarly, two parameters define the vertical beam pattern:

- Vertical beam width—Width of the source beam (degrees) in the vertical plane measured at the 3-dB down point. (The width is that of the beam steered towards broadside and not the width of the beam at the specified vertical steer direction.)
- Vertical steer direction—Direction in the vertical plane that the beam is steered relative to the horizontal (upward looking angles are positive).

To avoid sharp transitions that a rectangular beam might introduce, the power response at vertical angle θ is

$$\max\left\{\frac{\sin 2\lfloor n(\theta_s-\theta)\rfloor}{\left[n\sin(\theta_s-\theta)\right]^2}, 0.01\right\}$$

where n = 180°/θ_w is the number of half-wavelength-spaced elements in a line array that produces a main lobe with a beam width of θ_w. θ_s is the vertical beam steer direction.

Ping spacing—Distance between pings. For most sources this is generally just the product of the speed of advance of the platform and the repetition rate of the source. Animal motion is generally of no consequence as long as the source motion is greater than the speed of the animal (nominally, three knots). For stationary (or nearly stationary) sources, the ''average'' speed of the animal is used in place of the platform speed. The attendant assumption is that the animals are all moving in the same constant direction.

These parameters are defined for each of the acoustic sources in the following Table 9.

TABLE 9—DESCRIPTION OF NAVSEA NUWC KEYPORT RANGE COMPLEX SOURCES

Acoustic source description	Center frequency	Source level	Emission spacing	Vertical directivity horizontal	Horizontal directivity horizontal
Sub-bottom profiler	4.5 kHz	207 dB	0.2 m	20 deg	20 deg.
UUV source	15 kHz	205 dB	1.9 m	30 deg	50 deg.
REMUS Modem	10 kHz	186 dB	45 m	60 deg	360 deg.
REMUS–SAS–HF	150 kHz	220 dB	1.9 m	9 deg	15 deg.
Range Target	5 kHz	233 dB	93 m	60 deg	360 deg.
Test Vehicle 1	20 kHz	233 dB	45 m	20 deg	60 deg.
Test Vehicle 2	25 kHz	230 dB	540 m	20 deg	60 deg.
Test Vehicle 3	30 kHz	233 dB	617 m	20 deg	60 deg.

Step 2. Environmental Provinces

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. Propagation loss as a function of range responds to a number of environmental parameters:

- Water depth
- Sound speed variability throughout the water column
- Bottom geo-acoustic properties, and
- Wind speed

Due to the importance that propagation loss plays in modeling effects, the Navy has over the last four to five decades invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases of these environmental parameters, most of which are accepted as standards for all Navy modeling efforts.

- Water depth—Digital Bathymetry Data Base Variable Resolution (DBDBV)
- Sound speed—Generalized Digital Environmental Model (GDEM)
- Bottom loss—Low-Frequency Bottom Loss (LFBL), Sediment Thickness Database, and High-Frequency Bottom Loss (HFBL), and
- Wind speed—U.S. Navy Marine Climatic Atlas of the World

Representative environmental parameters are selected for each of the three operating areas: DBRC, Keyport, and Quinault. Sources of local environmental-acoustic properties were supplemented with Navy Standard OAML data to determine model inputs for bathymetry, sound-speed, and sediment properties.

The DBRC and Keyport ranges are located inland with limited water-depth variability: The maximum water depth in Dabob Bay is approximately 200 meters; the maximum in the Keyport range is approximately 30 meters (98 feet). The Quinault range, on the other hand, is located seaward of the Washington State Coast to depths greater than a kilometer.

Sound speed profiles for winter and summer from the OAML open-ocean database are presented in Figure 6–10 of the Navy's LOA application. The winter profile is a classic half-channel (sound speed monotonically increasing with depth). The summer profile consists of a shallow surface duct over a modest thermocline. Individual profiles taken from World Ocean Data Base (NODC, 2005) for DBRC and Keyport are generally consistent with these open-ocean profiles. Some of these profiles exhibit some effects of additional fresh water near the surface; others have a little warmer surface layer than this summer profile. However, the truncated deep-water profiles are adequately representative of the inland ranges.

The bottom type in the Quinault range varies consistently with water depth. The shallower depths (less than 500 meters) tend to have sandy bottoms (HFBL class = 2); the deeper depths tend to be silt (HFBL class = 8).

The sediment type of the DBRC and Keyport areas that we used for our modeling were different from those found in the Low Frequency Bottom Loss (LFBL) database or implied by the High-Frequency Bottom Loss (HFBL) database. Although the water depth of these areas can be greater that 50 m, the LFBL database assigned them the default ''coarse sand'' sediment type that was assigned to areas with water depth less than 50 m (Vidmar, 1994). Core data from these areas were collected as part of environmental monitoring (Llanso, 1998). Cores 14 and 15 from the northern parts of the DBRC area indicated sediments with sands and silty sands. A silty sand sediment type was assigned to these areas (HFBL class = 2). Core 304R from the southern part of the DBRC area indicated sediments with clay. A clay-silt sediment type (HFBL class = 4) was assigned to this area taking into account the transition from the more sandy northern area to the clay of the southern area. These assignments are consistent with the observation (Helton, 1976) that the boundary area between the northern and southern areas had sediments that were mostly mud with a small amount of sand. The Keyport area did not have any cores in the study area but had three cores surrounding the area: Core 308R to the northwest indicated sand sediment; core 69 to the northeast indicated sand and silty sand sediments; and core 34 to the south indicated clay sediment. Given the surrounding cores we assigned a sand-silt-clay sediment type to this area (HFBL class = 4).

The Keyport range has a proposed extension to the east and south of the existing boundaries. In addition to the existing DBRC boundary, there is one extension to the south and another extension to the south and the north. The Quinault range is extended into a much larger deep-water region coincident with W–237A with a surf zone at Pacific Beach.

Step 3. Impact Volumes and Impact Ranges

Many naval actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. Given fixed harassment metrics and thresholds, the number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

The expected impact volume associated with a particular activity is defined as the expected volume of water in which some acoustic metric exceeds a specified threshold. The product of this volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. There are two acoustic metrics for mid- and high-frequency acoustic sources effects: An energy term (energy flux density) or a pressure term (peak pressure). The thresholds associated with each of these metrics define the levels at which the animals exposed will experience some degree of harassment (ranging from behavioral change to hearing loss).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range is defined as the maximum range at which a particular threshold is exceeded for a single source emission.

The two measures of potential harm to marine wildlife due to mid- and high-frequency acoustic sources operations are the accumulated (summed over all source emissions) energy flux density received by the animal over the duration of the activity, and the peak pressure (loudest sound received) by the animal over the duration of the activity.

Regardless of the type of source, estimating the number of animals that may be harassed in a particular environment entails the following steps.

- Each source emission is modeled according to the particular operating mode of that source. The ''effective'' energy source level is computed by integrating over the bandwidth of the source, and scaling by the pulse length. The location of the source at the time of each emission must also be specified.
- For the relevant environmental acoustic parameters, Transmission Loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL data are sampled at the typical depth(s) of the source and at the nominal center frequency of the source.
- The accumulated energy and maximum sound pressure level (SPL) are sampled over a volumetric grid within the waters surrounding a source action. At each grid point, the received signal from each source emission is modeled as the source level reduced by the appropriate propagation loss from the location of the source at the time of each emission to that grid point. The maximum SPL field is calculated by taking the maximum level of the received signal over all emissions, and the energy field is calculated by summing the energy of the signal over all emissions, and adjusting for pulse length.
- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point for which the appropriate metric exceeds that threshold. For maximum SPL, calculation of the expected volume represented by each grid point depends on the maximum SPL at that point, and requires an extra step to apply the risk function.

Finally, the number of takes is estimated as the product (scalar or vector, depending upon whether an animal density depth distribution is available) of the impact volume and the animal densities.

(4) Computing Impact Volumes for Active Sonars

The computation for impact volumes of active acoustic sources uses the following steps:

- Identification of the underwater propagation model used to compute transmission loss data, a listing of the source-related inputs to that model, and a description of the output parameters that are passed to the energy accumulation algorithm.
- Definitions of the parameters describing each acoustic source type.
- Description of the algorithms and sampling rates associated with the energy accumulation algorithm.

A detailed discussion of computing methodologies is provided in the Navy's LOA application.

Estimated Takes of Marine Mammals

When analyzing the results of the acoustic exposure modeling to provide an estimate of effects, it is important to understand that there are limitations to the ecological data used in the model, and that the model results must be interpreted within the context of a given species' ecology. When reviewing the acoustic effects modeling results, it is also important to understand there have been no confirmed acoustic effects on any marine species in previous NAVSEA NUWC Keyport Range Complex exercises or from any other mid- and high-frequency active sonar RDT&E activities within the NAVSEA NUWC Keyport Range Complex.

The annual estimated number of exposures from acoustic sources are given for each species. The modeled exposure is the probability of a response that NMFS would classify as harassment under the MMPA. These exposures are calculated for all activities modeled and represent the total exposures per year and are not based on a per day basis.

Range Operating Policies and Procedures (ROP) Description operating policies and procedures, as described in NUWC Keyport Report 1509, *Range Operating Policies and Procedures Manual (ROP),* are followed for all NUWC Keyport range activities. NUWC Keyport would continue to implement the ROP policies and procedures within the NAVSEA NUWC Keyport Range Complex with implementation of the proposed range extension. The ROP is followed to protect the health and safety of the public and Navy personnel and equipment as well as to protect the marine environment. The policies and procedures address issues such as safety, development of approved run plans, range operation personnel responsibility, deficiency reporting, all facets of range activities, and the establishment of ''exclusion zones'' to ensure that there are no marine mammals within a prescribed area prior to the commencement of each in-water exercise within the NAVSEA NUWC Keyport Range Complex. All range operators are trained by NOAA in marine mammal identification, and active acoustic activities are suspended or delayed if whales, dolphins, or porpoises (cetaceans) are observed within range areas.

The modeling for acoustic sources using the risk function methodology predicts 15,130 annual acoustic exposures that result in Level B harassment and 2,026 annual exposures of pinnipeds that exceed the TTS threshold for Level B Harassment under these criteria. The model predicts 0 annual exposures that exceed the PTS threshold (Level A Harassment). The Navy is not requesting Level A harassment authorization for any marine mammal. The summary of modeled mid- and high-frequency acoustic source exposure harassment numbers by species are presented in Tables 9 through 12 and represent potential harassment after implementation of the ROP. Implementation of the ROP would result in a zero take with respect to all cetaceans except for the harbor porpoise.

Table 9. Estimated Annual MMPA Level B Exposures for Inland Water - Keyport Range Site

	TTS (Level B) Exposures	Risk Function Sub-TTS Behavioral Exposures
Harbor Seal	41	109
Total Level B Exposures (by criteria method)	41	109

Table 10. Estimated Annual MMPA Level B Exposures for Inland Water – DBRC Site

	TTS (Level B) Exposures	Risk Function Sub-TTS Behavioral Exposures
Killer whale	0	0
California sea lion	0	109
Harbor Seal	1,998	3,320
Total Level B Exposures (by criteria method)	1,998	3,429

Table 11. Estimated Annual MMPA Level B Exposures for Open Water – QUTR Site

	TTS (Level B) Exposures	Risk Function Sub-TTS Behavioral Exposures
Endangered & Threatened Species		
Blue whale	0	0
Fin whale	0	0
Humpback whale	0	0
Sei whale	0	0
Sperm whale	0	0
Killer whale	0	0
Steller sea lion	0	0
Non-ESA Listed Species		
Minke whale	0	0
Gray whale	0	0
Dwarf and pygmy sperm whale	0	0
Baird's beaked whale	0	0
Mesoplodons	0	0
Risso's dolphin	0	0
Pacific white-sided dolphin	0	0
Short-beaked common dolphin	0	0
Striped dolphin	0	0
Northern right whale dolphin	0	0
Dall's porpoise	0	0
Harbor porpoise*	0	11,282
Northern fur seal	0	44
California sea lion	0	5
Northern elephant seal	0	14
Harbor seal	23	78
Total Level B Exposures (by criteria method)	23	11,423

* For harbor porpoises, the model results represent the step function criteria where 100% of the population exposed to 120 dB SPL are listed. This is not a risk function calculation.

Table 12. Combined Estimated Annual MMPA Level B Exposures (TTS and Behavior) for Proposed Annual RDT&E Activities Operations at All Sites after Implementation of Proposed Mitigation Measures

	TTS (Level B) Exposures	Risk Function Sub-TTS Behavioral Exposures
Endangered & Threatened Species		
Blue whale	0	0
Fin whale	0	0
Humpback whale	0	0
Sei whale	0	0
Sperm whale	0	0
Killer whale	0	0
Steller sea lion	0	0
Non-ESA Listed Species		
Minke whale	0	0
Gray whale	0	0
Dwarf and pygmy sperm whale	0	0
Baird's beaked whale	0	0
Mesoplodons	0	0
Risso's dolphin	0	0
Pacific white-sided dolphin	0	0
Short-beaked common dolphin	0	0
Striped dolphin	0	0
Northern right whale dolphin	0	0
Dall's porpoise	0	0
Harbor porpoise*	1	11,282
Northern fur seal	0	44
California sea lion	0	114
Northern elephant seal	0	14
Harbor seal	2,062	3,507
Total Level B Exposures (by criteria method)	2,063	14,961

* For harbor porpoises, the model results represent the step function criteria where 100% of the population exposed to 120 dB SPL are listed. This is not a risk function calculation.

It is highly unlikely that a marine mammal would experience any long-term effects because the large NAVSEA NUWC Keyport Range Complex test areas make individual mammals' repeated and/or prolonged exposures to high-level sonar signals unlikely. Specifically, mid- and high-frequency acoustic sources have limited marine mammal exposure ranges and relatively high platform speeds. Moreover, there are no exposures that exceed the PTS threshold and result in Level A harassment from sonar and other active acoustic sources. Therefore, long-term effects on individuals, populations or stocks are unlikely.

When analyzing the results of the acoustic exposure modeling to provide an estimate of effects, it is important to understand that there are limitations to the ecological data (diving behavior, migration or movement patterns and population dynamics) used in the model, and that the model results must be interpreted within the context of a given species' ecology.

When reviewing the acoustic exposure modeling results, it is also important to understand that the estimates of marine mammal sound exposures are presented with consideration of standard protective measure operating procedures. The ROP along with monitoring and mitigation measures for the Keyport Range Complex RDT&E activities, including detection of marine mammals, protective measures such as stand off distances and delaying or halting activities, and power down procedures if marine mammals are detected within one of the exclusion zones, are provided below.

Because of the time delay between pings, an animal encountering the sonar will accumulate energy for only a few sonar pings over the course of a few minutes. Therefore, exposure to sonar would be a short-term event, minimizing any single animal's exposure to sound levels approaching the harassment thresholds.

Effects on Marine Mammal Habitat

The proposed extended area for the Keyport Range Site is also critical habitat of the Southern Resident killer whales. The current Keyport Range Site is outside the critical habitat area. There are no other areas within the Keyport Range Complex with extensions that are specifically considered as important physical habitat for marine mammals.

The prey of marine mammals are considered part of their habitat. The Navy's DEIS for the Keyport Range Complex RDT&E and range extension activities contain a detailed discussion of the potential effects to fish from active acoustic sources. Below is a summary of conclusions regarding those effects.

Effects on Fish From Active Acoustic Sources

The extent of data, and particularly scientifically peer-reviewed data, on the effects of high intensity sounds on fish is limited. In considering the available literature, the vast majority of fish species studied to date are hearing generalists and cannot hear sounds above 500 to 1,500 Hz (depending upon the species), and, therefore, behavioral effects on these species from higher frequency sounds are not likely. Moreover, even those fish species that may hear above 1.5 kHz, such as a few sciaenids and the clupeids (and relatives), have relatively poor hearing above 1.5 kHz as compared to their hearing sensitivity at lower frequencies. Therefore, even among the species that have hearing ranges that overlap with some mid- and high-frequency sounds, it is likely that the fish will only actually hear the sounds if the fish and source are very close to one another. Finally, since the vast majority of sounds that are of biological relevance to fish are below 1 kHz (*e.g.,* Zelick *et al.,* 1999; Ladich and Popper, 2004), even if a fish detects a mid- or high-frequency sound, these sounds will not mask detection of lower frequency biologically relevant sounds. Based on the above information, there will likely be few, if any, behavioral impacts on fish.

Alternatively, it is possible that very intense mid- and high frequency signals could have a physical impact on fish, resulting in damage to the swim bladder and other organ systems. However, even these kinds of effects have only been shown in a few cases when the fish has been very close to the source. Such effects have never been indicated in response to any Navy sonar. Moreover, at greater distances (the distance clearly would depend on the intensity of the signal from the source) there appears to be little or no impact on fish, and particularly no impact on fish that do not have a swim bladder or other air bubble that would be affected by rapid pressure changes.

Proposed Mitigation Measures

In order to issue an incidental take authorization (ITA) under Section 101(a)(5)(A) of the MMPA, NMFS must set forth the ''permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.'' The National Defense Authorization Act (NDAA) of 2004 amended the MMPA as it relates to military-readiness activities and the incidental take authorization process such that ''least practicable adverse impact'' shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the ''military readiness activity.''

In addition, any mitigation measure prescribed by NMFS should be known to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(a) Avoidance or minimization of injury or death of marine mammals wherever possible (goals b, c, and d may contribute to this goal).

(b) A reduction in the numbers of marine mammals (total number or number at a biologically important time or location) exposed to received levels underwater active acoustic sources or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(c) A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of underwater active acoustic sources or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(d) A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of underwater active acoustic sources expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing the severity of harassment takes only).

(e) A reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

(f) For monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS worked with the Navy and identified potential practicable and effective mitigation measures, which included a careful balancing of the likely benefit of any particular measure to the marine mammals with the likely effect of that measure on personnel safety, practicality of implementation, and impact on the military readiness activity. These mitigation measures are listed below.

Proposed Mitigation Measures for Active Acoustic Sources, Surface Operations and Other Activities

Current protective measures known as the ROP employed by the NAVSEA NUWC Keyport include applicable training of personnel and implementation of activity specific procedures resulting in minimization and/or avoidance of interactions with protected resources and are provided below.

(1) Range activities shall be conducted in such a way as to ensure marine mammals are not harassed or harmed by human-caused events.

(2) Marine mammal observers are on board ship during range activities. All range personnel shall be trained in marine mammal recognition. Marine mammal observer training is normally conducted by qualified organizations such as NOAA/National Marine Mammal Lab (NMML) on an as needed basis.

(3) Vessels on a range use safety lookouts during all hours of range activities. Lookout duties include looking for any and all objects in the water, including marine mammals. These lookouts are not necessarily looking only for marine mammals. They have other duties while aboard. All sightings are reported to the Range Officer in charge of overseeing the activity.

(4) Visual surveillance shall be accomplished just prior to all in-water exercises. This surveillance shall ensure that no marine mammals are visible within the boundaries of the area within which the test unit is expected to be operating. Surveillance shall include, as a minimum, monitoring from all participating surface craft and, where available, adjacent shore sites.

(5) The Navy shall postpone activities until cetaceans (whales, dolphins, and porpoises) leave the project area. When cetaceans have been sighted in an area, all range participants increase vigilance and take reasonable and practicable actions to avoid collisions and activities that may result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (*e.g.,* safety, weather).

(6) An ''exclusion zone'' shall be established and surveillance will be conducted to ensure that there are no marine mammals within this exclusion zone prior to the commencement of each in-water exercise. For cetaceans (whales, dolphins, and porpoises), the exclusion zone must be at least as large as the entire area within which the test unit may operate, and must extend at least 1,000 yards (914.4 m) from the intended track of the test unit. For pinnipeds, the exclusion zone extends out 100 yards (91 m) from the intended track of the test unit.

(7) Range craft shall not approach within 100 yards (91 m) of marine mammals and shall be followed to the extent practicable considering human and vessel safety priorities. All Navy vessels and aircraft, including helicopters, are expected to comply with this directive. This includes marine mammals ''hauled-out'' on islands, rocks, and other areas such as buoys.

(8) Passive acoustic monitoring shall be utilized to detect marine mammals in the area before and during activities, especially when visibility is reduced.

(9) Procedures for reporting marine mammal sightings on the NAVSEA NUWC Keyport Range Complex shall be promulgated, and sightings shall be entered into the Range Operating System and forwarded to NOAA/NMML Platforms of Opportunity Program.

Research and Conservation Measures for Marine Mammals

The Navy provides a significant amount of funding and support for marine research. The Navy provided $26 million in Fiscal Year 2008 and plans for $22 million in Fiscal Year 2009 to universities, research institutions, Federal laboratories, private companies, and independent researchers around the world to study marine mammals. Over the past five years the Navy has funded over $100 million in marine mammal research. The U.S. Navy sponsors seventy percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas,
- Developing methods to detect and monitor marine species before and during training,
- Understanding the effects of sound on marine mammals, sea turtles, fish, and birds, and
- Developing tools to model and estimate potential effects of sound.

The Navy's Office of Naval Research currently coordinates six programs that examine the marine environment and are devoted solely to studying the effects of noise and/or the implementation of technology tools that will assist the Navy in studying and tracking marine mammals. The six programs are as follows:

- Environmental Consequences of Underwater Sound,
- Non-Auditory Biological Effects of Sound on Marine Mammals,
- Effects of Sound on the Marine Environment,
- Sensors and Models for Marine Environmental Monitoring,
- Effects of Sound on Hearing of Marine Animals, and
- Passive Acoustic Detection, Classification, and Tracking of Marine Mammals.

Furthermore, research cruises led by NMFS and by academic institutions have received funding from the Navy.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods on instrumented ranges. However, acoustic detection, identification, localization, and tracking of individual animals still requires a significant amount of research effort to be considered a reliable method for marine mammal monitoring. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential mitigation and monitoring tool.

Overall, the Navy will continue to fund ongoing marine mammal research, and is planning to coordinate long-term monitoring/studies of marine mammals on various established ranges and operating areas. The Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include mitigation and monitoring programs; data sharing with NMFS and via the literature for research and development efforts.

Long-Term Prospective Study

NMFS, with input and assistance from the Navy and several other agencies and entities, will perform a longitudinal observational study of marine mammal strandings to systematically observe for and record the types of pathologies and diseases and investigate the relationship with potential causal factors (*e.g.,* sonar, seismic, weather). The study will not be a true ''cohort'' study, because we will be unable to quantify or estimate specific sonar or other sound exposures for individual animals that strand. However, a cross-sectional or correlational analysis, a method of descriptive rather than analytical epidemiology, can be conducted to compare population characteristics, *e.g.,* frequency of strandings and types of specific pathologies between general periods of various anthropogenic activities and non-activities within a prescribed geographic space. In the long term study, we will more fully and consistently collect and analyze data on the demographics of strandings in specific locations and consider anthropogenic activities and physical, chemical, and biological environmental parameters. This approach in conjunction with true cohort studies (tagging animals, measuring received sounds, and evaluating behavior or injuries) in the presence of activities and non-activities will provide critical information needed to further define the impacts of MTEs and other anthropogenic and non-anthropogenic stressors. In coordination with the Navy and other federal and non-federal partners, the comparative study will be designed and conducted for specific sites during intervals of the presence of anthropogenic activities such as sonar transmission or other sound exposures and absence to evaluate demographics of morbidity and mortality, lesions found, and cause of death or stranding. Additional data that will be collected and analyzed in an effort to control potential confounding factors include variables such as average sea temperature (or just season), meteorological or other environmental variables (*e.g.,* seismic activity), fishing activities, etc. All efforts will be made to include appropriate controls (*i.e.,* no sonar or no seismic); environmental variables may complicate the interpretation of ''control'' measurements. The Navy and NMFS along with other partners are evaluating mechanisms for funding this study.

Proposed Monitoring Measures

In order to issue an incidental take authorization (ITA) for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking.'' The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for LOAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present.

Monitoring measures prescribed by NMFS should accomplish one or more of the following general goals:

(a) An increase in the probability of detecting marine mammals, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the analyses mentioned below.

(b) An increase in our understanding of how many marine mammals are likely to be exposed to levels of HFAS/MFAS (or other stimuli) that we associate with specific adverse effects, such as behavioral harassment, TTS, or PTS.

(c) An increase in our understanding of how marine mammals respond to HFAS/MFAS (at specific received levels) or other stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival) through any of the following methods:

- Behavioral observations in the presence of HFAS/MFAS compared to observations in the absence of sonar (need to be able to accurately predict received level and report bathymetric conditions, distance from source, and other pertinent information).
- Physiological measurements in the presence of HFAS/MFAS compared to observations in the absence of sonar (need to be able to accurately predict received level and report bathymetric conditions, distance from source, and other pertinent information), and/or
- Pre-planned and thorough investigation of stranding events that occur coincident to naval activities.
- Distribution and/or abundance comparisons in times or areas with concentrated HFAS/MFAS versus times or areas without HFAS/MFAS.

(d) An increased knowledge of the affected species.

(e) An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

With these goals in mind, the following monitoring procedures for the proposed Navy's NAVSEA NUWC Keyport Range Complex RDT&E and range extension activities have been worked out between NMFS and the Navy. Keyport will conduct two special surveys per year to monitor HFAS and MFAS respectively. This will occur at the DBRC Range site. This will include visual surveys composed of vessel, shore monitoring and passive acoustic monitoring. Marine mammal observers may be on range craft and/or on shore side. NMFS and the Navy continue to improve the plan and may modify the monitoring plan based on input received during the public comment period.

Several monitoring techniques were prescribed for other Navy activities related to sonar exercises (see monitoring plan for Navy's Hawaii Range Complex; Navy, 2008). Every known monitoring technique has advantages and disadvantages that vary temporally and spatially. Therefore, a combination of techniques is proposed to be used so that the detection and observation of marine animals is maximized. Monitoring methods proposed during mission activity events in the NAVSEA NUWC Keyport Range Complex Study Area include a combination of the following research elements that would be used to collect data for comprehensive assessment:

- Visual Surveys—Vessel, Shore-based, and Aerial (as applicable)
- Passive Acoustic Monitoring (PAM)
- Marine Mammal Observers (MMOs) on Range craft

Visual Surveys

Visual surveys of marine animals can provide detailed information about their behavior, distribution, and abundance. Baseline measurements and/or data for comparison can be obtained before, during and after mission activities. Changes in behavior and geographical distribution may be used to infer if and how animals are impacted by sound. In accordance with all safety considerations, observations will be maximized by working from all available platforms: vessels, aircraft, land and/or in combination. Shore-based (for inland waters), vessel and aerial (as applicable) surveys may be conducted from shore support, range craft, Navy vessels, or contracted vessels. Visual surveys will be conducted during NAVSEA NUWC Keyport range events which are identified as being able to provide the highest likelihood of success.

Vessel surveys are often preferred by researchers because of their slow speed, offshore survey ability, duration and ability to more closely approach animals under observation. They also result in higher rate of species identification, the opportunity to combine line transect and mark-recapture methods of estimating abundance, and collection of oceanographic and other relevant data. Vessels can be less expensive per unit of time, but because of the length of time to cover a given survey area, may actually be more expensive in the long run compared to aerial surveys (Dawson *et al.,* 2008). Changes in behavior and geographical distribution may be used to infer if and how animals are impacted by sound. However, it should be noted that animal reaction (reactive movement) to the survey vessel itself is possible (Dawson *et al.,* 2008). Vessel surveys typically do not allow for observation of animals below the ocean surface (*e.g.* in the water column) as compared to aerial surveys (DoN, 2008a; Slooten *et al.,* 2004).

NAVSEA NUWC Keyport will conduct two special surveys per year to monitor HFAS and MFAS respectively. This will occur at the DBRC Range site. The determination to monitor in the DBRC area includes the following reasoning: (1) It would provide the highest amount of activity; (2) it is a controlled environment; (3) permanently bottom mounted monitoring hydrophones are in place; (4) most likely environment to get accurate data; and (5) conducive to excellent shore side observation.

For specified events, shore-based and vessel surveys will be used 1 day prior to and 1–2 days post activity. The variation in the number of days after allows for the detection of animals that gradually return to an area, if they indeed do change their distribution in response to the associated events. DBRC is a small area and animals are likely to return more quickly than if the test were in open ocean.

Surveys will include the range site with special emphasis given to the particular path of the test run. Passive acoustic system (hydrophone or towed array) would be used to determine if marine mammals are in the area before and/or after the event. When conducting a particular survey, the survey team will collect: (1) Species identification and group size; (2) location and relative distance from the acoustic source(s); (3) the behavior of marine mammals, including standard environmental and oceanographic parameters; (4) date, time and visual conditions associated with each observation; (5) direction of travel relative to the active acoustic source; and (6) duration of the observation. Animal sightings and relative distance from a particular active acoustic source will be used post-survey to determine potential received energy (dB re 1 micro Pa-sec). This data will be used, post-survey, to estimate the number of marine mammals exposed to different received levels (energy based on distance to the source, bathymetry, oceanographic conditions and the type and power of the acoustic source) and their corresponding behavior.

Although photo-identification studies are not typically a component of Navy RDT&E activity monitoring surveys, the Navy supports using the contracted platforms to obtain opportunistic data collection. Therefore, absent classification issues any unclassified digital photographs, if taken, of marine mammals during visual surveys will be provided to local researchers for their regional research if requested.

1. Shore-Based Surveys

A large number of test events in the Keyport Range complex are conducted in inland waters allowing for excellent shore based surveillance opportunities. When practicable, for test events planned adjacent to nearshore areas, where there are elevated topography or coastal structures, shore-based visual survey methods will be implemented using binoculars or theodolite. These methods have been proven valuable in similar monitoring studies such as ATOC and others (Frankel and Clark, 1998; Clark and Altman, 2006).

2. Vessel Surveys

Keyport Range Complex activities conducted in the inland waters are supported both from the shore (described above) and from range craft. The primary purpose of surveys performed from these range craft will be to document and monitor potential behavioral effects of the mission activities on marine mammals. As such, parameters to be monitored for potential effects are changes in the occurrence, distribution, numbers, surface behavior, and/or disposition (injured or dead) of marine mammal species before, during and after the mission activities. Post-analysis will focus on how the location, speed and vector of the survey vessel and the location and direction of the sonar source (*e.g.,* Navy surface vessel) relates to the animal. Any other vessels or aircraft observed in the area will also be documented.

Passive Acoustic Monitoring

There are both benefits and limitations to passive acoustic monitoring (Mellinger *et al.,* 2007). Passive acoustic monitoring (PAM) allows detection of marine mammals that vocalize but may not be seen during a visual survey. When interpreting data collected from PAM, it is understood that species specific results must be viewed with caution because not all animals within a given population are calling, or may only be calling only under certain conditions (Mellinger, 2007; ONR, 2007). The Keyport Range Complex study area has advanced features which allow for passive acoustic monitoring. These hydrophones are both permanently bottom mounted, towed or over-the-side. Subject matter experts are available for detection and identification of species type.

Marine Mammal Observer on Navy Vessels

All Keyport Range Complex operators are trained by NOAA in marine mammal identification. Additional use of civilian biologists as Marine Mammal Observers (MMOs) aboard range craft and Navy vessels may be used to research the effectiveness of Navy marine observers, as well as for data collection during other monitoring surveys.

MMOs will be field-experienced observers who are Navy biologists or contracted observers. These civilian MMOs will be placed alongside existing Navy marine observers during a sub-set of Keyport Range Complex RDT&E activities. This can only be done on certain vessels and observers may be required to have security clearance. NUWC Keyport may also use MMOs on range craft during test events being monitored. MMOs will not be placed aboard Navy platforms for every Navy testing event, but during specifically identified opportunities deemed appropriate for data collection efforts. The events selected for MMO participation will take into account safety, logistics, and operational concerns. Use of MMOs will verify Navy marine observer sighting efficiency, offer an opportunity for more detailed species identification, provide an opportunity to bring animal protection awareness to the vessels' crew, and provide the opportunity for an experienced biologist to collect data on marine mammal behavior. Data collected by the MMOs is anticipated to assist the Navy with potential improvements to marine observer training as well as providing the marine observers with a chance to gain additional knowledge on marine mammals.

Events selected for MMO participation will be an appropriate fit in terms of security, safety, logistics, and compatibility with Keyport Range Complex RDT&E activities. The MMOs will not be part of the Navy's formal vessel reporting chain of command during their data collection efforts, and Navy marine observers will follow the appropriate chain of command in reporting marine mammal sightings. Exceptions will be made if an animal is observed by the MMO within the shutdown zone and was not seen by the Navy marine observer. The MMO will inform the Navy marine observer of the sighting so that appropriate action may be taken by the chain of command. For less biased data, it is recommended that MMOs schedule their daily observations to duplicate the Navy marine observers' schedule.

Civilian MMOs will be aboard Navy vessels involved in the study. As described earlier, MMOs will meet and adhere to necessary qualifications, security clearance, logistics and safety concerns. MMOs will monitor for marine mammals from the same height above water as the Navy marine observers and as all visual survey teams, they will collect the same data collected by Navy marine observers, including but not limited to: (1) Location of sighting; (2) species (if not possible, identification of whale or dolphin); (3) number of individuals; (4) number of calves present, if any; (5) duration of sighting; (6) behavior of marine animals sighted; (7) direction of travel; (8) environmental information associated with sighting event including Beaufort sea state, wave height, swell direction, wind direction, wind speed, glare, percentage of glare, percentage of cloud cover; and (9) when in relation to navy exercises did the sighting occur.

In addition, the Navy is developing an Integrated Comprehensive Monitoring Program (ICMP) for marine species to assess the effects of Keyport Range Complex RDT&E activities on marine species and investigate population trends in marine species distribution and abundance in locations where Keyport Range Complex RDT&E activities regularly occur. As part of the ICMP, knowledge gained from other Navy MMO monitored events will be incorporated into NUWC Keyport monitoring/mitigations as part of the adaptive management approach.

The ICMP will provide the overarching coordination that will support compilation of data from range-specific monitoring plans (*e.g.,* Keyport Range Complex plan) as well as Navy funded research and development (R&D) studies. The ICMP will coordinate the monitoring program's progress toward meeting its goals and develop a data management plan. The ICMP will be evaluated annually to provide a matrix for progress and goals for the following year, and will make recommendations on adaptive management for refinement and analysis of the monitoring methods.

The primary objectives of the ICMP are to:

- Monitor and assess the effects of Navy activities on protected species;
- Ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
- Assess the efficacy and practicality of the monitoring and mitigation techniques;

• Add to the overall knowledge-base of marine species and the effects of Navy activities on marine species.

The ICMP will be used both as: (1) A planning tool to focus Navy monitoring priorities (pursuant to ESA/MMPA requirements) across Navy Range Complexes and Exercises; and (2) an adaptive management tool, through the consolidation and analysis of the Navy's monitoring and watchstander data, as well as new information from other Navy programs (*e.g.*, R&D), and other appropriate newly published information.

In combination with the adaptive management component of the proposed NAVSEA NUWC Keyport Range Complex rule and the other planned Navy rules (*e.g.,* Atlantic Fleet Active Sonar Training, Hawaii Range Complex, and Southern California Range Complex), the ICMP could potentially provide a framework for restructuring the monitoring plans and allocating monitoring effort based on the value of particular specific monitoring proposals (in terms of the degree to which results would likely contribute to stated monitoring goals, as well as the likely technical success of the monitoring based on a review of past monitoring results) that have been developed through the ICMP framework, instead of allocating based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across Range complexes. For example, if careful prioritization and planning through the ICMP (which would include a review of both past monitoring results and current scientific developments) were to show that a large, intense monitoring effort would likely provide extensive, robust and much-needed data that could be used to understand the effects of sonar throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as ''high priority'' by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes. The ICMP will identify:

• A means by which NMFS and the Navy would jointly consider prior years' monitoring results and advancing science to determine if modifications are needed in mitigation or monitoring measures to better effect the goals laid out in the Mitigation and Monitoring sections of this proposed Keyport Range Complex rule.

• Guidelines for prioritizing monitoring projects

• If, as a result of the Navy-NMFS 2011 Monitoring Workshop and similar to the example described in the paragraph above, the Navy and NMFS decide it is appropriate to restructure the monitoring plans for multiple ranges such that they are no longer evenly allocated (by Range Complex), but rather focused on priority monitoring projects that are not necessarily tied to the geographic area addressed in the rule, the ICMP will be modified to include a very clear and unclassified recordkeeping system that will allow NMFS and the public to see how each Range Complex/project is contributing to all of the ongoing monitoring (resources, effort, money, etc.).

Adaptive Management

Our understanding of the effects of HFAS/MFAS on marine mammals is still in its relative infancy, and yet the science in this field is evolving fairly quickly. These circumstances make the inclusion of an adaptive management component both valuable and necessary within the context of 5-year regulations for activities that have been associated with marine mammal mortality in certain circumstances and locations (though not the Keyport Range Complex Study Area). The use of adaptive management will give NMFS the ability to consider new data from different sources to determine (in coordination with the Navy), on an annual basis, if new or modified mitigation or monitoring measures are appropriate for subsequent annual LOAs. Following are some of the possible sources of applicable data:

• Results from the Navy's monitoring from the previous year (either from the Keyport Range Complex Study Area or other locations).

• Results from specific stranding investigations (either from the Keyport Range Complex Study Area or other locations, and involving coincident Keyport Range Complex RDT&E or not involving coincident use).

• Results from the research activities associated with Navy's HFAS/MFAS.

• Results from general marine mammal and sound research (funded by the Navy or otherwise).

• Any information which reveals that marine mammals may have been taken in a manner, extent or number not authorized by these regulations and subsequent Letters of Authorization.

Mitigation measures could be modified or added if new data suggest that such modifications would have a reasonable likelihood of accomplishing the goals of mitigation laid out in this proposed rule and if the measures are practicable. NMFS would also coordinate with the Navy to modify or add to the existing monitoring requirements if the new data suggest that the addition of a particular measure would more effectively accomplish the goals of monitoring laid out in this proposed rule. The reporting requirements associated with this proposed rule are designed to provide NMFS with monitoring data from the previous year to allow NMFS to consider the data in issuing annual LOAs. NMFS and the Navy will meet annually prior to LOA issuance to discuss the monitoring reports, Navy R&D developments, and current science and whether mitigation or monitoring modifications are appropriate.

Reporting

In order to issue an ITA for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking.'' Effective reporting is critical both to monitoring compliance as well as ensuring that the most value is obtained from the required monitoring. Some of the reporting requirements are still in development and the final rule may contain additional details not contained in the proposed rule. Additionally, proposed reporting requirements may be modified, removed, or added based on information or comments received during the public comment period.

Notification of Injured or Dead Marine Mammals

Navy personnel will ensure through proper chain of command that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Keyport Range Complex RDT&E activities utilizing active acoustic sources. The Navy will provide NMFS with species or description of the animal (s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The Stranding Response Plan contains more specific reporting requirements for specific circumstances.

Annual Report

The Navy will submit its first annual report to the Office of Protected Resources, NMFS, no later than 120 days before the expiration of the LOA. These reports will, at a minimum, include the following information:

- The estimated number of hours of sonar and other operations involving active acoustic sources, broken down by source type.
- If possible, the total number of hours of observation effort (including observation time when sonar was not operating).
- A report of all marine mammal sightings (at any distance) to include, when possible and to the best of their ability, and if not classified:

—Species.
—Number of animals sighted.
—Location of marine mammal sighting.
—Distance of animal from any operating sonar sources.
—Whether animal is fore, aft, port, starboard.
—Direction animal is moving in relation to source (away, towards, parallel).
—Any observed behaviors of marine mammals.

- The status of any sonar sources (what sources were in use) and whether or not they were powered down or shut down as a result of the marine mammal observation.
- The platform that the marine mammals were sighted from.

Keyport Range Complex Comprehensive Report

The Navy will submit to NMFS a draft report that analyzes and summarizes all of the multi-year marine mammal information gathered during test activities involving active acoustic sources for which annual reports are required as described above. This report will be submitted at the end of the fourth year of the rule (anticipated to be December 2013), covering activities that have occurred through June 1, 2012. The Navy will respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

Analysis and Negligible Impact Determination

Pursuant to NMFS' regulations implementing the MMPA, an applicant is required to estimate the number of animals that will be ''taken'' by the specified activities (*i.e.*, takes by harassment only, or takes by harassment, injury, and/or death). This estimate informs the analysis that NMFS must perform to determine whether the activity will have a ''negligible impact'' on the species or stock. Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects. A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of Level B harassment takes alone is not enough information on which to base an impact determination.

In addition to considering estimates of the number of marine mammals that might be ''taken'' through behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature of estimated Level A takes, the number of estimated mortalities, and effects on habitat.

The Navy's specified activities have been described based on best estimates of the planned RDT&E activities the Navy would conduct within the proposed NAVSEA NUWC Keyport Range Complex Extension. The acoustic sources proposed to be used in the NAVSEA NUWC Keyport Range Complex Extension are low intensity and total proposed sonar operation hours are under 1,570 hours. Taking the above into account, along with the fact that NMFS anticipates no mortalities and injuries to result from the action, the fact that there are no specific areas of reproductive importance for marine mammals recognized within the Keyport Range Complex Extension study area, the sections discussed below, and dependent upon the implementation of the proposed mitigation measures, NMFS has determined that Navy RDT&E activities utilizing underwater acoustic sources will have a negligible impact on the affected marine mammal species and stocks present in the proposed action area.

Behavioral Harassment

As discussed in the Potential Effects of Exposure of Marine Mammals to HFAS/MFAS and illustrated in the conceptual framework, marine mammals can respond to HFAS/MFAS in many different ways, a subset of which qualifies as harassment. One thing that the take estimates do not take into account is the fact that most marine mammals will likely avoid strong sound sources to some extent. Although an animal that avoids the sound source will likely still be taken in some instances (such as if the avoidance results in a missed opportunity to feed, interruption of reproductive behaviors, etc.) in other cases avoidance may result in fewer instances of take than were estimated or in the takes resulting from exposure to a lower received level than was estimated, which could result in a less severe response. The Keyport Range Complex application involves mid-frequency and high frequency active sonar operations shown in Table 2, and none of the tests would involve powerful tactical sonar such as the 53C series MFAS. Therefore, any disturbance to marine mammals resulting from MFAS and HFAS in the proposed Keyport Range Complex RDT&E activities is expected to be significantly less in terms of severity when compared to major sonar exercises (*e.g.*, AFAST, HRC, SOCAL). In addition, high frequency signals tend to have more attenuation in the water column and are more prone to lose their energy during propagation. Therefore, their zones of influence are much smaller, thereby making it easier to detect marine mammals and prevent adverse effects from occurring.

There is little information available concerning marine mammal reactions to MFAS/HFAS. The Navy has only been conducting monitoring activities since 2006 and has not compiled enough data to date to provide a meaningful picture of effects of HFAS/MFAS on marine mammals, particularly in the Keyport Range Complex Study Area. From the four major training exercises (MTEs) of HFAS/MFAS in the AFAST Study Area for which NMFS has received a monitoring report, no instances of obvious behavioral disturbance were observed by the Navy watchstanders in the 700+ hours of effort in which 79 sightings of marine mammals were made (10 during active sonar operation). One cannot conclude from these results that marine mammals were not harassed from HFAS/MFAS, as a portion of animals within the area of concern may not have been seen (especially those more cryptic, deep-diving species, such as beaked whales or *Kogia* sp.) and some of the non-biologist watchstanders might not have had the expertise to characterize behaviors. However, the data demonstrate that the animals that were observed did not respond in any of the obviously more severe ways, such as panic, aggression, or anti-predator response.

In addition to the monitoring that will be required pursuant to these regulations and subsequent LOAs, which is specifically designed to help us better understand how marine mammals respond to sound, the Navy and NMFS have developed, funded, and begun conducting a controlled exposure experiment with beaked whales in the Bahamas.

Diel Cycle

As noted previously, many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hr cycle). Substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.*, 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007).

In the previous section, we discussed the fact that potential behavioral responses to HFAS/MFAS that fall into the category of harassment could range in severity. By definition, the takes by Level B behavioral harassment involve the disturbance of a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns (such as migration, surfacing, nursing, breeding, feeding, or sheltering) to a point where such behavioral patterns are abandoned or significantly altered. These reactions would, however, be more of a concern if they were expected to last over 24 hours or be repeated in subsequent days. Different sonar testing may not occur simultaneously. Some of the marine mammals in the Keyport Range Complex Study Area are residents and others would not likely remain in the same area for successive days, it is unlikely that animals would be exposed to HFAS/MFAS at levels or for a duration likely to result in a substantive response that would then be carried on for more than one day or on successive days.

TTS

NMFS and the Navy have estimated that individuals of some species of marine mammals may sustain some level of TTS from HFAS/MFAS operations. As mentioned previously, TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths. The TTS sustained by an animal is primarily classified by three characteristics:

- Frequency—Available data (of mid-frequency hearing specialists exposed to mid to high frequency sounds—Southall *et al.*, 2007) suggest that most TTS occurs in the frequency range of the source up to one octave higher than the source (with the maximum TTS at ½ octave above).
- Degree of the shift (*i.e.,* how many dB is the sensitivity of the hearing reduced by)—generally, both the degree of TTS and the duration of TTS will be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). The threshold for the onset of TTS (> 6 dB) for Navy sonars is 195 dB (SEL), which might be received at distances of up to 275–500 m from the most powerful MFAS source, the AN/SQS–53 (the maximum ranges to TTS from other sources would be less). An animal would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be difficult considering the marine observers and the nominal speed of a sonar vessel (10–12 knots). Of all TTS studies, some using exposures of almost an hour in duration or up to 217 dB SEL, most of the TTS induced was 15 dB or less, though Finneran *et al.* (2007) induced 43 dB of TTS with a 64-sec exposure to a 20 kHz source (MFAS emits a 1-s ping 2 times/minute).
- Duration of TTS (Recovery time)—see above. Of all TTS laboratory studies, some using exposures of almost an hour in duration or up to 217 dB SEL, almost all recovered within 1 day (or less, often in minutes), though in one study (Finneran *et al.*, 2007), recovery took 4 days.

Based on the range of degree and duration of TTS reportedly induced by exposures to non-pulse sounds of energy higher than that to which free-swimming marine mammals in the field are likely to be exposed during HFAS/MFAS testing activities, it is unlikely that marine mammals would sustain a TTS from MFAS that alters their sensitivity by more than 20 dB for more than a few days (and the majority would be far less severe). Also, for the same reasons discussed in the Diel Cycle section, and because of the short distance within which animals would need to approach the sound source, it is unlikely that animals would be exposed to the levels necessary to induce TTS in subsequent time periods such that their recovery were impeded. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from MFAS (the source from which TTS would more likely be sustained because the higher source level and slower attenuation make it more likely that an animal would be exposed to a higher level) would not usually span the entire frequency range of one vocalization type, much less span all types of vocalizations.

Acoustic Masking or Communication Impairment

As discussed above, it is also possible that anthropogenic sound could result in masking of marine mammal communication and navigation signals. However, masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which occurs continuously for its duration. Masking effects from HFAS/MFAS are expected to be minimal. If masking or communication impairment were to occur briefly, it would be in the frequency range of MFAS, which overlaps with some marine mammal vocalizations; however, it would likely not mask the entirety of any particular vocalization or communication series because the pulse length, frequency, and duty cycle of the HFAS/MFAS signal does not perfectly mimic the characteristics of any marine mammal's vocalizations.

PTS, Injury, or Mortality

The Navy's model estimated that no marine mammal would be taken by Level A harassment (injury, PTS included) or mortality due to the low intensity of the active sound sources being used.

Based on the aforementioned assessment, NMFS preliminarily determines that there would be the following number of takes: 11,283 harbor porpoises, 44 northern fur seals, 114 California sea lions, 14 northern elephant seals, and 5,569 (5,468 Washington Inland Waters stock and 101 Oregon/Washington Coastal stock) harbor seals at Level B harassment (TTS and sub-TTS) as a result of the proposed Keyport Range Complex RDT&E sonar testing activities. These numbers do not represent the number of individuals that would be taken, since it's most likely that many individual marine mammals would be taken multiple times. However, under the worst case scenario that each animal is taken only once, it is expected that these take numbers represent approximately 29.89%, 0.01%, 0.05%, 0.01%, 37.42%, and 0.41% of the Oregon/Washington Coastal stock harbor porpoises, Eastern Pacific stock northern fur seals, U.S. stock California sea lions, California breeding stock northern elephant seals, Washington Inland Waters stock harbor seals, and Oregon/Washington Coastal stock harbor seals, respectively, in the vicinity of the proposed Keyport Range Complex Study Area (calculation based on NMFS 2007 U.S. Pacific Marine Mammal Stock Assessments and 2007 U.S. Alaska Marine Mammal Stock Assessments).

No Level A take (injury, PTS included) or mortality would occur as the result of the proposed RDT&E and range extension activities for the Keyport Range Complex.

Based on these analyses, NMFS has preliminarily determined that the total taking over the 5-year period of the regulations and subsequent LOAs from the Navy's NAVSEA NUWCX Keyport Range Complex RDT&E and range extension activities will have a negligible impact on the marine mammal species and stocks present in the Keyport Range Complex Study Area.

Subsistence Harvest of Marine Mammals

NMFS has preliminarily determined that the total taking of marine mammal species or stocks from the Navy's mission activities in the Keyport Range Complex study area would not have an unmitigable adverse impact on the availability of the affected species or stocks for subsistence uses, since there are no such uses in the specified area.

ESA

There are eight marine mammal species/stocks over which NMFS has jurisdiction that are listed as endangered or threatened under the ESA that could occur in the NAVSEA NUWCX Keyport Range Complex study area: Blue whales, fin whales, sei whales, humpback whales, North Pacific right whales, sperm whales, Southern Resident killer whales, and Steller sea lions. The Navy has begun consultation with NMFS pursuant to section 7 of the ESA, and NMFS will also consult internally on the issuance of regulations and LOAs under section 101(a)(5)(A) of the MMPA for mission activities in the Keyport Range Complex study area. Consultation will be concluded prior to a determination on the issuance of a final rule and an LOAs.

NEPA

The Navy is preparing an Environmental Impact Statement (EIS) for the proposed Keyport Range Complex RDT&E and range extension activities. A draft EIS was released for public comment from September 12–October 27, 2008 and is available at *http://www-keyport.kpt.nuwc.navy.mil.* NMFS is a cooperating agency (as defined by the Council on Environmental Quality (40 CFR 1501.6)) in the preparation of the EIS. NMFS has reviewed the Draft EIS and will be working with the Navy on the Final EIS (FEIS).

NMFS intends to adopt the Navy's FEIS, if adequate and appropriate, and we believe that the Navy's FEIS will allow NMFS to meet its responsibilities under NEPA for the issuance of the 5-year regulations and LOAs (as warranted) for mission activities in the Keyport Range Complex study area. If the Navy's FEIS is not adequate, NMFS would supplement the existing analysis and documents to ensure that we comply with NEPA prior to the issuance of the final rule and LOA.

Preliminary Determination

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat and dependent upon the implementation of the mitigation and monitoring measures, NMFS preliminarily finds that the total taking from NAVSEA NUWC Keyport Range Complex RDT&E and range extension activities utilizing active acoustic sources in the NAVSEA NUWC Keyport Range Complex study area will have a negligible impact on the affected marine mammal species or stocks. NMFS has proposed regulations for these exercises that prescribe the means of effecting the least practicable adverse impact on marine mammals and their habitat and set forth requirements pertaining to the monitoring and reporting of such taking.

Classification

This action does not contain a collection of information requirements for purposes of the Paperwork Reduction Act.

This proposed rule has been determined by the Office of Management and Budget to be not significant for purposes of Executive Order 12866.

Pursuant to the Regulatory Flexibility Act, the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The RFA requires Federal agencies to prepare an analysis of a rule's impact on small entities whenever the agency is required to publish a notice of proposed rulemaking. However, a Federal agency may certify, pursuant to 5 U.S.C. 605(b), that the action will not have a significant economic impact on a substantial number of small entities. The Navy is the sole entity that will be affected by this proposed rulemaking, not a small governmental jurisdiction, small organization or small business, as defined by the RFA. This proposed rulemaking authorizes the take of marine mammals incidental to a specified activity. The specified activity defined in the proposed rule includes the use of active acoustic sources during RDT&E activities that are only conducted by and for the U.S. Navy. Additionally, the proposed regulations are specifically written for ''military readiness'' activities, as defined by the Marine Mammal Protection Act, as amended by the National Defense Authorization Act, which means that they cannot apply to small businesses. Additionally, any requirements imposed by a Letter of Authorization issued pursuant to these regulations, and any monitoring or reporting requirements imposed by these regulations, will be applicable only to the Navy. Because this action, if adopted, would directly affect the Navy and not a small entity, NMFS concludes the action would not result in a significant economic impact on a substantial number of small entities. Accordingly, no IRFA and none has been prepared.

List of Subjects in 50 CFR Part 218

Exports, Fish, Imports, Incidental take, Indians, Labeling, Marine mammals, Navy, Penalties, Reporting and recordkeeping requirements, Seafood, Sonar, Transportation.

Dated: June 30, 2009.

James W. Balsiger,

Acting Assistant Administrator for Fisheries, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 218 is proposed to be amended as follows.

PART 218—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

1. The authority citation for part 218 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*

2. Subpart S is added to part 218 to read as follows:

Subpart S—Taking Marine Mammals Incidental to U.S. Navy Research, Development, Test, and Evaluation Activities in the Naval Sea System Command Naval Undersea Warfare Center Keyport Range Complex and the Associated Proposed Extensions Study Area

Sec.
218.170 Specified activity and specified geographical area.
218.171 Permissible methods of taking.
218.172 Prohibitions.
218.173 Mitigation.
218.174 Requirements for monitoring and reporting.

Subpart S—Taking Marine Mammals Incidental to U.S. Navy Research, Development, Test, and Evaluation Activities in the Naval Sea System Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex and the Associated Proposed Extensions Study Area

§ 218.170 Specified activity and specified geographical area.

(a) Regulations in this subpart apply only to the U.S. Navy for the taking of marine mammals that occur in the area outlined in paragraph (b) of this section and that occur incidental to the activities described in paragraph (c) of this section.

(b) These regulations apply only to the taking of marine mammals by the Navy that occurs within the Keyport Range Complex Action Area, which includes the extended Keyport Range Site, the extended DBRC Range Complex (DBRC) Site, and the extended Quinault Underwater Tracking Range (QUTR) Site, as presented in the Navy's LOA application. The NAVSEA NUWC Keyport Range Complex is divided into open ocean/offshore areas and in-shore areas:

(1) Open Ocean Area—air, surface, and subsurface areas of the NAVSEA NUWC Keyport Range Complex Extension that lie outside of 12 nautical miles (nm) from land.

(2) Offshore Area—air, surface, and subsurface ocean areas within 12 nm of the Pacific Coast.

(3) In-shore—air, surface, and subsurface areas within the Puget Sound, Port Orchard Reach, Hood Canal, and Dabob Bay.

(c) These regulations apply only to the taking of marine mammals by the Navy if it occurs incidental to the following activities within the designated amounts of use:

(1) Range Activities Using Active Acoustic Devices:

(i) General range tracking: Narrow frequency output between 10 to 100 kHz with source levels (SL) between 195–203 dB re 1 microPa-m.

(ii) UUV Tracking Systems: Operating frequency of 10 to 100 kHz with SLs less than 195 dB re 1 microPa-m at all range sites.

(iii) Torpedo Sonars: Operating frequency from 10 to 100 kHz with SL under 233 dB re 1 microPa-m.

(iv) Range Targets and Special Test Systems: 5 to 100 kHz frequency range with a SL less than 195 dB re 1 microPa-m at the Keyport Range Site and SL less than 238 dB re microPa-m at the DBRC and QUTR sites.

(v) Special Sonars: Frequencies vary from 100 to 2,500 kHz with SL less than 235 dB re 1 microPa-m.

(vi) Sonobuoys and Helicopter Dipping Sonar: Operate at frequencies of 2 to 20 kHz with SLs of less than 225 dB re 1 microPa-m.

(vii) Side Scan Sonar: Multiple frequencies typically at 100 to 700 kHz with SLs less than 235 dB re 1 microPa-m.

(viii) Other Acoustic Sources:

(A) Acoustic Modems: Emit pulses at frequencies from 10 to 300 kHz with SLs less than 210 dB re 1 microPa-m.

(B) Target Simulators: Operate at frequencies of 100 Hz to 10 kHz at source levels of less than 170 dB re 1 microPa-m.

(C) Aids to Navigation: Operate at frequencies of 70 to 80 kHz at SLs less than 210 dB re 1 microPa-m.

(D) Subbottom Profilers: Operate at 2 to 7 kHz at SLs less than 210 dB re 1 microPa-m, and 35 to 45 kHz at SLs less than 220 dB re 1 microPa-m.

(E) Surface Vessels, Submarines, Torpedoes, and Other UUVs: Acoustic energy from engines usually from 50 Hz to 10 kHz at SLs less than 170 dB re 1 microPa-m.

(2) Increased Tempo and Activities due to Range Extension: Proposed annual range activities and operations as listed in the following table:

Range Activity	Platform/System Used	Proposed Number of Activities/Year* Keyport Range Site	DBRC Site	QUTR Site
Test Vehicle Propulsion	Thermal propulsion systems	5	130	30
	Electric/Chemical propulsion systems	55	140	30
Other Testing Systems and Activities	Submarine testing	0	45	15
	Inert mine detection, classification and localization	5	20	10
	Non-Navy testing	5	5	5
	Acoustic & non-acoustic sensors (magnetic array, oxygen)	20	10	5
	Countermeasure test	5	50	5
	Impact testing	0	10	5
	Static in-water testing	10	10	6
	UUV test	45	120	40
	Unmanned Aerial System (UAS) test	0	2	2
Fleet Activities** (excluding RDT&E)	Surface Ship activities	1	10	10
	Aircraft activities	0	10	10
	Submarine activities	0	30	30
	Diver activities	45	5	15
Deployment Systems (RDT&E)	Range support vessels:			
	Surface launch craft	35	180	30
	Special purpose barges	25	75	0
	Fleet vessels***	15	20	20
	Aircraft (rotary and fixed wing)	0	10	20
	Shore and pier	45	30	30

* There may be several activities in 1 day. These numbers provide an estimate of types of range activities over the year.
** Fleet activities in the NAVSEA NUWC Keyport Range Complex do not include the use of surface ship and submarine hull-mounted active sonars.
*** As previously noted, Fleet vessels can include very small craft such as SEAL Delivery Vehicles.

§ 218.171 Permissible methods of taking.

(a) Under Letters of Authorization issued pursuant to §§ 216.106 and 218.176 of this chapter, the Holder of the Letter of Authorization may incidentally, but not intentionally, take marine mammals within the area described in § 218.170(b), provided the activity is in compliance with all terms, conditions, and requirements of these regulations and the appropriate Letter of Authorization.

(b) The activities identified in § 218.170(c) must be conducted in a manner that minimizes, to the greatest extent practicable, any adverse impacts on marine mammals and their habitat.

(c) The incidental take of marine mammals under the activities identified in § 218.170(c) is limited to the following species, by Level B harassment only and the indicated number of times:

(1) Harbor porpoise (*Phocoena phocoena*)—56,415 (an average of 11,283 annually),

(2) Northern fur seal (*Callorhinus ursinus*)—220 (an average of 44 annually);

(3) California sea lion (*Zalophus californianus*)—570 (an average of 114 annually);

(4) Northern elephant seal (*Mirounga angustirostris*)—70 (an average of 14 annually);

(5) Harbor seal (*Phoca vitulina richardsi)* (Washington Inland Waters stock)—27,340 (an average of 5,468 annually); and

(6) Harbor seal (*P. v. richardsi*) (Oregon/Washington Coastal stock)—505 (an average of 101 annually);

§ 218.172 Prohibitions.

Notwithstanding takings contemplated in § 218.171 and authorized by a Letter of Authorization issued under § 216.106 of this chapter and § 218.176, no person in connection with the activities described in § 218.170 may:

(a) Take any marine mammal not specified in § 218.171(b);

(b) Take any marine mammal specified in § 218.171(b) other than by incidental take as specified in § 218.171 (b);

(c) Take a marine mammal specified in § 218.171(b) if such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(d) Violate, or fail to comply with, the terms, conditions, and requirements of these regulations or a Letter of Authorization issued under § 216.106 of this chapter and § 218.176.

§ 218.173 Mitigation.

When conducting RDT&E activities identified in § 218.170(c), the mitigation measures contained in this subpart and subsequent Letters of Authorization issued under § 216.106 of this chapter and § 218.176 must be implemented. These mitigation measures include, but are not limited to:

(a) Marine mammal observers training:

(1) All range personnel shall be trained in marine mammal recognition.

(2) Marine mammal observer training shall be conducted by qualified organizations approved by NMFS.

(b) Lookouts onboard vessels:

(1) Vessels on a range shall use lookouts during all hours of range activities.

(2) Lookout duties include looking for marine mammals.

(3) All sightings of marine mammals shall be reported to the Range Officer in charge of overseeing the activity.

(c) Visual surveillance shall be conducted just prior to all in-water exercises.

(1) Surveillance shall include, as a minimum, monitoring from all participating surface craft and, where available, adjacent shore sites.

(2) When cetaceans have been sighted in the vicinity of the operation, all range participants increase vigilance and take reasonable and practicable actions to avoid collisions and activities that may result in close interaction of naval assets and marine mammals.

(3) Actions may include changing speed and/or direction, subject to environmental and other conditions (*e.g.,* safety, weather).

(d) An ''exclusion zone'' shall be established and surveillance will be conducted to ensure that there are no marine mammals within this exclusion zone prior to the commencement of each in-water exercise.

(1) For cetaceans, the exclusion zone shall extend out 1,000 yards (914.4 m) from the intended track of the test unit.

(2) For pinnipeds, the exclusion zone shall extend out 100 yards (91 m) from the intended track of the test unit.

(e) Range craft shall not approach within 100 yards (91 m) of marine mammals, to the extent practicable considering human and vessel safety priorities. This includes marine mammals ''hauled-out'' on islands, rocks, and other areas such as buoys.

(f) In the event of a collision between a Navy vessel and a marine mammal, NUWC Keyport activities shall notify immediately the Navy chain of Command, which shall notify NMFS immediately.

(g) Passive acoustic monitoring shall be utilized to detect marine mammals in the area before and during activities.

(h) Procedures for reporting marine mammal sightings on the NAVSEA NUWC Keyport Range Complex shall be promulgated, and sightings shall be entered into the Range Operating System and forwarded to NOAA/NMML Platforms of Opportunity Program.

§ 218.174 Requirements for monitoring and reporting.

(a) The Holder of the Letter of Authorization issued pursuant to § 216.106 of this chapter and § 218.176 for activities described in § 218.170(c) is required to cooperate with the NMFS when monitoring the impacts of the activity on marine mammals.

(b) The Holder of the Authorization must notify NMFS immediately (or as soon as clearance procedures allow) if the specified activity identified in § 218.170(c) is thought to have resulted in the mortality or injury of any marine mammals, or in any take of marine mammals not identified or authorized in § 218.171(c).

(c) The Navy must conduct all monitoring and required reporting under the Letter of Authorization, including abiding by the NAVSEA NUWC Keyport Range Complex Monitoring Plan, which is incorporated herein by reference, and which requires the Navy to implement, at a minimum, the monitoring activities summarized below:

(1) Visual Surveys:

(i) The Holder of this Authorization shall conduct a minimum of 2 special visual surveys per year to monitor HFAS and MFAS respectively at the DBRC Range site.

(ii) For specified events, shore-based and vessel surveys shall be used 1 day prior to and 1–2 days post activity.

(A) Shore-based Surveys:

(*1*) Shore-based monitors shall observe test events that are planned in advance to occur adjacent to near shore areas where there are elevated topography or coastal structures, and shall use binoculars or theodolite to augment other visual survey methods.

(*2*) Shore-based surveys of the test area and nearby beaches shall be conducted for stranded marine animals following nearshore events. If any distressed, injured or stranded animals are observed, an assessment of the animal's condition (alive, injured, dead, or degree of decomposition) shall be reported immediately to the Navy and the information shall be transmitted immediately to NMFS through the appropriate chain of command.

(B) Vessel-based Surveys:

(*1*) Vessel-based surveys shall be designed to maximize detections of marine mammals near mission activity event.

(*2*) Post-analysis shall focus on how the location, speed and vector of the range craft and the location and direction of the sonar source (*e.g.,* Navy surface vessel) relates to the animal.

(*3*) Any other vessels or aircraft observed in the area shall also be documented.

(iii) Surveys shall include the range site with special emphasis given to the particular path of the test run. When conducting a particular survey, the survey team shall collect the following information.

(A) Species identification and group size;

(B) Location and relative distance from the acoustic source(s);

(C) The behavior of marine mammals including standard environmental and oceanographic parameters;

(D) Date, time and visual conditions associated with each observation;

(E) Direction of travel relative to the active acoustic source; and

(F) Duration of the observation.

(iv) Animal sightings and relative distance from a particular active acoustic source shall be used post-survey to determine potential received energy (dB re 1 micro Pa-sec). This data shall be used, post-survey, to estimate the number of marine mammals exposed to different received levels (energy based on distance to the source, bathymetry, oceanographic conditions and the type and power of the acoustic source) and their corresponding behavior.

(2) Passive Acoustic Monitoring (PAM):

(i) The Navy shall deploy a hydrophone array in the Keyport Range Complex Study Area for PAM.

(ii) The array shall be utilized during the two special monitoring surveys in DBRC as described in § 218.174(c)(1)(i).

(iii) The array shall have the capability of detecting low-frequency vocalizations (<1,000 Hz) for baleen whales and relatively high frequency (up to 30 kHz) for odontocetes.

(iv) Acoustic data collected from the PAM shall be used to detect acoustically active marine mammals as appropriate.

(3) Marine Mammal Observers on range craft or Navy vessels:

(i) Navy Marine mammal observers (NMMOs) may be placed on a range craft or Navy platform during the event being monitored.

(ii) The NMMO must possess expertise in species identification of regional marine mammal species and experience collecting behavioral data.

(iii) NMMOs may be placed alongside existing lookouts during the two specified monitoring events as described in § 218.174(c)(1)(i).

(iv) NMMOs shall inform the lookouts of any marine mammal sighting so that appropriate action may be taken by the chain of command. NMMOs shall schedule their daily observations to duplicate the lookouts' schedule.

(v) NMMOs shall observe from the same height above water as the lookouts, and they shall collect the same data collected by lookouts listed in § 218.174(c)(1)(iii).

(d) The Navy shall complete an Integrated Comprehensive Monitoring Program (ICMP) Plan in 2009. This planning and adaptive management tool shall include:

(1) A method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority.

(2) A method for annually reviewing, with NMFS, monitoring results, Navy R&D, and current science to use for potential modification of mitigation or monitoring methods.

(3) A detailed description of the Monitoring Workshop to be convened in 2011 and how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.

(4) An adaptive management plan.

(5) A method for standardizing data collection for NAVSEA NUWC Keyport Range Complex Extension and across range complexes.

(e) Notification of Injured or Dead Marine Mammals—Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercise utilizing underwater explosive detonations. The Navy shall provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

(f) Annual Keyport Range Complex Monitoring Plan Report—The Navy shall submit a report annually on December 1 describing the implementation and results (through September 1 of the same year) of the Keyport Range Complex Monitoring Plan. Data collection methods will be standardized across range complexes to allow for comparison in different geographic locations. Although additional information will also be gathered, the NMMOs collecting marine mammal data pursuant to the Keyport Range Complex Monitoring Plan shall, at a minimum, provide the same marine mammal observation data required in § 218.174(c). The Keyport Range Complex Monitoring Plan Report may be provided to NMFS within a larger report that includes the required Monitoring Plan Reports from Keyport Range Complex and multiple range complexes.

(g) Keyport Range Complex 5-yr Comprehensive Report—The Navy shall submit to NMFS a draft comprehensive report that analyzes and summarizes *all* of the multi-year marine mammal information gathered during tests involving active acoustic sources for which individual reports are required in § 218.174(d–f). This report will be submitted at the end of the fourth year of the rule (June 2013), covering activities that have occurred through September 1, 2013.

(h) The Navy shall respond to NMFS comments and requests for additional information or clarification on the Keyport Range Complex Extension Comprehensive Report, the Annual Keyport Range Complex Monitoring Plan Report (or the multi-Range Complex Annual Monitoring Report, if that is how the Navy chooses to submit the information) if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

(i) In 2011, the Navy shall convene a Monitoring Workshop in which the Monitoring Workshop participants will be asked to review the Navy's Monitoring Plans and monitoring results and make individual recommendations (to the Navy and NMFS) of ways of improving the Monitoring Plans. The recommendations shall be reviewed by the Navy, in consultation with NMFS, and modifications to the Monitoring Plan shall be made, as appropriate.

§ 218.175 Applications for Letters of Authorization.

To incidentally take marine mammals pursuant to these regulations for the activities identified in § 218.170(c), the U.S. Navy must apply for and obtain either an initial Letter of Authorization in accordance with § 218.176 or a renewal under § 218.177.

§ 218.176 Letters of Authorization.

(a) A Letter of Authorization, unless suspended or revoked, will be valid for a period of time not to exceed the period of validity of this subpart, but must be renewed annually subject to annual renewal conditions in § 218.177.

(b) Each Letter of Authorization will set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact on the species, its habitat, and on the availability of the species for subsistence uses (*i.e.,* mitigation); and

(3) Requirements for mitigation, monitoring and reporting.

(c) Issuance and renewal of the Letter of Authorization will be based on a determination that the total number of marine mammals taken by the activity as a whole will have no more than a negligible impact on the affected species or stock of marine mammal(s).

§ 218.177 Renewal of Letters of Authorization and adaptive management.

(a) A Letter of Authorization issued under § 216.106 and § 218.176 for the activity identified in § 218.170(c) will be renewed annually upon:

(1) Notification to NMFS that the activity described in the application submitted under § 218.175 shall be undertaken and that there will not be a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming 12 months;

(2) Timely receipt of the monitoring reports required under § 218.174(b); and

(3) A determination by the NMFS that the mitigation, monitoring and reporting measures required under § 218.173 and the Letter of Authorization issued under §§ 216.106 and 218.176, were undertaken and will be undertaken during the upcoming annual period of validity of a renewed Letter of Authorization.

(b) If a request for a renewal of a Letter of Authorization issued under §§ 216.106 and 218.177 indicates that a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming season will occur, the NMFS will provide the public a period of 30 days for review and comment on the request. Public comment on renewals of Letters of Authorization are restricted to:

(1) New cited information and data indicating that the determinations made in this document are in need of reconsideration, and

(2) Proposed changes to the mitigation and monitoring requirements contained in these regulations or in the current Letter of Authorization.

(c) A notice of issuance or denial of a renewal of a Letter of Authorization will be published in the **Federal Register**.

(d) NMFS, in response to new information and in consultation with the Navy, may modify the mitigation or monitoring measures in subsequent LOAs if doing so creates a reasonable likelihood of more effectively accomplishing the goals of mitigation and monitoring set forth in the preamble of these regulations. Below are some of the possible sources of new data that could contribute to the decision to modify the mitigation or monitoring measures:

(1) Results from the Navy's monitoring from the previous year (either from Keyport Range Complex Study Area or other locations).

(2) Findings of the Monitoring Workshop that the Navy will convene in 2011 (§ 218.174(i)).

(3) Compiled results of Navy funded research and development (R&D) studies (presented pursuant to the ICMP (§ 218.174(d)).

(4) Results from specific stranding investigations (either from the Keyport Range Complex Study Area or other locations).

(5) Results from the Long Term Prospective Study described in the preamble to these regulations.

(6) Results from general marine mammal and sound research (funded by the Navy (described below) or otherwise).

(7) Any information which reveals that marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent Letters of Authorization.

§ 218.178 Modifications to Letters of Authorization.

(a) Except as provided in paragraph (b) of this section and § 218.177(d), no substantive modification (including withdrawal or suspension) to the Letter of Authorization by NMFS, issued pursuant to § 216.106 of this chapter and § 218.176 and subject to the provisions of this subpart shall be made until after notification and an opportunity for public comment has been provided. For purposes of this paragraph, a renewal of a Letter of Authorization under § 218.177, without modification (except for the period of validity), is not considered a substantive modification.

(b) If the Assistant Administrator determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 218.171(b), a Letter of Authorization issued pursuant to § 216.106 of this chapter and § 218.176 may be substantively modified without prior notification and an opportunity for public comment. Notification will be published in the **Federal Register** within 30 days subsequent to the action.

[FR Doc. E9–15839 Filed 6–30–09; 4:15 pm]

BILLING CODE 3510–22–P

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/249-08
DEC 5 2008

Mr. Bob Lohn
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115

Dear Mr. Lohn:

Subj: NAVSEA NUWC KEYPORT RANGE COMPLEX EXTENSION BIOLOGICAL EVALUATION

Per enclosure 1, Naval Undersea Warfare Center Division, Keyport (NAVSEA NUWC Keyport) is forwarding copies of our Biological Evaluation (BE) for your review. The BE assesses possible impacts to both U.S. Fish and Wildlife Service and National Marine Fisheries Service listed species that potentially occur within the NAVSEA NUWC Keyport Range Complex.

Please forward any comments on the BE and your concurrence to me at the address above. A determination of concurrence on the BE received by March 31, 2009, would be most appreciated. If you need additional information or have questions, please feel free to contact Ms. Shaari Unger, who can be reached at (360) 315-2258 or via email at shaari.unger@navy.mil or Mr. Fabio D'Angelo at (360) 396-5682 or via email at fabio.d'angelo@navy.mil.

Sincerely,

Kim X. Bennis

KIM X. BENNIS
Head, Operations Services Department
By direction of
the Commander

Enclosure: 1. Letter 5090, Ser N456K/8U158346, dtd 14 NOV 2008, Ron Trickle (OPNAV N45) to Ms. Somma (NMFS)
2. NAVSEA NUWC Keyport Range Complex Extension Biological Evaluation (October 2008)

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO
5090
Ser N456K/8U158346
14 November 2008

Ms. Angela Somma
Division Chief Endangered Species Division
Office of Protected Resources
National Oceanic and Atmospheric Administration
National Marine Fisheries Service (NMFS)
B-SSMC3 Room 13821
1315 East-West Highway
Silver Springs, MD 20910-3282

Dear Ms. Somma:

The Commander, Naval Undersea Warfare Center, Keyport (NUWC Keyport) is preparing an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with the extension of the NUWC Keyport Range Complex in Washington State. Specifically, the proposed action is to provide additional operating space and volume outside the existing operational areas to support existing and future range operations, including manned and unmanned vehicle program needs, in multiple marine environments. The Keyport Range Complex is comprised of three geographically distinct range sites: the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. Through our cooperating agency agreement, the Navy and National Marine Fisheries Service (NMFS) are working together to develop these DEISs/OEISs prior to release for public comment.

In a letter dated November 16, 2007, the Navy requested the NMFS' permit division initiate early consultation in anticipation of submitting a Marine Mammal Protection Act request for rulemaking and Letters of Authorization. In accordance with 50 CFR §401.12(f), the Navy is submitting its Biological Evaluation (BE) [Enclosure (1)] and is requesting formal consultation pursuant to Section 7(a)(2).

This BE assesses the potential effects of the proposed actions on species protected under the Endangered Species Act (ESA) that potentially occur within the NAVSEA NUWC Keyport Range Complex.

In accordance with 50 CFR §401.14(c) the attached BE includes: (1) a description of the proposed action; (2) descriptions of the specific areas where the proposed action will occur (also called Study Area); (3) descriptions of the listed species and critical

Enclosure (1)

habitat that may be affected by the actions; (4) the potential effects on listed and proposed species or critical habitat; (5) an analysis of cumulative effects; and (6) measures proposed by the Navy to mitigate potential effects of the proposed action. Please direct your attention to those species and critical habitats under the jurisdiction of NMFS.

Additional technical information regarding the process by which the Navy determined the listed species distribution in these geographic areas is detailed in Enclosure 2. These reports are in a draft stage, and would benefit from your staff's input, should any technical errors be identified. We are providing this report as additional relevant technical information for purposes of consultation under the ESA.

My staff point of contact for this matter is Dr. Kelly Brock who can be reached at 703-604-5420 or via email at Kelly.brock@navy.mil; NUWC Keyport's point of contact for this matter is Ms. Shaari Unger, who can be reached at (360)-315-2258 or via email at shaari.unger@navy.mil.

Sincerely,

R E Tickle

Ronald E. Tickle
Head, Operational Environmental
Readiness and Planning Branch
Environmental Readiness Division
(OPNAV N45)

Enclosures:

(1) Biological Evaluation for NAVSEA NUWC Keyport Range Complex.
(2) Marine Resources Assessment Update for the Pacific Northwest Operating Area (Draft Report September 2006 - CD Copy)

Copy to (w/o enclosures):
OASN(I&E)
OPNAV N43
NAVSEA 04RE
NUWCHQ (Code 26)
NUWC Keyport (Code 236)
NAVFAC Northwest (Code EV2.KK)

National Marine Fisheries Service
Northwest Regional Office

Attn: Mr. Bob Lohn
7600 Sand Point Way NE
Seattle, WA 98115

3

Enclosure (1)

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser N456P/8U159165
02 June 2008

Mr. P. Michael Payne, Division Chief
Permits, Conservation and Education Division
Office of Protected Resources
National Oceanic and Atmospheric Administration
National Marine Fisheries Service (NMFS)
B-SSMC3 Room 13822
1315 East-West Highway
Silver Spring, MD 20910-3282

Dear Mr. Payne,

In accordance with the Marine Mammal Protection Act, as amended and 50 CFR Part 216.106, the U.S. Navy requests a Letter of Authorization (LOA) for the incidental take of marine mammals associated with the research, development, test, and evaluation (RDT&E) activities within the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension.

The proposed action will involve mid- and high-frequency acoustic sources used for many purposes including underwater communication, mapping the seabed, torpedo countermeasures, and detecting submarines, inert mines and obstacles. There are no explosive warheads tested or placed on test units on the range. There are three distinct locations that are a part of the Keyport Range Complex Extension. They are the: (1) Keyport Range Site, a shallow underwater testing range located adjacent to NUWC Keyport; (2) Dabob Bay Range Complex (DBRC) which includes the Dabob Bay Military Operating Area, the Hood Canal North and South Military Operating Area adjacent to Submarine Base Bangor, and the Connecting Waters south of the Hood Canal South area; and (3) Quinault Underwater Tracking Range (QUTR) located 6.5 nm off the Pacific Coast at Kalaloch, WA. Enclosure (1) provides the specific information required by the National Marine Fisheries Service for consideration of an incidental take request for action in the Navy range.

We appreciate your continued support in helping the Navy to meet its environmental responsibilities. My staff point of contact for this action is Ms. Linda S. Petitpas at

(703) 604-1233, or e-mail Linda.petitpas@navy.mil. Naval Sea Systems Command point of contact for this matter is Deborah Verderame at (202) 781-1837 or email deborah.verderame@navy.mil.

Sincerely,

RONALD E. Tickle
Head, Operational Environmental
Readiness and Planning Branch
Environmental Readiness Division
(OPNAV N456)

Enclosure:

(1) Request for Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting from Navy Research, Development, Test, and Evaluation Activities Conducted within the NAVSEA NUWC Keyport Range Complex Extension (April 2008) delivered via FedEx under separate cover on 16 May 08.

Copy to (w/o enclosure):
DASN (E)
OPNAV N43
USFF N77
CPF N01CE
COMNAVREGNW
NAVFACPACNW

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser N456K/7U158327
16 Nov 2007

Mr. P. Michael Payne
Division Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service (NMFS)
National Oceanic and Atmospheric Administration
B-SSMC3 Room 13821
1315 East-West Highway
Silver Spring, MD 20910-3282

Dear Mr. Payne:

The Commander, Naval Undersea Warfare Center, Keyport (NUWC Keyport) is preparing an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with the extension of the Northwest Range Complex in Washington State. The NAVSEA NUWC Keyport Range Complex is comprised of three geographically distinct range sites: the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site.

Specifically, the proposed action is to provide additional operating space and volume outside the existing operational areas to support existing and future range operations, including manned and unmanned vehicle program needs, in multiple marine environments. NUWC Keyport operations will be evaluated within the EIS/OEIS. These operations are described in the Enclosure (1). Alternatives currently being evaluated are broken out for each range site within the Northwest Range Complex. The following is a brief description of the alternatives:

- Extend Keyport Range Site from 1.5 nm^2 to 3.1 nm^2
- Extend DBRC south to the Hamma Hamma River and/or north to 1 mile south of the Hood Canal Bridge. This would increase the operating area from 30.9 nm^2 to approximately 43.4 nm^2.
- Extend QUTR approximately 51.8 nm^2, to the W-237A boundary area, approximately 2,655 nm^2, and include a surf zone corridor from the shoreline to the boundary of W-237A. The

- surf zone component would extend 5 nm along the eastern boundary of W-237A, extend approximately 3 nm to shore along the mean-lower-low-water line, and encompass 1 mile of shoreline. There are three alternative surf zone locations under consideration.

Specific descriptions of these alternatives are detailed in Enclosure (1).

Conduct of these activities will likely result in acoustic exposure of marine mammals listed under the Marine Mammal Protection Act (MMPA) from active sonar, and likely require a Letter of Authorization (LOA). As such, the Navy will be submitting an LOA request to your office in the coming months for these activities. It is expected that species for which an LOA is sought may include species listed under the Endangered Species Act (ESA). In addition to marine mammals listed under the ESA, the proposed activities may result in impacts to listed salmon.

As an applicant for an MMPA permit, the Navy requests your office to initiate early consultation procedures with the Endangered Species Division, in accordance with Section 7(a)(3) of the ESA, and its implementing regulations at 50 CFR §402.11. In accordance with these regulations, the enclosed Draft Description of the Proposed Action and Alternatives (Chapters 1 and 2) for the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS serves as the Navy's definitive proposal outlining the action. As previously stated, the effects of the proposed action for purposes of the MMPA permit will be from exposure to acoustic energy from active sonar. The level of magnitude of these effects is still being modeled, and will be included in the Navy's request for an LOA.

Title 10, Section 5062 of the United States Code requires the Navy to be "organized, trained, and equipped primarily for prompt and sustained combat incident to operations at sea." The additional operating space to support existing and future range operations, including manned and unmanned vehicle program needs are proposed in response to this legal requirement. Thus, in accordance with 50 CFR §402.11(b), this letter serves as the Navy's certification that it has a definite proposal and intends to implement that proposal should an MMPA permit be obtained from your office.

We appreciate your continued support in helping us meet our Section 7 responsibilities. My point of contact for this matter is Ms. Elizabeth Phelps, 703-604-5420 or Elizabeth.phelps@navy.mil and NUWC Keyport's point of contact is Ms. Shaari Unger, 360-315-2258 or shaari.unger@navy.mil.

Sincerely,

Ronald Tickle
Head, Operational Environmental
Readiness and Planning Branch
Environmental Readiness Division
(OPNAV N45)

Enclosures:
(1) Chapter 1 & 2 from the Preliminary Draft Environmental Impact Statement/Overseas Environmental Impact Statement for the NAVSEA NUWC Keyport Range Complex Extension

Copy to (w/enclosures):
Office of Protected Resources
Attn: Angela Somma
1315 East-West Highway
Silver Spring, MD 20910

National Marine Fisheries Service
Northwest Regional Office
Attn: Mr. Bob Lohn
7600 Sand Point Way NE
Seattle, WA 98115

Copy to (w/o enclosures):
OASN(I&E)
OPNAV N43
NAVSEA 04RE
NUWCHQ (Code 26)
NUWC Keyport (Code 236)
NAVFAC Northwest (Code EV2.KK)

Endangered Species Act Section 7

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From:	Unger, Shaari M CIV NAVSEA KPWA
To:	Kevin_Shelley@fws.gov
Cc:	Hart, George A CIV CNRNW, N40BA; D"angelo, Fabio G CIV NAVSEA KPWA; Haselman, Carl T CIV NAVSEA KPWA; Hisayasu, Deborah A CIV NAVSEA KPWA; Kler, Kimberly H CIV NAVFAC NW, EV1; Renken, Martin C CIV NAVSEA KPWA
Subject:	RE: Keyport Range Complex Extension...table 2-1, page 2-2
Date:	Monday, October 05, 2009 7:32:37

Hello Kevin,

George forwarded your questions to me to answer.

1. That would be 10 hit shots total in the year.
2. No this is not impulsive or concussive or even sonar. None of that. This is two objects underwater with a chance of hitting one another. Neither has any kind of explosive in it and it cannot be compared to a pile driving hammer in any way.

Respectfully,
Shaari :)

-----Original Message-----
From: Hart, George A CIV CNRNW, N40BA
Sent: Monday, October 05, 2009 7:21
To: Unger, Shaari M CIV NAVSEA KPWA
Subject: FW: Keyport Range Complex Extension...table 2-1, page 2-2
Importance: High

Shaari,

I am forwarding this to you for response...

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

There is no expedient to which a man will not go to avoid the labor of thinking.
Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Thursday, October 01, 2009 17:03
To: Hart, George A CIV CNRNW, N40BA
Subject: RE: Keyport Range Complex Extension...table 2-1, page 2-2

George; thanks for the reply...I don't have the DEIS or BE here at home.

So are the impacts tests between two steel objects in the water? Does 10 tests mean 10 days of impacts (with multiple impacts per day) or are there simply 10 impact events being tested, either occurring all on one day or 1 impact per day for up to 10 days?

Now for the more difficult question, probably one for the acoustic folks. It seems to me that the impact would produce a sound wave...a concussive type of sound wave. It also seems to me, one way to think about it is that the impact could be compared to one hit from a pile driving hammer on a steel pile, concrete pile or something like that. Nonetheless, the 1 impact between 2 metal objects will result in some energy put through the water...do you know how much?

Before I go much further, help me on these questions. Thanks. ks

Kevin Shelley
Senior Fish and Wildlife Biologist

U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102
Lacey, WA 98503 ph. 360-753-9440

-----"Hart, George A CIV CNRNW, N40BA" <george.hart1@navy.mil> wrote: -----

To: <Kevin_Shelley@fws.gov>
From: "Hart, George A CIV CNRNW, N40BA" <george.hart1@navy.mil>
Date: 10/01/2009 03:06PM
cc: "Unger, Shaari M CIV NAVSEA KPWA" <shaari.unger@navy.mil>, "Kler, Kimberly H CIV NAVFAC NW, EV1" <kimberly.kler@navy.mil>
Subject: RE: Keyport Range Complex Extension...table 2-1, page 2-2

Kevin,

Sure, I took this out of the most current draft of the EIS:

Impact Testing. This type of test evaluates the durability of test vehicles by causing an impact between them or between the test vehicle and some other object. Such tests evaluate the functioning of approach and guidance and control capabilities of test vehicles. Currently, activities of this type are scheduled an average of 10 days per year within the DBRC Site and 5 days per year within the QUTR Site (no impact testing activities occur at the Keyport Range Site). Individual tests of this type typically last about 8 hours.

Just to reiterate there are no explosives involved. Sometimes we just have the vehicles come close to each other in other words they are separated by different depths but would be in the same vertical plane. Hope this helps.

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

There is no expedient to which a man will not go to avoid the labor of thinking.
Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Thursday, October 01, 2009 14:38
To: Hart, George A CIV CNRNW, N40BA
Subject: Keyport Range Complex Extension...table 2-1, page 2-2

George; I just noticed something today for the first time. In the subject table, I see under "Platform/Systems Used" something called "Impact Testing"....10 times per year at DBRC. Please describe to me the nature of this activity or test. ks

Kevin Shelley
Senior Fish and Wildlife Biologist

U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102
Lacey, WA 98503 ph. 360-753-9440

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

AUG 28 2009

In Reply Refer To:
13410-2009-F-0082

Kim X. Bennis
Head, Operations Services Department
Naval Undersea Warfare Center Division
610 Dowell St.
Keyport, Washington 98345-7610

Subject: Department of Defense, Naval Undersea Warfare Center Division, Keyport, request to initiate formal consultation for the proposed 2010-2015 extension and operations at the Keyport Range Complex

Dear Ms. Bennis:

This letter acknowledges the U.S. Fish and Wildlife Service's (Service) receipt of your Biological Evaluation and letter dated 22 July, 2009, requesting initiation of formal consultation in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). We received your letter on 29 July, 2009.

This consultation concerns the potential effects of the proposed activities to be undertaken in the Naval Undersea Warfare Center Division, Keyport Range Complex (Navy) in Puget Sound and the Pacific Coast of the State of Washington. The submitted letter and Biological Evaluation, dated December 2008, provides information in support of *"may affect likely to adversely affect"* determinations for the bull trout (*Salvelinus confluentus*) and the marbled murrelet (*Brachyramphus marmoratus*) and a *"may affect not likely to adversely affect"* determination for designated bull trout critical habitat. In addition, the Navy determined the action would have "*no effect*" on the snowy plover (*Charadrius alexandrinus*).

Although we still have questions concerning acoustical effects from underwater testing of countermeasures and sonar, we believe the information included in the Biological Evaluation or that which was acquired through subsequent discussion between Navy and Service staff, is sufficient to initiate section 7 consultation. With this notification, the Service has initiated formal section 7 consultation and has assigned reference number 13410-2009-F-0082 to this consultation. Please use this reference number in future correspondence regarding this consultation.

The Section 7 implementing regulations allow the Service up to 90 calendar days to conclude formal consultation with your agency and an additional 45 calendar days to prepare a Biological Opinion, unless an extension is mutually agreed upon. However, should the project design change, or new information be provided during this 135-day time period, the Service has the right to suspend or extend formal consultation until the new information is evaluated. The Service anticipates providing you with draft Biological Opinion on or before 5 October 2009.

As a reminder, the Act requires that after initiation of formal consultation, the Federal action agency shall not make any irreversible or irretrievable commitment of resources. This practice insures agency actions do not preclude the formulation or implementation of reasonable and prudent alternative measures that avoid jeopardizing the continued existence of endangered or threatened species, or destroying or modifying their critical habitats.

If you have any questions about this letter or your responsibilities under the Act, please contact Kevin Shelley at (360) 753-4325 kevin_shelley@fws.gov, Ron Malecki at (360) 753-4371, ron_malecki@fws.gov or John Grettenberger at (360) 753-6044 john_grettenberger@fws.gov of my staff.

Sincerely,

for Ken S. Berg, Manager
Washington Fish and Wildlife Office

cc:
National Marine Fisheries Service, Lacey, WA (S. Landino)

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

22 July 2009

Ken S. Berg, Manager
Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

Subj: LETTER 13410-2009-I-0082 FROM THE UNITED STATES FISH AND WILDLIFE SERVICE (SERVICE) TO THE DEPARTMENT OF THE NAVY, NAVAL SEA SYSTEMS COMMAND, NAVAL UNDERSEA WARFARE CENTER, KEYPORT RANGE COMPLEX (NAVY)

Dear Mr. Berg:

This letter is in response to the subject letter documenting the Service's non-concurrence with the Navy's determination that the activities proposed to occur within the Keyport Range Complex Extension (KRCE) may affect, but are not likely to adversely affect, the threatened marbled murrelet, and suggesting that the Navy should initiate formal consultation pursuant to Section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)

After a thorough review of the subject letter, the Navy has numerous questions regarding the scientific justification for the Service's determination that the Navy's proposed activities are likely to adversely affect the marbled murrelet, and believes that the Service may require further clarification from the Navy about the proposed action. However, the Navy will agree to and is now requesting that formal consultation regarding the proposed action and the marbled murrelet begin upon receipt of this letter.

If you need additional information or have any questions, please contact Ms. Shaari Unger at (360) 315-2258 or via e-mail at shaari.unger@navy.mil, or Mr. Fabio D'Angelo at (360) 396-5682 or via e-mail at fabio.dangelo@navy.mil.

Sincerely,

Kim X. Bennis

Kim X. Bennis
Head, Operations Services Department

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

JUN 11 2009

In Reply Refer To:
13410-2009-I-0082

Kim X. Bennis
Head, Operations Services Department
Naval Undersea Warfare Center Division
610 Dowell St.
Keyport, Washington 98345-7610

Subject: Department of Navy, Naval Sea Systems Command, Naval Undersea Warfare Center, Keyport Range Complex, (Navy) request to initiate informal consultation for the proposed 2010-2015 extension and increased military operations at the Keyport Range Complex

Dear Ms. Bennis:

This letter is in response to the Navy's subject request, dated December 5, 2008, for review of the subject action under section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). As a follow-up to our May 5, 2009, email message and for the reasons described below, the US Fish and Wildlife Service (Service) does not concur with the Navy's determination that the activities proposed within the Keyport Range Complex Extension (KRCE) "may affect, are not likely to adversely affect" (NLAA) the threatened marbled murrelet (*Brachyramphus marmoratus*) (murrelet).[1]

We arrived at this decision following our review of the information presented in the Biological Evaluation (BE) submitted with the December 5, 2008, request and our review of the supplemental information provided by the Navy on March 31, 2009, and April 14, 2009. The additional information was requested by the Service to better assess the Navy's determinations and enhance our understanding of the potential acoustical effects caused by the Navy's proposed underwater testing of countermeasures and use of active sonar.

[1] The Navy informed the Service on January 21, 2009, that the intended determination for the murrelet was "may affect, not likely to adversely affect," although it was not explicitly stated in the December 5, 2008, request or accompanying biological evaluation.

At the suggestion of your staff, we met on March 31, 2009, to hear more detailed rationale in support of the Navy's NLAA determination for murrelets. The meeting yielded two important outcomes: 1) a general description of the required test conditions for countermeasures and the use of active sonar and 2) a description of the acoustical characteristics of countermeasure testing and active sonar. Neither were sufficiently addressed in the BE in regards to the potential effects that underwater sound pressure levels might have on murrelets.

Specifically, we learned that the 275 countermeasure tests proposed to occur in Puget Sound will have a duration of 8 - 36 hours each, can occur at any depth, and will produce a minimum (source) sound pressure level of 233 dB[2]. Dr. Renken, the Navy's acoustician who attended the March 31, 2009, meeting, further informed us that the sound propagated from countermeasure tests is a "low to mid frequency" continuous sound source. Dr. Renken later provided a report, dated April 14, 2009, in which he estimated a distance of 440 meters for the underwater sound from countermeasures to attenuate to 180 dB[3].

The Navy reported in the BE that the effects to murrelets from countermeasure testing and sonar use, or any other research, testing, development, and experimental activity within the KRCE, would be minimal "given the temporary, localized nature of any disturbance to individuals" (BE, p. 5-13). On this basis, you arrived at a NLAA determination for the effects of the proposed KRCE, which indicates you believe the effects of the KRCE would be insignificant or discountable.

However, the information provided by the Navy indicates some underwater tests will have high sound pressure levels for relatively long durations while murrelets are expected to be present in the test locations. Murrelets may be particularly at risk in the Dabob Bay Range Complex due to the proposed high number of countermeasure tests and the frequent occurrence of murrelets. High underwater sound pressure levels are known to have negative physiological and neurological effects on a wide variety of vertebrate species including fishes and birds (Yelverton et al. 1973, p. 9; Yelverton and Richmond 1981, p. 6; Steevens et al. 1999; Fothergill et al. 2001; U.S. Department of Defense 2002; Cudahy and Ellison 2002) and it's reasonable to assume that murrelets could be similarly affected. This information provides a sufficient basis to reasonably conclude the activities proposed within the KRCE may affect, and are likely to adversely affect murrelets and that some affected individuals may be breeding adults actively incubating or provisioning for nestlings. As a result, we do not concur with the Navy's NLAA determination.

The Service recognizes that the paucity of applicable bioacoustical research creates considerable uncertainty when assessing the potential consequences of murrelets being exposed to sound sources that have different wave characteristics than those studied in the above-cited research. However, the unstable population status of the species (see McShane et al. 2004, p. 3-58) and the biological significance of potential injury to individual murrelets within the KRCE argues for a thorough consideration and a cautious inference of the best available scientific data.

---

[2] re: 1 μPA

[3] 180 dB_{peak} and higher peak underwater sound pressure levels are considered by the Service to have a likelihood to kill or injure marine birds during underwater foraging bouts.

Although our review thus far indicates murrelets are likely to be adversely affected by the proposed action, the Service has not yet evaluated the full extent of effects on murrelets or any other listed resource within the KRCE. A full analysis of the effects related to the research, testing, development, and evaluation proposed within the KRCE will be accomplished in the biological opinion. Through this analysis we will determine the amount and extent of incidental take that may occur.

Prior to initiating formal consultation, the Service requests that the Navy consider developing a suite of conservation measures as part of the proposed activities within the KRCE to avoid or minimize the potential for acoustic impacts to murrelets. Specifically, we encourage the Navy to consider developing conservation measures that reduce or eliminate the exposure of murrelets to both active sonar and continuous underwater, high energy sound by potentially restricting activities seasonally or geographically. When feasible, the Service also encourages the suspension of tests that emit potentially injurious levels of high energy sound when murrelets are observed on the water at a given test site.

Given the established purpose for the KRCE as a research, development, test, and evaluation environment, it seems the suggested conservation measures mentioned above could be integrated into the KRCE test and evaluation program with the goal to test the necessity and/or effectiveness of potential conservation measures. For example, a series of well designed studies could help test the Service's assumption that marine birds are as vulnerable to underwater sound as they are to sound above water, an assumption the Navy pointed out in the BE (p. 5-13) as "untested." This or similar studies could address our mutual interests in designing and implementing cost-effective, scientifically-tested conservation measures without compromising the purpose and need of the KRCE. Given this shared interest, we believe using a collaborative approach to develop a suite of conservation measures would be beneficial for this and future Navy actions that may affect the murrelet or other listed resources in the marine environment.

Finally, the Service's response to your NLAA determination for the threatened bull trout (*Salvelinus confluentus*) in the Coastal Puget Sound interim recovery unit will be provided as a component of the final biological opinion for the murrelet. At your discretion, formal consultation can be initiated anytime following receipt of this letter.

If you have any questions about this letter, please contact Kevin Shelley at (360) 753-4325 (kevin_shelley@fws.gov) or Marc Whisler at (360) 753-4410 (marc_whisler@ fws.gov) of my staff.

Sincerely,

AM Whisler

for Ken S. Berg, Manager
Washington Fish and Wildlife Office

cc:
National Marine Fisheries Service, Lacey, WA (S. Landino)

LITERATURE CITED

Cudahy, E. and W.T. Ellison. 2002. A review of the potential for in vivo tissue damage by exposure to underwater sound. Naval Submarine Research Laboratory, Department of the Navy, Groton, Connecticut, March 12, 2002, 6 pp.

Fothergill, D.M., J.R. Sims, and M.D. Curley. 2001. Recreational scuba diver's aversion to low-frequency underwater sound. Undersea and Hyperbaric Medicine 28(1):9-18.

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon.

Steevens, C.C., K.L. Russell, M.E. Knafeic, P.F. Smith, E.W. Hopkins, and J.B. Clark. 1999. Noise-induced neurological disturbances in divers exposed to intense water-borne sound: Two case reports. Undersea and Hyperbaric Medicine 26(4):261-65.

U.S. Department of Defense. 2002. Record of Decision for surveillance towed array sensor system low frequency active. Federal Register 67(141):48145-54.

Yelverton, J.T. and D.R. Richmond. 1981. Underwater explosion damage risk criteria for fish, birds, and mammals. *In*: 102nd Meeting of the Acoustical Society of America, 36,November 30 - December 04, Miami Beach, Florida. Department of Biodynamics, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico. 36 pp.

Yelverton, J.T., D.R. Richmond, R.E. Fletcher, and R.K. Jones. 1973. Safe distances from underwater explosions for mammals and birds. Lovelace Foundation for Medical Education and Research, Albuquerque, NM, September 26, 1973, 64 pp.

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Monday, June 22, 2009 12:37
To: Hart, George A CIV CNRNW, N40BA
Subject: Re: Murrelets

George; the most sensitive time depends on the stressor. In general, there are two time periods of concern: 1) the breeding period, particularly after nest initiation through the fledging date, due to adults provisioning for young. The breeding period is long due to asynchronous breeding and runs from 1 April to 15 Sept and concerns a small but vital proportion of the population; and 2) during the full pre-basic molt when birds are flightless for up to 2 months and thus mobility is is very restricted and requires birds to be located in close proximity to predictable prey resource - this of course affects all birds and occurs sometime between July through November. So the 2 vital (sensitive) periods
overlap by 2 and a half months. Hope this helps. ks

Kevin Shelley
Senior Fish and Wildlife Biologist

U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102
Lacey, WA 98503 ph. 360-753-9440

"Hart, George A CIV CNRNW, N40BA" <george.hart1@navy.mil>

06/22/2009 08:19 AM

To: <Kevin_Shelley@fws.gov>

cc

Subject: Murrelets

Kevin,

What is the most sensitive time for murrelets within Hood Canal and off the coast? My understanding its from April through July is that correct?
Thanks

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

Opportunity is missed by most people because it is dressed in overalls and looks like work.
Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Tuesday, June 02, 2009 10:20
To: Hart, George A CIV CNRNW, N40BA
Subject: Re: Letter

George; you should receive it this week.

Kevin Shelley, Senior Fish and Wildlife Biologist U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102 Lacey, WA 98503 ph. 360-753-9440

The information contained in this email message and any attachments is strictly confidential. If you are not the intended recipient, you are not authorized to use, disclose, or share this information and the USFWS requests immediate notification by reply mail or telephone and you must delete this message, along with any attachments, from your mail system.

"Hart, George A
CIV CNRNW, N40BA"
<george.hart1@nav
y.mil>
To
<Kevin_Shelley@fws.gov>
cc
06/01/2009 09:03 AM
"Unger, Shaari M CIV NAVSEA KPWA" <shaari.unger@navy.mil>
Subject
Letter

Kevin,

Could you please give me the status of the letter to Keyport? Thanks

George

PS Thanks for the map on the owl and grizzly.

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

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Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Tuesday, May 05, 2009 17:44
To: Hart, George A CIV CNRNW, N40BA
Cc: John_Grettenberger@fws.gov; Marc_Whisler@fws.gov; Ron_Malecki@fws.gov
Subject: Re: Status

George: This email a follow-up to our call earlier today regarding the status of the Navy's two ongoing consultations: Keyport Range Complex Extension and the NW Training Range Complex.

Keyport RCE

The FWS will not be able to concur with the Navy's determination that the activities proposed within the Keyport Complex "may affect, are not likely to adversely affect" the marbled murrelet (note: we learned in our 21 Jan
2009 meeting here in Lacey this was the intended determination of the Navy, although not explicitly stated in the BE on pages 5-13 and 7-1). We arrived at this decision following our analysis of the additional information provided by the Navy in our 31 March meeting where the Navy presented some bioacoustic information to inform our consideration of the effects of countermeasure testing. We will follow this email with a letter to the Navy explaining our decision in greater detail later this week or early next week.

Specifically, the FWS determined that 1) there is a sufficiently high probability that murrelets will be exposed to countermeasure testing at Dabob Bay and 2) the evidence on the effects of the exposure does not support an insignificant or discountable effect, as presented in the BE.
The Navy's conclusion in the Keyport Biological Evaluation states that murrelet exposure "can reasonably be anticipated" (so we agree on that point), but "given the temporary, localized nature of any disturbance to individuals" the impact was considered to be minimal (page 5-13).

Regarding the second point, in response to questions raised by the FWS on 10 March, the Navy presented additional information at the 31 March meeting to support the "minimal impact" finding (the written response was provided on 3 April). The FWS found the information useful towards understanding the basic physics of sound and the nature of countermeasure testing. In addition, the Navy provided a findings report by Dr. Renken on 14 April 2009, concerning the modeled S5 sound scource - deemed by Dr. Renken as a reasonable surrogate for modeling the unknown sound attributes of countermeasures. Dr. Renken's estimate of a 440 meter radius to 180 dB really helped with the FWS exposure analysis from countermeasures.

From the Navy's supplemental information, we disagree the disturbance is "temporary" as stated in the BE, given the lengthy duration of 8 -36 hrs per test and over 250 tests. In addition, the high SPL, the frequency (continuous SPL of 233 dB at source, we guessed at a range of frequencies from 0.8 -10 kHz), and the absence of directly applicable bioacoustical research on the consequences of such an exposure to marine birds (no testing on birds of a given sound type doesn't imply no effect) adds to the reasoning behind not agreeing with the Navy's inference that the impact would be "minimal." On the other hand, the FWS has not yet determined to what extent murrelets will be affected by Keyport activities - a more thorough analysis will be done in biological opinion to determine if incidental take is to be expected. Thus, it is premature to conclude or infer that any of the activities at Keyport will result in "incidental take" (harm or harass) as defined by the regulations governing Section 7 of the ESA.

NW Training Range Complex

We agreed earlier today to meet on May 13 here in Lacey to discuss the additional information needs to initiate formal consultation. During that meeting, we will discuss the nature of the proposed action and focus our discussion on the exposure/stressors we expect on marine and terrestrial-listed resources and hopefully establish a timeframe to initiate formal consultation.

I look forward to working with you to ensure I have a clear understanding of the biological implications for ESA resources so the FWS can complete consultation in a timely manner so the Navy can achieve these critical objectives.

Kevin Shelley, Senior Fish and Wildlife Biologist U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102
Lacey, WA 98503 ph. 360-753-9440

"Hart, George A
CIV CNRNW, N40BA"
<george.hart1@nav
y.mil>

To: <Kevin_Shelley@fws.gov>

05/01/2009 01:30
PM

cc: "Unger, Shaari M CIV NAVSEA KPWA" <shaari.unger@navy.mil>, "Kler, Kimberly H CIV NAVFAC NW, EV1" <kimberly.kler@navy.mil>

Subject: Status

Kevin,

Thought I would touch base with you to see what the status of the Keyport consultation might be. I

know we have had further discussions but if you remember we were hoping for a April 1, 2009 finish on the consultation.
Since that has long gone by the wayside do we have a new date that we may shoot for? We are hoping it will be rather soon so we can complete our routing process of the document. Thanks in advance and look forward to hearing from you.

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

Opportunity is missed by most people because it is dressed in overalls and looks like work.
Thomas A. Edison
US inventor (1847 - 1931)

From: Hart, George A CIV CNRNW, N40BA
To: Kevin_Shelley@fws.gov;
cc: Unger, Shaari M CIV NAVSEA KPWA;
Kler, Kimberly H CIV NAVFAC NW, EV1;
Subject: Status
Date: Friday, May 01, 2009 13:30:46

Kevin,

Thought I would touch base with you to see what the status of the Keyport consultation might be. I know we have had further discussions but if you remember we were hoping for a April 1, 2009 finish on the consultation. Since that has long gone by the wayside do we have a new date that we may shoot for? We are hoping it will be rather soon so we can complete our routing process of the document. Thanks in advance and look forward to hearing from you.

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

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Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Tuesday, April 14, 2009 15:01
To: Hart, George A CIV CNRNW, N40BA
Cc: D'angelo, Fabio G CIV NAVSEA KPWA; Kler, Kimberly H CIV NAVFAC NW, EV1; Wallis, Renee B CIV CNRNW, N40; Ron_Malecki@fws.gov; Unger, Shaari M CIV NAVSEA KPWA
Subject: Re: Response's to Questions

George; The FWS will add any new information contained in the response to that already being considered. Unfortunately, despite being lengthy, the response was relatively weak in addressing the central issues for Section 7 analyses (raised in my email) and capturing the salient points of our March 31 meeting.

For the record, I believe the most informative outcomes from our meeting was what we learned about 1) the sound characteristics of countermeasures (source level of 230 dB (minimum), low to mid frequency - continuous wave type, 36 hr duration, and up to 5 times per week) and 2) active sonar.
Given the location, frequency, and duration of countermeasure testing and the use of low to mid frequency active sonar, the FWS is being dilegent in our assessment on whether or not there's a reasonable likelihood of a measureable effect on bull trout or murrelets. I'll let you know what we decide.

Kevin Shelley, Senior Fish and Wildlife Biologist U.S. Fish and Wildlife Service, WA Fish and Wildlife Office Complex Division of Consultation and Technical Assistance 510 Desmond Dr. SE, Ste. 102
Lacey, WA 98503 ph. 360-753-9440

(See attached file: USFWS Ensonification volumes – Peak 180 (2).doc)

Ensonification Radii for USFWS – requested during informal consultation 3/31/09

by Dr. Martin Renken - 14 April 2009

The information provided in the final table was requested at an informal consultation with the USFWS regarding the biological opinion related to the marbled murrelet and the bull trout. The question concerned the acoustic effects of RDT&E systems tested on the Keyport range complex. Information from the Draft EIS (tables C-2 and C-3) was used to describe the relevant acoustic parameters of representative acoustic sources. These representative acoustic sources were used for modeling the impacts on marine mammals pursuant to the MMPA. The modeling and the exact use of these sources is described in Appendix C of the DEIS/OEIS. For USFWS purposes, these two tables are given below.

The information in these tables was used in a simplified model of underwater transmission to estimate an approximate radius for the ensonification volume of each acoustic source. Note the information conveyed in Table 1 of this report is to be used to provide a rough idea of the effects of sound in the underwater environment, and more specifically the range from each acoustic source to a specific level. However, as discussed in Appendix C, modeling underwater acoustic propagation is quite complex. The numbers in Table 1 below do not account for different environmental provinces, land shadowing or a whole host of other effects encountered in underwater propagation. Consequently, the information provided in this report should only be considered an indication of the approximate range of acoustic effects, not a thorough quantitative analysis. The level (180 dB re 1 μPa) used to establish the ensonification volume radii shown in Table 1 was chosen from conversations with the USFWS.

The results in Table 1 account for the source frequency, output pressure level and the directivity of each source. For sea-birds it is assumed that the peak sound pressure level is the important parameter of the acoustic effect (using the discussion from the WSDOT study). Consequently, Table 1 reports the radius (or distance) from the source to a peak sound pressure level of 180 dB re 1 μPa. Two radii are given for each source, corresponding to the horizontal and vertical directivity of each source.

Table C-2 (from DEIS/OEIS). Representative Acoustic Sources Employed in NAVSEA NUWC Keyport Range Complex

Source Designation	Source Description	Frequency Class	Takes Reported
S1	Sub-bottom profiler	Mid-frequency	Per 4-hour run
S2	UUV source	High frequency	Per 2-hour run
S3	REMUS Modem	Mid-frequency	Per 2-hour run
S4	REMUS-SAS-HF	High frequency	Per 2-hour run
S5	Range Target	Mid-frequency	Per 20-minute run
S6	Test Vehicle 1	High-frequency	Per 10-minute-run
S7	Test Vehicle 2	High-frequency	Per 10-minute-run
S8	Test Vehicle 3	High-frequency	Per 10-minute-run

Table C-3 (from DEIS/OEIS). Description of Representative Acoustic Sources Used at NAVSEA NUWC Keyport Range Complex

Source Designation	Center Freq	Source Level *(dB re 1 μPa @ 1 m)*	Emission Spacing	Vertical Directivity	Horizontal Directivity
S1	4.5 kHz	207 dB	0.2 m	20 deg	20 deg
S2	15 kHz	205 dB	1.9 m	30 deg	50 deg
S3	10 kHz	186 dB	45 m	60 deg	360 deg
S4	150 kHz	220 dB	1.9 m	9 deg	15 deg
S5	5 kHz	233 dB	93 m	60 deg	360 deg
S6	20 kHz	233 dB	45 m	20 deg	60 deg
S7	25 kHz	230 dB	540 m	20 deg	60 deg
S8	30 kHz	233 dB	617 m	20 deg	60 deg

Table 1 – Radius to 180 dB (re μPa) from representative source

Source Designation	Vertical Radius (m)	Horizontal Radius (m)
S1	4	4
S2	5	7
S3	< 1	2
S4	6	9
S5	220	440
S6	70	350
S7	50	145
S8	65	180

Note, for peak levels greater than 180 dB, the first four sources have negligible radii. So only the last four sources should be considered. As shown in Table C-2, the duration of the runs for these sources is measured in minutes.

-----Original Message-----
From: Hart, George A CIV CNRNW, N40BA
Sent: Thursday, March 19, 2009 9:06
To: Kevin_Shelley@fws.gov; Unger, Shaari M CIV NAVSEA KPWA; D'angelo, Fabio G CIV NAVSEA KPWA
Subject: Meeting to respond to questions pertaining to the Keyport EIS
Importance: High

Kevin and Team,

I would like for us to set up a meeting the week of 30 March to further respond to the request for additional information on the Keyport EIS and Biological Evaluation. I am available any day that week. I would suggest a
2 hour meeting and I suggest the agenda follow the requested information email. Please RSVP with your availability for that week. Please respond to all with your availability. Thanks.

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

Opportunity is missed by most people because it is dressed in overalls and looks like work.
Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Hart, George A CIV CNRNW, N40BA
Sent: Monday, March 16, 2009 11:09
To: Kevin_Shelley@fws.gov
Cc: Hart, George A CIV CNRNW, N40BA
Subject: RE: GIS Layers

Kevin,

As soon as we have the shape files ready I will ensure you have a set.

For tomorrow I am bringing Shaari and Fabio (both from Keyport) with me to assist in answering your questions. What is your reference on the hair cells being damaged in some diving birds?

I must admit I was a little surprised from your email especially after our meeting where we discussed this project extensively. We were basing a lot of our determinations on the lack of the species being in the area and the amount of time that activity is conducted.

If you remember we had made a not likely to adversely affect determination on both the Murrelet and the Bull trout.

On the entanglement of sea turtles with parachutes please refer to pages 5-9 and 5-10 for the explanation as to why we believe no entanglement will occur.

Look forward to the meeting tomorrow.

George

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

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Thomas A. Edison
US inventor (1847 - 1931)

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Friday, March 13, 2009 15:27
To: Hart, George A CIV CNRNW, N40BA; Ron_Malecki@fws.gov
Subject: GIS Layers

George; when you come to Lacey on tues, could you come prepared to talk about sharing GIS data for our analysis. We need shapefiles of the activity areas. The data will be particularly helpful for establishing the Action Area for NTRC so we can do our spatial analysis. Thanks. ks

-----Original Message-----
From: Kevin_Shelley@fws.gov [mailto:Kevin_Shelley@fws.gov]
Sent: Tuesday, March 10, 2009 10:55
To: Hart, George A CIV CNRNW, N40BA
Cc: Marc_Whisler@fws.gov; Ron_Malecki@fws.gov; John_Grettenberger@fws.gov
Subject: Keyport Consultation

George: after a bit more thorough read of the BA/BE and the BA/BE summary you provided at our 11 Feb 2009 meeting, we have a few details we still need addressed on the subject action concerning effects to bull trout and the marbled murrelet.

1. The Navy's argument submitted for the effects of vessel movement and aircraft overflights being discountable (and I think other activities as well) is based upon the premise of a small potential for exposure (ie. "small increase in vessel movement or aircraft overflight would not affect the species overall..." and "the area is very large and there is a very small potential of any interaction with the species..." Perhaps you are arguing that habituation by the species has occurred and the increase, based upon some evidence, will not change that habitatuation?

As you know, we don't consult on the effects of increases in activities, per se. We consult on the effects of activities and, as the information in the BA/BE is presented, we cannot evaluate the validity of the Navy's argument with the information currently contained in the BA/BE. The Navy's proposed vessel and flight activities need a better description:
frequency, flight altitudes, duration, intensity, location, etc. for each activity. In other words, we have no spatial or temporal reference information to evaluate the argument, nor can we locate sufficient

characterization of proposed frequency, duration, intensity, or location to assess species response. For example, if there are not seasonal timing restrictions on all or some vessel and overflight activities, that should be stated.

Please realize that the biological relevance of the Navy's past use of the current Keyport Range is not a vital component of our evaluation of your effects determination for the proposed new and expanded Keyport Range. While it helps the FWS appreciate how the proposal will increase the scale of current activities, it doesn't lend much insight to a species response. If the current activities are disrupting (reducing) or imparing (stopping) habitat use of important seasonal habitat (that otherwise would reasonably recieve more use if the current activities were not present), then I'd like to know that. Then you are set to display the effects of the increase. So, I suggest displaying the effects of the proposal from the perspective of comparing species response under 2 scenarious: with and without the proposed activities.

To get what we need, I suggest a focus on three physical areas: the photic zone, 5 miles off the coast, and the area beyond 5 miles defined by the most intense sound generating activities that would reasonbly be expected to attentuate into the photic zone or 5 miles off the coast - where murrelets and bull trout exposure and their prey is most likely.

This is important because the BA/BE and BE summary you provided states "sound levels from acoustic sources may reach the USFWS behavioral effect threshold but would not exceed the threshold for injury" for murrelets. We all know that injury can occur to listed species and their prey when sound is sufficiently high, but the BA offers no supporting information to the statement. We also now know there is information available that acoustic sources can damage the hearing (hair cells) in some diving birds, especially frequencies in the medium to high range used in sonar. How did you consider this potential for a significant effect to murrelets and yet arrive as such a clear conclusion that injury would be avoided?

The statement in the previous paragraph literally states that a behavioral effect may occur. But again, we didn't see information in the BA/BE to help us sufficiently minimize the likelihood of occurence other than "it is a big area." Without clarification, the statement implies that the threshold for significant effects, maybe even harassment (incidental take), is a reasonable expectation from the Navy's proposal. Disclosing the possibility is fine, in fact, necessary. However, the argument for insignificance is dependent on the Navy ruling-out or at least, demonstrating, with some reasoning, that the effect is highly unlikely to occur. The BE summary you provided did not display the reasoning behind most of the the statements concluding avoidance of significant effects.
The reasoning could be added using the same format of the 11 Feb. table you provided for each stressor.

Uncertainty is okay, as long as we have fully considered the best available information. As you know, I can't evaluate your conclusion for discountable effects (based on a low exposure potential) or insignificant effects (based upon the proposed activity types, frequency, duration, etc.
that are extremely unlikely to produce an effect that is measurable or biologically meaningful) in the absence of some direct or indirect evidence and/or reasoning supporting the determination. Without this information, our evaluation of your determination is much more difficult and time consuming.

2. We request general information describing the timing and location of the

submarine testing activities. When (seasonally) will they occur, what specific activities will be occurring, and where (we care most about the photic zone for bull trout and within 5 miles of shore for marbled murrelet).

3. Re: inert mine detection: are there any type of sensors/anti-mine systems that, when used, may potentially impact species if they are in the testing area? A list of activities related to this training element would be a good start.

4. Re: countermeasures. Apparently there are units that emit sounds "louder than the target" and others that "emit acoustic energy of varying frequencies into the water." The frequencies and sound intensity should be reported and assessed for species impacts.

5. Re: expendable materials and other waste materials. we request estimates by volume (by weight or some other measure) and material types scaled to units over time. Various polymers and other similar potential contaminants are an increasing concern among scientists in the marine environment because they may pose a risk to species or the food web when ingested. For example, parachutes deployed over marine waters, as with plastics, may expose seaturtles to injury or death if they consume them or are entangled (you stated "no entanglement" risk, but offered no explanation why). Recent (in 2008 I think) photos in the news of an albatros necropsy that discovered a golf ball lodged in its' digestive tract is sufficient evidence for our Agencies to do our dilegence in assessing the Navy's waste materials.

If you have already provided this key information, we need your help in locating it. Thanks in advance for you help.

Kevin Shelley, Senior Fish and Wildlife Biologist USFWS, Washington Fish and Wildlife Office Complex 510 Desmond Dr. SE, Suite 102
Lacey, WA 98503 ph. 360.753.9440

-----Original Message-----
From: Hart, George A CIV CNRNW, N40BA
Sent: Monday, February 09, 2009 14:29
To: kevin_shelley@fws.gov
Cc: Hart, George A CIV CNRNW, N40BA; Unger, Shaari M CIV NAVSEA KPWA
Subject: Keyport EIS
Importance: High

Kevin,

I notice from the email traffic that you have inherited the Keyport Range Complex Extension EIS. The Navy representatives met with your office about 3 weeks ago to discuss the DEIS as there were some questions. Out of this meeting we were to provide a table with the determinations based on species availability in the areas of Keyport, Dabob, and Quinault on the coast. Your office agreed to provide that data or information.

We received a two page document that unfortunately was full of EOD areas and our project is not associated with EOD. We have no EOD explosions. I would very much like to meet with you ASAP and give you the table with our determinations and further discuss any issues or concerns that may remain. Thanks for your time and patience.

V/R
George

PS. I left you a voice mail as well.

George A. Hart
NRNW N40BA, Biologist
Navy Region Northwest
1101 Tautog Circle
Silverdale, Wa. 98315
Phone 360-315-5103
Fax 360-315-5095

"Life is not a journey to the grave with the intention of arriving safely in a pretty and well preserved body........ but rather to skid in broadside, thoroughly used up, totally worn out, and loudly proclaiming -- WOW--WHAT A RIDE!!"

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/250-08

DEC 5 2008

Mr. Ken S. Berg, Manager
Western Washington Fish and Wildlife Office
U.S. Fish and Wildlife Service
510 Desmond Drive SE, Suite 102
Lacey, WA 98503

Dear Mr. Berg:

Subj: NAVSEA NUWC KEYPORT RANGE COMPLEX EXTENSION BIOLOGICAL EVALUATION

Naval Undersea Warfare Center Division, Keyport (NAVSEA NUWC Keyport) is seeking your concurrence with the determinations made in the enclosed Biological Evaluation (BE). The BE assesses possible impacts to both U.S. Fish and Wildlife Service and National Marine Fisheries Service listed species that potentially occur within the NAVSEA NUWC Keyport Range Complex.

Please forward any comments on the BE and your concurrence to me at the address above. A determination of concurrence on the BE received by March 31, 2009, would be most appreciated. If you need additional information or have questions, please feel free to contact Mr. Fabio D'Angelo who can be reached at (360) 396-5682 or via email at fabio.d'angelo@navy.mil.

Sincerely,

Kim X. Bennis

KIM X. BENNIS
Head, Operations Services Department
By direction of
the Commander

Enclosure: 1. NAVSEA NUWC Keyport Range Complex Extension Biological Evaluation (October 2008)

Copy to: Western Washington Fish and Wildlife Office
U.S. Fish and Wildlife Service
Attn: John Grettenberger, Supervisor
Consultation and Technical Assistance Division
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503

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Coastal Zone Management Act

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

September 30 , 2008

Mr. Jeffery Barnick
Department of the Navy
Naval Undersea Warfare Center Division
610 Dowell Street
Keyport, Washington 98345

RE: Federal Consistency – Extension of the Range Sites at the Keyport Range Complex

Dear Mr. Barnick:

The Department of Ecology, Shorelands and Environmental Assistance Program received your Coastal Zone Management Consistency determination for the proposed extension of the range sites at the Naval Undersea Warfare Center Division, Keyport Range Complex. The complex is comprised of the Keyport Range Site in Kitsap County, the Dabob Bay Range Complex in Jefferson and Kitsap Counties, and the Quinault Underwater Tracking Range Site off the coast of Jefferson County, Washington. The proposed extension includes portions of Kitsap, Mason, and Grays Harbor Counties.

Upon review of the proposed action, Ecology agrees with your determination and assessment that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management Program and will not result in any significant impacts to the State's coastal resources.

If you have any questions regarding this letter please contact Jessica Moore at (360) 407-7421.

Sincerely,

Brenden McFarland, Section Manager
Environmental Review and Transportation Section
Shorelands and Environmental Assistance Program

cc: Jessica Moore, Ecology

DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 172/197-08
SEP 5 2008

Ms. Loree Randall
Federal Consistency Coordinator
Shorelands and Environmental Assistance Program
Department of Ecology
PO Box 47600
Olympia Washington 98504

Dear Ms. Randall:

Pursuant to the National Environmental Policy Act, the Navy is preparing an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to analyze the potential impacts of a proposed action which involves the extension of the range sites at the Naval Undersea Warfare Center Division, Keyport Range Complex. To comply with Subpart C of the National Oceanic and Atmospheric Administration, Federal Consistency Regulation, 15 CFR 930 and Coastal Zone Management Act §307(c)(1), we are submitting a Coastal Zone Consistency Determination (CCD) for Federal Facilities (Enclosure 1).

The Naval Undersea Warfare Center Division, Keyport Range Complex is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the Coast of Jefferson County. The proposed extension of the Keyport Site remains within Kitsap County, while the DBRC Site and QUTR Site extensions would also include portions of Mason County and off the Coast of Grays Harbor County, respectively. No facilities will be constructed or alterations to the shoreline will occur as part of the proposed action. A detailed description of the proposed action is attached as Enclosure 2.

Based on the effects analysis conducted during the development of the EIS/OEIS, the proposed action was determined to be consistent to the maximum extent practicable with the State of Washington's Shoreline Management Act RCW 90.58 et seq. and the associated counties' Shoreline Management Master Programs. Enclosures (3) and (4) are copies of your previously issued Federal Consistency Concurrence Letters for similar activities performed at the Keyport Site (Navy 2003 Autonomous Underwater Vehicle Fest) and DBRC Site (Adoption and Implementation of an Operations and Management Plan), respectively.

If you have further question concerning this CCD, please feel free to contact Mr. Carl Haselman at (360) 396-5430 or email: carl.haselman@navy.mil.

Sincerely,

JEFFERY W BARNICK
Head, Infrastructure Services Division
By direction of
the Commander

COASTAL ZONE CONSISTENCY DETERMINATION
FOR FEDERAL ACTIVITIES

Project Description: The activity is located at the NAVSEA Naval Undersea Warfare Center Division, Keyport Range Complex which is comprised of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay. The DBRC Site is located in Hood Canal and Dabob Bay, and is within Jefferson and Kitsap counties. The QUTR Site is located off the coast of Jefferson County. The action involves the extension of the range sites. The associated action alternative for the Keyport Range Site remains within Kitsap County, the DBRC Site alternatives are located in Kitsap, Mason and Jefferson counties, and the QUTR Site alternatives are located in Jefferson and Grays Harbor counties. **See Enclosure 2 for more details.**

This action under Coastal Zone Management Act (CZMA) §307(c)(1) is for activities which will take place within Washington's coastal zone, or which will affect a land use, water use or natural resource of the coastal zone. (*The coastal zone includes Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, Wahkiakum and Whatcom counties.*)

The action complies with the following enforceable policies of the Coastal Zone Management Program (CZMP):

1. Shoreline Management Act (SMA):

Is outside of SMA jurisdiction	(X)		
Is under current SMA application	( )	SMA#__________	Date Issued_______
Has a valid Shoreline Permit	( )		
Has received an SMA Exemption	( )		

2. State Water Quality Requirements:

Does not impact water quality	(X)		
Is under current water quality application	( )		
Has received a short-term modification of water quality standards	( )	Mod# __________	Date Issued_______
Has received a 401 Certification	( )	401# __________	Date Issued_______

3. State Air Quality Requirements:

Does not impact air quality	(X)		
Is under current application for air permit	( )		
Has received an air permit from the local air authority	( )	Air Permit #______	Date Issued_______

Enclosure (1)

PROPOSED PROJECT DESCRIPTION

INTRODUCTION

The Department of the Navy (Navy) proposes to extend the operating areas of the Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex in Washington State, and marginally increase the use of selected range sites for Research, Development, Test, and Evaluation (RDT&E) activities conducted by NUWC Keyport. The NUWC Keyport Range Complex is comprised of the Keyport Range Site, the Dabob Bay Range Complex (DBRC) Site, and the Quinault Underwater Tracking Range (QUTR) Site (Figure 1). The Keyport Range Site is located in Kitsap County and includes portions of Liberty Bay and Port Orchard Reach. The DBRC Site is located in Hood Canal and Dabob Bay, in Jefferson and Kitsap counties. The QUTR Site is located in the Pacific Ocean off the Coast of Jefferson County.

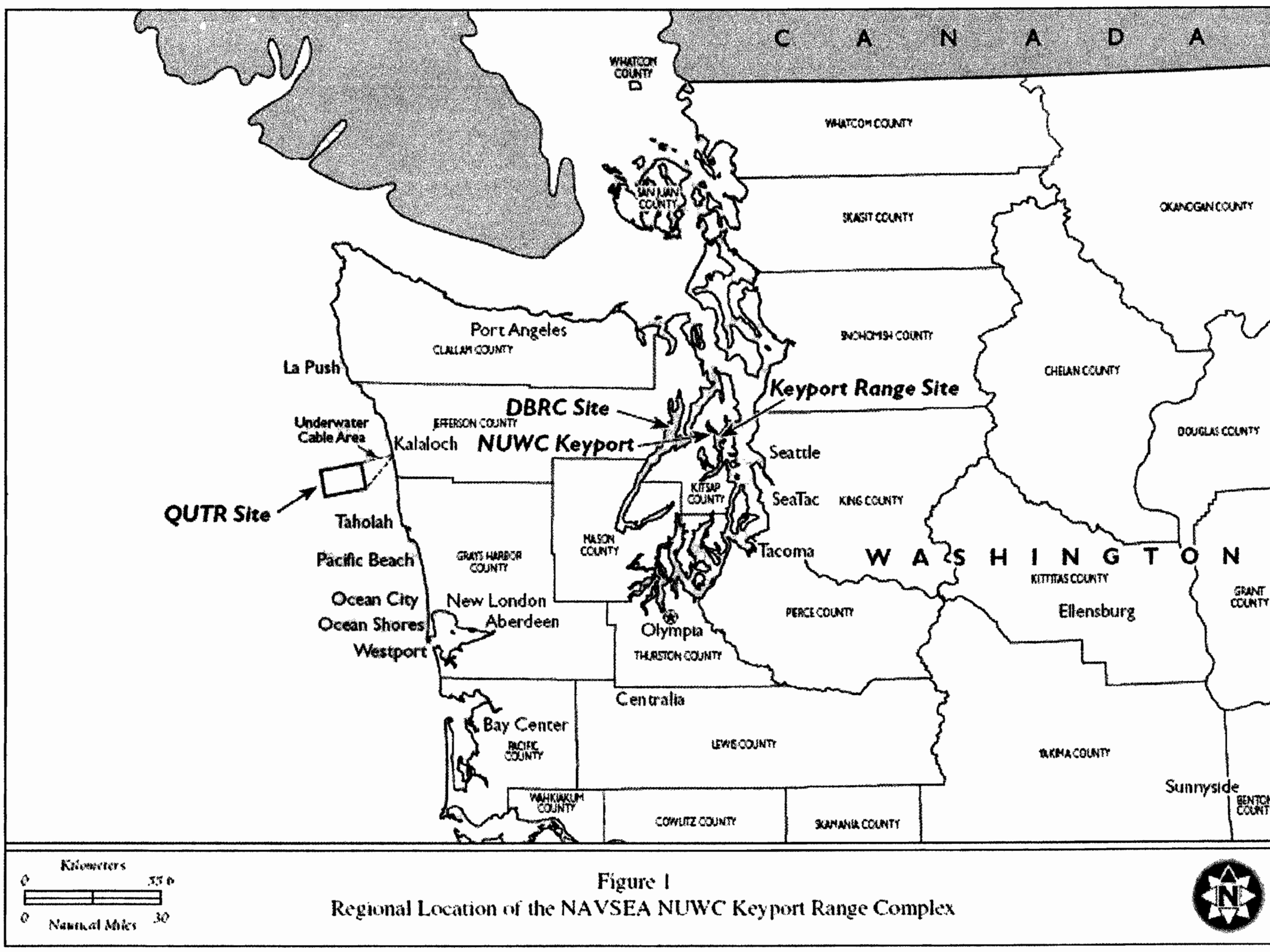


Figure 1
Regional Location of the NAVSEA NUWC Keyport Range Complex

Historically, the average annual days of use at each range site have been approximately 60 days for the Keyport Range Site, 130 days for the DBRC Site, and 20 days for the QUTR Site. Currently, the average annual range utilization is 55 days for the Keyport Range Site, 200 days for the DBRC Site, and 14 days for the QUTR Site. In addition to extensions of the Keyport Range and QUTR sites, the Proposed Action includes small increases in the average annual number of tests and days of testing at those range sites. The Proposed Action at the DBRC Site involves extension of the operating area only; no increase in operational tempo beyond the current level of activity is proposed for the DBRC Site. Changes in national security requirements may affect the number of days per year that range sites are used.

Enclosure (2)

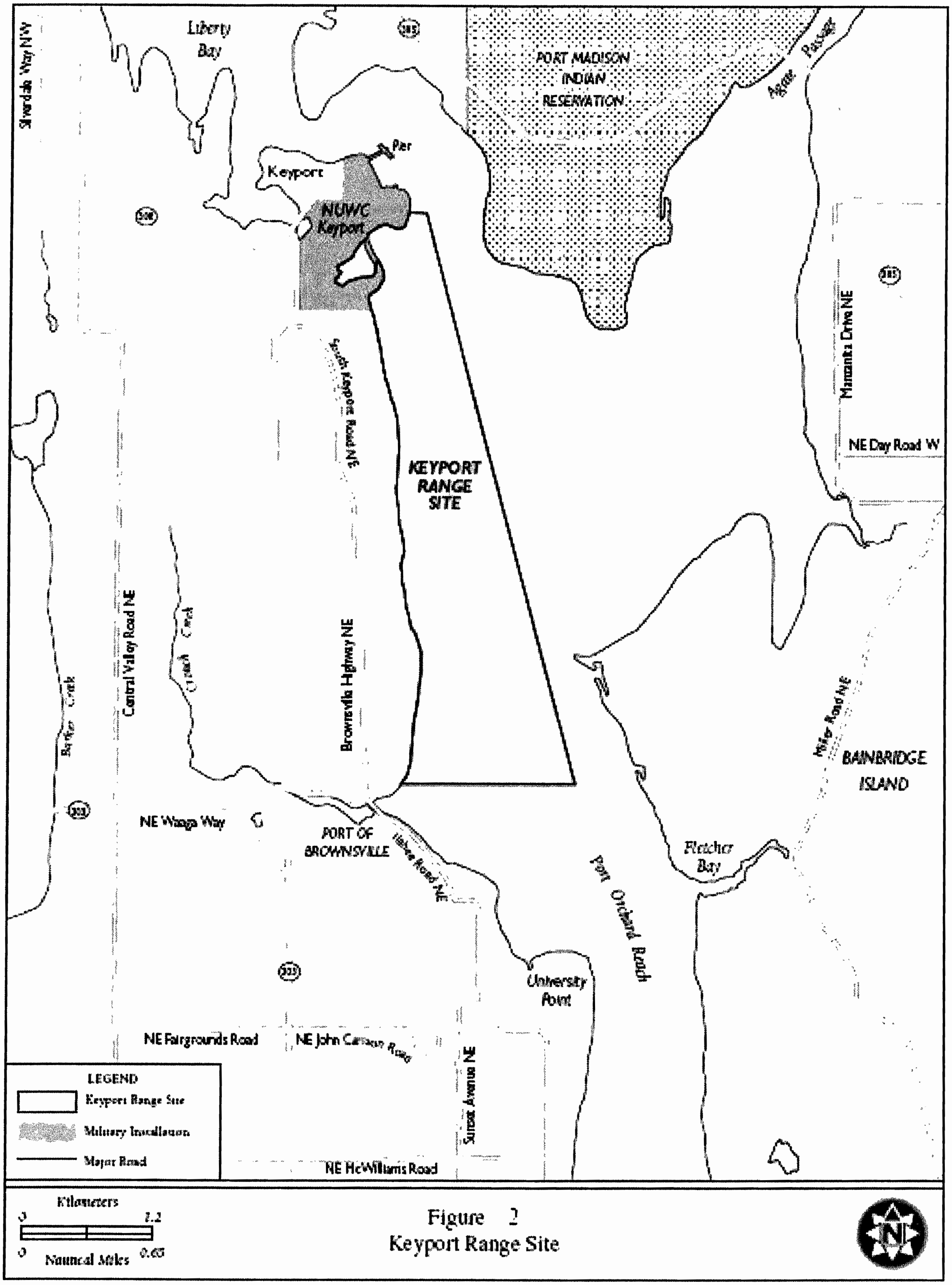


Figure 2
Keyport Range Site

Primary activities at the DBRC Site support proofing of underwater systems, research and development test support, and Fleet training and tactical evaluations involving aircraft, submarines, and surface ships. Tests and evaluations of underwater systems, from the first prototype and pre-production stages up through Fleet activities (inception to deployment), ensure reliability and availability of underwater systems and their Fleet components. As with the Keyport Range Site, there are no explosive warheads tested or placed on test units within the DBRC Site. The DBRC Site also supports acoustic/magnetic measurement programs. These programs include underwater vehicle/ship noise/magnetic signature recording, radiated sound investigations, and sonar evaluations. In the course of these activities, various combinations of aircraft, submarines, and surface ships are used as launch platforms. Test equipment may also be launched or deployed from shore off a pier or placed in the water by hand.

NUWC Keyport conducts activities in four underwater testing areas at the DBRC Site:

• Dabob Bay MOA – a deep-water range in Jefferson County approximately 14.5 nm^2 (49.9 km^2) in size. The acoustic tracking space within the range is approximately 7.3 by 1.3 nm (13.4 by 2.3 km) (9 nm^2 [31 km^2]) with a maximum depth of 600 ft (183 m). The Dabob Bay MOA is the principal range and the only component of the DBRC Site with extensive acoustic monitoring instrumentation installed on the seafloor, allowing for object tracking, communications, passive sensing, and target simulation. Activities within the Dabob Bay MOA are supported by land based facilities at Zelatched Point. The Zelatched Point area occupies 28 acres (11 ha) of land owned by the Navy overlooking Dabob Bay. There is also a landing pad at Zelatched Point to support helicopter activities.

• Hood Canal MOAs – two deep-water operating areas adjacent to Naval Base Kitsap-Bangor in Hood Canal with an average depth of 200 ft (61 m). Hood Canal MOA South is approximately 4.5 nm^2 (15.4 km^2) in size and Hood Canal MOA North is approximately 7.9 nm^2 (27.0 km^2). The Hood Canal MOAs are used for vessel sensor accuracy tests and launch and recovery of test systems where tracking is optional.

• Connecting Waters – the portion of the Hood Canal that connects the Dabob Bay MOA with the Hood Canal MOAs (Figure 3). The shortest distance between the Dabob Bay MOA and Hood Canal MOA South by water is approximately 3.8 nm (7.0 km) and the total area of the Connecting Waters is approximately 5.8 nm^2 (19.8 km^2). Water depth in the Connecting Waters is typically greater than 300 ft (91 m). The connecting waters are used for vessel traffic, sensor accuracy tests, and launch and recovery of test systems where tracking is optional.

The Dabob Bay and Hood Canal MOAs are charted as Naval Operating Areas on NOAA Navigation Chart 18458.

QUTR Site

The Navy has conducted underwater testing at the QUTR Site since 1981 and maintains a control center at the Kalaloch Ranger Station. As at the other range sites, no explosive warheads are used at the QUTR Site. The QUTR Site is a rectangular-shaped test area of about 48.3 nm^2 (165.5 km^2), located approximately 6.5 nm (12 km) off the Pacific Coast at Kalaloch, Washington (Figure 4). Water depth at the QUTR Site is less than 400 ft (122 m). It lies within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS). The QUTR Site is instrumented to track surface vessels, submarines, and various undersea vehicles. Bottom sensors are permanently mounted on the sea floor for tracking and are maintained and configured by the Navy. The sensors are connected to the shore via cables, which extend under the beach to the bluffs and end at a Navy trailer and communication tower in Kalaloch (National Park Service property). In addition, portable range equipment may be set up prior to conducting various activities on the range and removed after it is no longer needed. All communications are sent back to NUWC Keyport for monitoring. QUTR Site use averages 14 days/year offshore and minimally for surf-zone activities. The shoreline near Kalaloch has been used in the past to

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to enable NUWC Keyport to continue fulfilling its mission of providing test and evaluation services and expertise to support the Navy's evolving manned and unmanned vehicle program activities. NUWC Keyport has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare. Range support requirements for such activities include testing, training, and evaluation of system capabilities such as guidance, control, and sensor accuracy in multiple marine environments (e.g., differing depths, salinity levels, sea states) and in surrogate and simulated war-fighting environments.

Technological advancements in the materials, instrumentation, guidance systems, and tactical capabilities of manned and unmanned vehicles continue to evolve in parallel with emerging national security priorities and threat assessments. In response, range requirements and vehicle test protocols must also evolve in order to provide effective program support for such changes. To be effective, the range complex must offer the necessary combination of physical characteristics (e.g., sufficient operating area for vehicle maneuverability and monitoring; variations in water depth; shore access; substrate diversity; dynamic sound and buoyancy characteristics) to satisfy the emerging test and evaluation criteria for each type of vehicle. Examples of emerging requirements in undersea vehicle testing include: 1) an increased focus on littoral threat environments such as shorelines, bays, and harbors; 2) a greater ability to differentiate between multiple, widely separated targets of different types (including false targets); 3) deeper water environments up to 4,500 feet (ft) (1,372 meters [m]); 4) increased opportunities for larger, combined exercise test/training scenarios involving Fleet assets; and 5) greater availability of real-world testing in actual surf-zone conditions instead of simulated surf conditions.

The Proposed Action to extend the existing operational boundaries of the NUWC Keyport Range Complex is needed because the existing Range Complex is becoming increasingly incapable of satisfying the existing and evolving operational capabilities and test requirements of next-generation manned and unmanned vehicles. In some cases, test plans have already had to be scaled down to contain test activities within the current range boundaries. The operational endurance and sensor capabilities of such vehicles are expected to continue to expand, and the Navy needs an expanded test range capability to match the projected operational and test requirements. Extending the Range Complex operating areas beyond the current boundaries would enable the Navy to support future vehicle test requirements, including evolving manned and unmanned vehicle program requirements in multiple marine environments.

PROPOSED ACTION

The Proposed Action would provide additional operating space outside the existing operational areas to support existing and evolving range activities by NUWC Keyport. The scope of the Proposed Action includes only those activities scheduled and coordinated by NUWC Keyport.

Keyport Range Site

The proposed Keyport Range Site extension would increase the size of the range from approximately 1.5 nm^2 to 3.2 nm^2 (5.1 km^2 to 11.0 km^2), thereby providing more operational space for NUWC Keyport activities. The range would be extended to the northeast and east, and to the south in Port Orchard Reach near University Point (Figure 5). This would extend the available operating area to include more east, west and north-south maneuvering room, and also incorporate the pier associated with NUWC Keyport. Creating any new designation on standard NOAA navigational charts would occur as a separate action after the ROD.

Thermal propulsion systems are not currently used in the Keyport Range Site; under the Proposed Action, thermal propulsion test vehicles would be used about 5 times per year, and electrical/chemical propulsion test vehicle use would increase from 45 (currently) to 55 times per year. In addition, the average number of days on which activities would occur at the Keyport Range Site would increase to 60 from the current average of 55 days per year.

The pier facility at Keyport includes the berthing, docking, loading, configuration management for craft, pier-side launch, recovery, recovery and acoustic test facility (ATF) which is a facility to test sections of acoustics without the system moving through the water.

DBRC Site

The Proposed Action would extend the southern boundary of the DBRC Site approximately 10 nm (19 km) to the Hamma Hamma River and extend the northern boundary to 1 nm (2 km) south of the Hood Canal Bridge (Highway 104) (Figure 6). This would increase the size of the current operating area from approximately 32.7 nm^2 (112.1 km^2) to approximately 45.7 nm^2 (156.7 km^2) and would afford a straight run of approximately 27.5 nm (50.9 km). The creation of any new designation on standard NOAA navigational charts would occur as a separate action after the ROD.

The number of proposed activity days would remain the same as the current level (200 days/year) for the DBRC Site. The only exception is the addition of testing of Unmanned Aerial Systems (UAS). The average annual days of use would also not change. The proposed range extensions would allow the opportunity to test systems in areas where freshwater comes from large rivers (e.g., Duckabush River, Hamma Hamma River) to form freshwater layers, changing the dynamics of underwater sound and buoyancy. The proposed range extensions would also allow for a longer vehicle track with the areas connected throughout the DBRC Site.

A variety of UASs would potentially be tested at the DBRC Site. UASs are remotely piloted or self piloted (i.e., preprogrammed flight pattern) aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. They can carry cameras, sensors, communications equipment, or other payloads. UASs can vary in size up to approximately 10 ft (3 m) in length, with gross vehicle weights of a couple hundred pounds. Propulsion types can range from traditional turbofans, turboprops, and piston engine-driven propellers, to electric motor-driven propellers powered by rechargeable batteries (lead-acid, nickel-cadmium, and lithium ion), photovoltaic cells, and/or hydrogen fuel cells. At the DBRC Site, UAS testing could support one or more of the following mission areas: intelligence, surveillance, and reconnaissance; anti-surface ship warfare and antisubmarine warfare (ASW); mine warfare; communications relay; and derivations of these themes.

Prior to testing at a range site, a UAS would be ground checked to ensure proper system operations. Takeoff procedures would vary by UAS, using the helipad at Zelatched Point or a portable launcher from a surface vessel. Personnel would use computers to remotely operate the UAS from a command post on a surface ship or located within an existing building at Zelatched Point. Depending on the UAS being tested, individual flights within the DBRC Site could extend just a few nautical miles or tens of nautical miles. Maximum altitudes for flights would be approximately 3,000 ft (915 m) above mean sea level. Maximum velocities attained would be approximately 50 knots (93 kph). Use of UASs would occur only in accordance with Federal Aviation Administration regulations. The types of UAS tests conducted could include demonstration of aircraft flight worthiness and endurance, surveillance activities using onboard cameras and other sensors, and over-the-horizon targeting. Approximately two flights per year would occur within the DBRC Site and would last up to 2 hours each. At the completion of each flight test, the vehicle would land in a small clearing, the helipad at Zelatched Point, or using retrieval nets from a surface craft.

QUTR Site

The Proposed Action would extend the NUWC Keyport activities to coincide with Navy activities within the entirety of the established W-237A; additionally, a surf zone would be located at Pacific Beach (Figure 7). The number of annual activities within the extended QUTR Site would increase for vehicle propulsion tests and submarine, inert mine, static in-water, and UUV testing, while UAS and shore deployment system testing would be new to the range. The average number of days that the activities would occur would increase from 14 to 16 days for the larger offshore area and 30 days for the proposed surf-zone location.

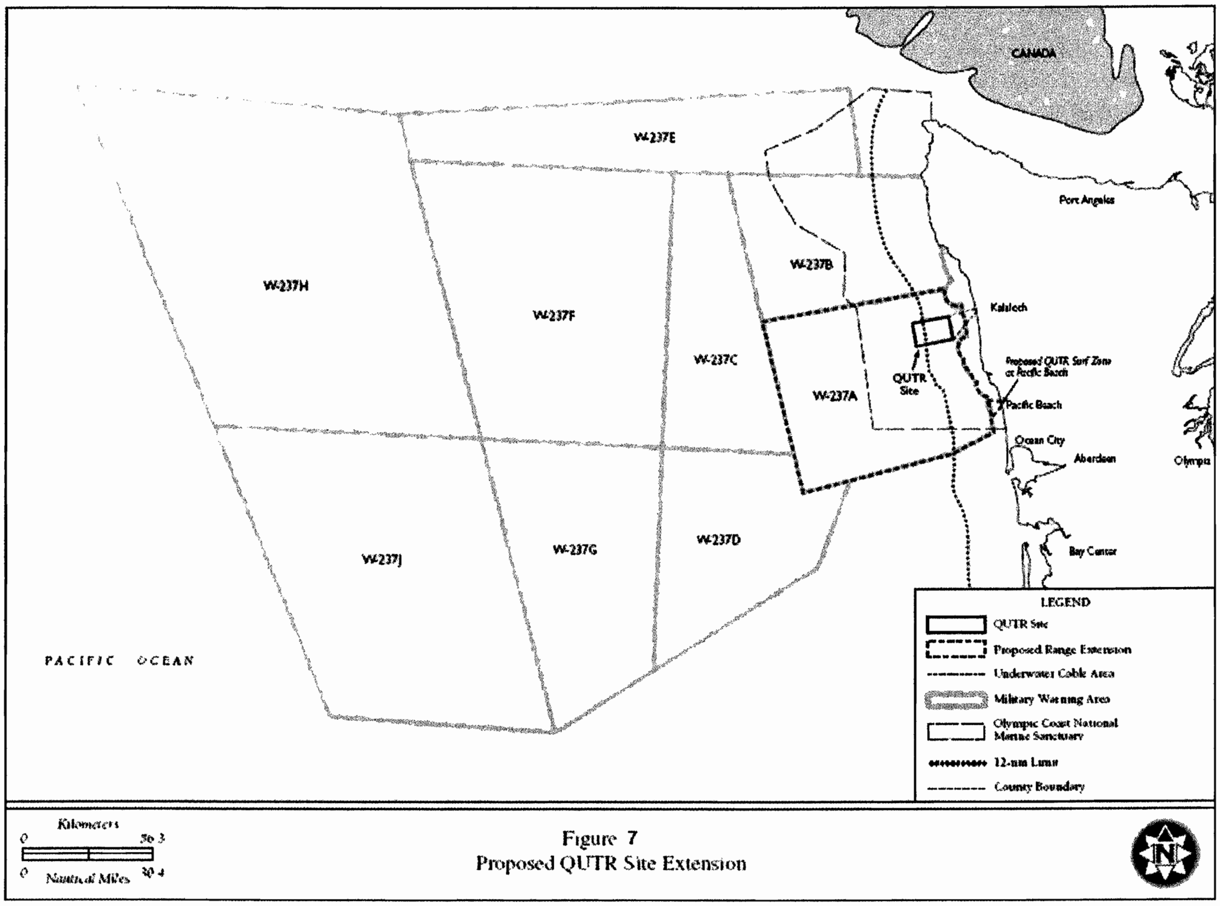
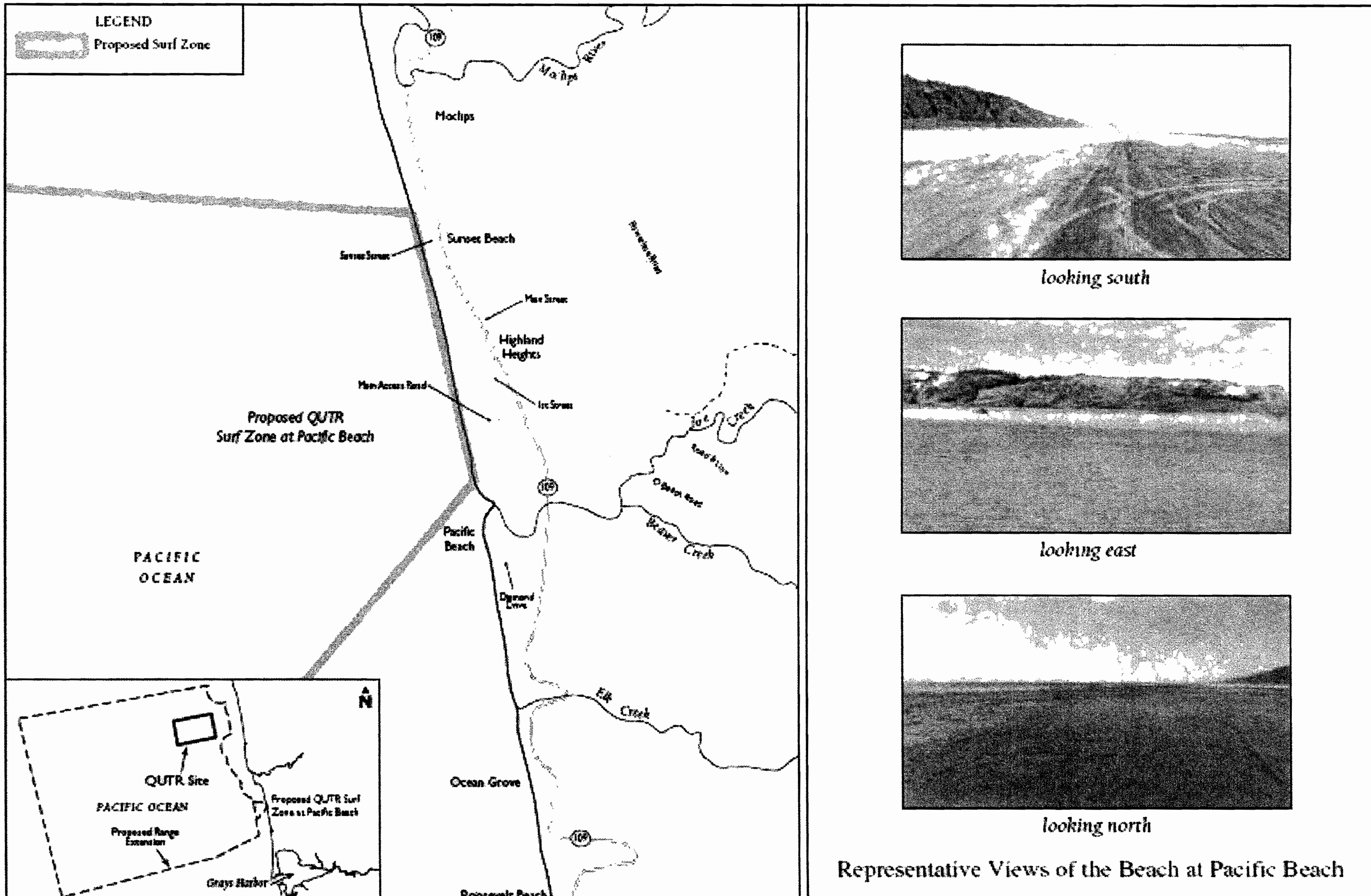


Figure 7
Proposed QUTR Site Extension

The proposed range extension would not result in additional permanent bottom deployed instrumentation. All bottom deployed equipment is temporary and would be recovered. Temporary deployment is being defined as less than 2 years, which includes planning, funding, and availability to retrieve/recover. Extending the operating area would provide a more varied range of bottom topography than the existing permanently instrumented range site. The current instrumented site is a gently sloping, hard, reverberant sand bottom with up to approximately 300 ft (91 m) of depth. The proposed extension offers multiple types of substrate with mud, rocks, and canyons as deep as 6,000 ft (1,829 m). This would enable deeper runs and variations in bottom type and acoustic characteristics. Sensors could also be used in multiple environments from shallow to deep simulating other coastlines with surf, cross currents, and distant shipping noise. This proposed extension would also allow for combined test and training activities with larger area for maneuverability of Fleet platforms and for longer vehicle tracks.



Kilometers
0 1.2
0 Nautical Miles 0.65

Figure 8
QUTR Site Proposed Surf Zone Access at Pacific Beach

13

Enclosure (2)

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

December 10, 2001

Mr. S. M. Herron
Head, Safety, Security, Environmental/Facilities
Naval Undersea Warfare Center Division
610 Dowell Street
Keyport, WA 98345-7610

RE: Federal Consistency
Adoption and Implementation of an Operations and Management Plan

Dear Mr. Herron:

The Department of Ecology, Shorelands and Environmental Assistance Program received your Coastal Zone Consistency Determination for adoption and implementation of an Operations and Management Plan to regulate testing operations occurring in Dabob Bay in Jefferson County and Hood Canal in Kitsap and Jefferson Counties, Washington.

Upon review of this proposal, Ecology agrees with your determination and assessment that the proposed action is consistent to the maximum extent practicable with the enforceable policies of Washington's Coastal Zone Management Program and will not result in any significant impacts to the State's coastal resources.

If you have any questions regarding this letter please contact Linda Rankin our federal consistency specialist at (360) 407-6527.

Sincerely,

Gordon White
Program Manager
Shorelands and Environmental Assistance Program

Enclosure (4)

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National Marine Sanctuaries Act

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DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

22 July 2009

Carol Bernthal
Superintendent
Olympic Coast National Marine Sanctuary
115 East Railroad Avenue, Suite 301
Port Angeles, WA 98362-2925

Dear Ms. Bernthal:

This letter is in response to your letter dated 27 October 2008 regarding your agency's recommendation that the Navy initiate consultation concerning activities proposed to be conducted by NUWC Keyport and analyzed in the NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS. I regret the delay in responding to your letter. Since we received your letter through the Draft EIS/OEIS public comment process, we intended to address the contents of your letter as we would address other public comments. .However, when NOAA Fisheries, our cooperating agency, recently forwarded your comments on the Preliminary Final EIS/OEIS, we realized the need to respond directly to your office.

We do not believe consultation under the National Marine Sanctuaries Act (NMSA) or the Olympic Coast National Marine Sanctuary (OCNMS) regulations is required. First, we disagree with your characterization of the Quinault Training Range (QUTR) extension. Although NUWC Keyport is proposing to conduct activities beyond the existing QUTR in the area encompassed by W-237A, the Navy has been operating within W-237A for decades. Thus, activities within the QUTR extension would not cover a "significantly greater area" of the OCNMS if considered in light of the area currently in use by the Navy.

Second, we believe that both the 1993 OCNMS EIS and the OCNMS regulations recognize that activities would occur outside of the QUTR, and these activities are covered by existing documentation and exemptions. The OCNMS EIS provides that "[t]he location and/or size of the undersea tracking area is adjusted from time to time to support specific Navy testing requirements, but it remains within W-237" and not only within the QUTR. The OCNMS EIS also provides that "[t]here are a variety of activities that take place within the sanctuary area in support of Quinault Range use and maintenance." In addition, the OCNMS regulations provide that the prohibitions found at 15 C.F.R. § 922.152(a)(2) through (7) do not apply to "activities ***associated with*** the Quinault Range." Thus, the regulatory prohibitions are also inapplicable to those activities that occur outside of the QUTR that are associated with the QUTR. Furthermore, we do not consider the proposed NUWC Keyport activities to be "new" activities.

Finally, NUWC Keyport activities proposed to be conducted in the QUTR under the preferred alternative do not appear to meet the trigger for consultation under the NMSA (i.e., "likely to destroy, cause the loss of, or injure a sanctuary resource"). Therefore, consultation under § 304(d) of the NMSA is not required.

We appreciate your comments and thank you for your attention to this matter. If you have any questions, please contact Mr. Fabio D'Angelo at (360) 396-5682 or via e-mail at fabio.dangelo@navy.mil, or Ms. Shaari Unger at (360) 315-2258 or via e-mail at shaari.unger@navy.mil.

Respectfully,

Kim X. Bennis

Kim X. Bennis
Head, Operations Services Department

Copy to:
Office of National Marine Sanctuaries

-----Original Message-----
From: Carol Bernthal [mailto:Carol.Bernthal@noaa.gov]
Sent: Wednesday, July 15, 2009 9:02
To: Hart, George A CIV CNRNW, N40BA
Subject: Re: Response to letter dated 27 Oct 2008 requesting consultation

I was wondering what was up.....thanks for the clarification and will look for the letter shortly.

Carol

Hart, George A CIV CNRNW, N40BA wrote:
> Carol,
>
> I wanted to let you know that the Navy is extremely apologetic for not responding soonest but your letter somehow ended up in the comments on the DEIS. After our cooperating agency NOAA Fisheries submitted your comments to us we realized the error. That said we determined that the request should go through the chain of command prior to our issuing a response. The response letter is going through the final stages of editing and should be sent out very soon. I would speculate that a meeting might be in order after you review the letter. Again the Navy sends its deepest apologies for this unnecessary delay in responding.
>
> V/R
> George
>
> George A. Hart
> NRNW N40BA, Biologist
> Navy Region Northwest
> 1101 Tautog Circle
> Silverdale, Wa. 98315
> Phone 360-315-5103
> Fax 360-315-5095
>
> Opportunity is missed by most people because it is dressed in overalls and looks like work.
> Thomas A. Edison

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Olympic Coast National Marine Sanctuary
115 East Railroad Avenue, Suite 301
Port Angeles, WA 98362-2925

October 27, 2008

Ms. Kimberly Kler
Naval Facilities Command
1101 Tautog Circle, Suite 203
Silverdale, WA 98315-1101

Dear Ms. Kler:

Thank you for the opportunity to review the Draft NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS dated September 2008 (Keyport DEIS). The NOAA Office of National Marine Sanctuaries (ONMS) acknowledges and appreciates the substantial effort the Navy has made with this DEIS to articulate the proposed activities, identify alternatives, and analyze potential environmental impacts. We have identified some areas of deficiency in the analysis which are being transmitted to the Navy via NOAA Fisheries. In addition, because the proposed expansion of the Quinault Underwater Testing Range (QUTR), and Navy activities therein, would cover a significantly greater area within the Olympic Coast National Marine Sanctuary (OCNMS or sanctuary) than is presently the case, the ONMS has some particular concerns about the relationship between the proposed QUTR expansion and OCNMS regulations and the National Marine Sanctuaries Act.

As noted on page 1-30 of the Keyport DEIS, the QUTR instrumented area, special use airspace W-237A and activities therein were described in NOAA's 1993 Environmental Impact Statement (EIS) for the OCNMS. The NOAA EIS was the foundation for a management plan, regulations, and the establishment of the OCNMS in 1993-1994.

OCNMS regulations at 15 CFR §922.152 (d)(1) specify that "All Department of Defense military activities shall be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources and qualities." Furthermore, §922.152(d)(1)(i) notes that prohibitions in §922.152(a)(2) through (7) do not apply to activities associated with the Quinault Range, including the in-water testing of non-explosive torpedoes.

It is our view that the exemptions in OCNMS regulations for Department of Defense activities would not apply to the expanded QUTR, including the proposed surf zone, as the present OCNMS regulations were based on Department of Defense operations areas and activities as described in NOAA's 1993 EIS. The regulations, specifically 15 CFR §922.152 (d)(ii), allow that new activities may be exempted by the Director of the Office of National Marine Sanctuaries only after consultation between the Director and the Department of Defense.

In addition to this regulatory requirement to consult, section 304(d) of the National Marine Sanctuaries Act (16 U.S.C. 1434(d)) requires Federal agencies to consult with the Secretary of Commerce (delegated to the ONMS) prior to taking any action that is likely to destroy, cause the loss of, or injure any sanctuary resource. We believe that further consultations on the proposed QUTR expansion, activities to be conducted therein, and the manner in which they will be conducted will also satisfy the 304(d) requirement, thereby allowing both consultation requirements to be met in a single process.

Our primary concern is that, under all alternatives in the Keyport DEIS, the QUTR would be increased from 48.3 square nautical miles to approximately 1,840 square nautical miles and would include an extension through the surf zone. This represents an expansion to an area approximately 40 times the size of the existing area used by the Navy for testing operations within the sanctuary. This expansion incorporates a variety of habitat types and creates the potential for impacts to habitats and resources that do not occur in the current QUTR. The rationale for expansion of the QUTR to coincide with the entire W-237A area is not well developed in the DEIS; because of this, the ONMS believes that the Navy's objectives could be achieved with a smaller expansion of the QUTR that better considers the size necessary to fulfill the objective of different habitat types, particularly if the southern portion of W-237A is considered.

In addition, three action alternatives are outlined for the QUTR, two with surf zones in the sanctuary (Alternatives 1 and 2) and one outside the sanctuary (Alternative 3). The ONMS has concerns about the accidental loss and abandonment of equipment, potential contaminant impacts (from fuels or batteries, for example), and potential disturbance or loss of both living and non-living OCNMS benthic resources that could result from testing in these high energy environments. Therefore, we would like to discuss with the Navy the possibility of pursuing an alternative that includes both a smaller expansion of the QUTR and a surf zone located outside OCNMS boundaries, in order to eliminate adverse impacts on sanctuary resources in the intertidal area.

I believe that these issues can be addressed in a manner that meets the goals and objectives of both the Navy and the ONMS. I recommend that, at the earliest opportunity, the Navy initiate consultation with us to discuss ways the Navy can address these concerns, including improvements that can be made to the Navy's alternatives and the development of measures necessary to protect sanctuary resources to the maximum extent practicable. Please contact me at your convenience to set up further discussions and continue the consultation process.

I can be reached by phone at 360-457-6622 ext. 11 or by email at carol.bernthal@noaa.gov.

Sincerely,

Carol Bernthal
Superintendent

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DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER DIVISION
610 DOWELL STREET
KEYPORT, WASHINGTON 98345-7610

5090
Ser 17/97-10
APR 28 2010

Mr. Barry A. Thom
Acting Regional Administrator
United States Department of Commerce
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N. E., Building 1
Seattle, WA 98115

Dear Mr. Thom:

SUBJECT: LETTER FROM THE U.S. DEPARTMENT OF COMMERCE TO THE DEPARTMENT OF THE NAVY, NAVAL SEA SYSTEMS COMMAND, NAVAL UNDERSEA WARFARE CENTER DIVISION, KEYPORT, RE: MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION FOR THE NAVAL UNDERSEA WARFARE CENTER KEYPORT RANGE COMPLEX EXTENSION IN KITSAP, JEFFERSON, AND MASON COUNTIES, WASHINGTON (HUC17110019, PUGET SOUND)

Thank you for National Marine Fisheries Services' (NMFS) review of the Biological Evaluation (BE) dated December 15, 2008, from the U.S. Navy for the Naval Undersea Warfare Center (NUWC) Division, Keyport Range Complex Extension. NUWC Division Keyport received your letter containing essential fish habitat (EFH) conservation recommendations pursuant to the Magnuson-Stevens Fishery conservation and Management Act (MSA) on April 21, 2010. This letter serves as Keyport's required 30-day written response to NMFS pursuant to 16 United States code (U.S.C.) 1855 (b)(4)(B). The following responds specifically to the NMFS comments and conservation recommendations.

The NMFS provided the following EFH conservation recommendation: "NMFS recommends that the Navy implement the following conservation measures to minimize the potential adverse effects to EFH for Pacific groundfish, coastal pelagic species, and Pacific salmon: Inventory existing eelgrass beds within the action area and avoid conducting project activities that may disturb or remove portions of the eelgrass beds and thus affect their productivity. Recover all expended materials in Habitat Area of Particular Concern (HAPCs) to avoid disturbance of sensitive habitats."

NUWC Division, Keyport does not agree with NMFS suggestion that any activity involving bottom contact may disturb or remove eelgrass, and must therefore be avoided or mitigated. Bottom contact by foot traffic (at low tide), divers, temporary placement of instruments, or the use of Underwater Autonomous Vehicle crawlers all represent minor, temporary effects as defined in the applicable regulations and should not require mitigation.

NUWC Division, Keyport used the minimal/temporary criteria to identify activities falling within the EFH adverse effect definition. Any impacts that were either minimal or temporary did not reach the level of adverse effect. The 50 CFR 600.815(a)(2)(ii) and the EFH Final Rule were used as guidance for this determination. Temporary effects are those that are limited in duration and allow the particular environment to recover without measureable impact (see 67 Fed Reg 2354). Minimal effects are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

Based on NUWC Division, Keyport's assessment of bottom disturbing activities in the range complex, including their locations and estimated seafloor footprint; NUWC Division, Keyport continues to conclude that impacts on EFH are either minimal or temporary, and based on the best available data would only result in inconsequential changes to habitat; as such, NUWC Division, Keyport did not seek consultation with NMFS per the Magnuson-Stevens Fishery Conservation and Management Act. NUWC Division, Keyport concludes that NMFS proposed conservation recommendation to recover all expended materials in HAPCs is not practicable either from a legal or military readiness perspective.

NUWC Division, Keyport can see no scientific basis to conclude that essential fish habitat is being negatively affected. NUWC Division, Keyport will agree to review its processes and procedures to ensure that all material that can be reasonably recovered is. Moreover, even if it were possible to recover all materials, such activities could result in negatively effecting the environment.

NUWC Division, Keyport will use existing information from state agencies as well as non-profits and academic researchers, as updated, on the distribution of eelgrass beds. NUWC Division, Keyport will not undertake inventory studies since that would duplicate work done by others.

As a matter of standard practice, to the extent practicable the NUWC Division, Keyport retrieves expendable materials and avoids and minimizes any loss or discharge of materials incidental to Research, Development, Test and Evaluation and training activities per OPNAVINST 5090.1C Chapter 22. No further measures are necessary to protect fish and EFH during the proposed activities.

NUWC Division, Keyport will avoid conducting activities in eelgrass beds that entail bottom excavation and the uprooting of established eelgrass and validate location of eelgrass beds in the vicinity prior to planning a test that might cause any damage and to the most practicable extent avoid those areas.

NUWC Division, Keyport is willing to work with NMFS to establish an approach for improving coordination on data collection efforts and sharing such data to the extent national security and other US Navy restrictions allow. Also as data collection and other research results in new habitat data NUWC Division, Keyport will continue to reassess and incorporate such information into future environmental planning for the Range complex.

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In conclusion, NUWC Division, Keyport appreciates NMFS' expertise and review of the BE. If you need additional information or have any questions, please contact Ms. Shaari Unger at (360) 315-2258 or via e-mail: shaari.unger@navy.mil, or Mr. Fabio D'Angelo at (360) 396-5682 or via e-mail: fabio.dangelo@navy.mil.

Sincerely,

Kim X. Bennis

KIM X. BENNIS
Head, Operations Services
Department
By direction of
the Commander

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, Washington 98115

NMFS Tracking No
2008/07993

April 13, 2010

Shaari Unger
Naval Sea Systems Command
Naval Undersea Warfare Center Keyport Division
610 Dowell Street
Keyport, Washington 98345

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Naval Undersea Warfare Center Keyport Range Complex Extension in Kitsap, Jefferson and Mason Counties, Washington (HUC17110019, Puget Sound).

Dear Ms. Unger:

The National Marine Fisheries Service (NMFS) Washington State Habitat Office reviewed the Biological Evaluation (BE) received on December 15, 2008, from the U.S. Navy for the Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension and concluded that the proposed project may adversely affect essential fish habitat (EFH) for Pacific groundfish, coastal pelagic species, and Pacific salmon.

Federal agencies are required, under section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR 600 Subpart K), to consult with NMFS regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect EFH. The MSA section 3 defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." If an action would adversely affect EFH, NMFS is required to provide the Federal action agency with EFH conservation recommendations (MSA section 305(b)(4)(A)). This consultation is based, in part, on information provided by the Federal action agency and descriptions of EFH for Pacific coast groundfish, coastal pelagic species, and Pacific salmon contained in the Fishery Management Plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

Proposed Project

The NUWC Keyport Range Complex has historically provided facilities and capabilities to support testing of torpedoes, other unmanned vehicles, submarine readiness, diver training, and similar activities that are critical to the success of undersea warfare.

Range support requirements for such activities include testing, training, and evaluation of system capabilities such as guidance, control, and sensor accuracy in multiple marine environments (e.g., differing depths, salinity levels, sea states) and in surrogate and simulated war-fighting environments.

The Navy proposes to continue in-water research, development, test, and evaluation (RDT&E) activities at the NUWC Keyport Range Complex over a five-year period beginning in January 2010 and ending in January 2015; to extend the operating areas of the NUWC Keyport Range Complex on three range sites in Washington State; and to increase the frequency of use of two of the range sites. Typical activities conducted by NUWC Keyport on the three range sites primarily support undersea warfare RDT&E program requirements, but general equipment test and military personnel training needs, including fleet activities, are also supported. Test and training activities include submarine testing; inert mine detection, classification, and localization; thermal, electric, or chemical propulsion of test vehicles; use of acoustic and nonacoustic sensors; countermeasure testing; impact testing of test vehicles; and unmanned undersea vehicle testing. Fleet activities that occur as part of the proposed project may involve use of ships, aircraft, submarines, or Navy divers but do not include the use of surface ship and submarine hull-mounted sonars. The BE provided scenarios to describe typical RDT&E activities that would be conducted within the proposed range extension at each of the three range sites. Parameters of various propulsion, acoustic, and mechanical systems were analyzed individually.

At the Keyport Range Site, the Navy proposes to extend the range boundaries to the north, east, and south, increasing the size of the range from 1.5 to 3.2 square nautical miles (nm). At the Dabob Bay Range Complex Site, the Navy proposes to extend the southern boundary approximately 10 nm and the northern boundary to 1 nm south of the Hood Canal Bridge, increasing the size of the range from 32.7 to 45.7 square nm. The Quinault Underwater Tracking Range (QUTR) is a rectangular-shaped test area of about 48.3 square nm, located approximately 6.5 nm off the Pacific Coast at Kalaloch, Washington, and lies within the boundaries of the Olympic Coast National Marine Sanctuary. The Navy proposes to extend the range boundaries to coincide with the overlying special use airspace of Warning Area 237A and to include a 7.8 square-nm surf zone near Pacific Beach instead of at Kalaloch. In addition to these range extensions, the proposed project includes small increases in the average number of tests and days of testing at the Keyport Range and QUTR sites.

The action area for the proposed project includes water immediately adjacent to Keyport Range Site and the proposed range extension. Specifically, it consists of the waters of Liberty Bay to the northwest, Agate Pass to the northeast, and Port Orchard Reach to the east and south to approximately Illahee, just south of University Point. For the Dabob Bay Range Complex Site, the action area includes the marine waters of Hood Canal from approximately the Hood Canal Bridge south to the Hamma Hamma River, including Dabob Bay. For the QUTR site, the action area includes the offshore marine waters within the proposed QUTR Site range extension and the nearshore coastal waters from approximately Cedar Creek in the north to Copalis Beach in the south. The existing instrumented QUTR site is a gently sloping, hard, reverberant sand bottom to approximately 300 feet deep. The proposed extension includes multiple types of substrate with mud, rocks, and canyons as deep as 6,000 feet. The action area also includes the proposed surf zone area near Pacific Beach.

Essential Fish Habitat

The action area includes habitat which has been designated as EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific salmon. The action area also includes habitat which has been designated as habitat areas of particular concern (HAPC) for groundfish. HAPCs are specific habitat areas, a subset of the much larger area identified as EFH, that play an important ecological role in the fish life cycle or that are especially sensitive, rare, or vulnerable. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (e.g., seamounts, offshore banks, and canyons) are designated HAPCs for groundfish. The BE provides descriptions of sea grass beds and kelp known to occur within the action area. Eelgrass (Zostera marina) has a patchy distribution along the subtidal and intertidal areas of the Keyport range site and is abundant along the subtidal and intertidal areas of the entire Hood Canal arm as well as Dabob Bay. Maximum depth of eelgrass beds in Hood Canal and Dabob Bay are minus 15 to minus 20 feet mean lower low water (MLLW). In general, there is a lack of kelp beds in Hood Canal, with only 0.3 to 0.5 percent of the coastline containing kelp. These kelp beds are located near the Hood Canal Bridge north of the proposed range extension. Aquatic vegetation occurring in the intertidal and subtidal areas along the Olympic Coast includes many species of kelp, surfgrass, and seaweed. Because of their dependence on light for growth and reproduction, marine plants tend to occur within the photic zone. Depth of this layer varies seasonally and locally, generally ranging between 60 to about 260 feet deep.

The proposed project may adversely affect EFH for Pacific coast groundfish, coastal pelagic species, and Pacific salmon through activities that contact and disturb the substrate or activities that leave behind expended materials that could later disturb the substrate and sensitive habitats. Any project activities that would be in contact with the substrate in intertidal and shallow subtidal areas in Hood Canal may disturb or remove existing eelgrass beds. Expended materials used in RDT&E activities are not all recovered and thus will contribute to marine debris and may disturb sensitive habitats. Cables, lines, chains, guidance wire, sonobuoy debris, fiber optic cables, and other items are proposed for use during RDT&E activities within the action area. Some unmanned undersea vehicles trail thin guidance or communication wires as they conduct their activities; these wires then fall to the bottom substrate. For example, a plastic-coated copper wire guide is expended during each torpedo test. Each wire is 1/25-inch diameter, averages about 8 miles long, and contains 55 pounds of copper. The wire pays out behind the torpedo during the test and sinks to the bottom. There may be some parts of targets, torpedo launching accessories, sonobuoys, markers, target parts and components that are not recovered. Accumulation and movement of the expended materials could result in long term impacts on substrates, submerged aquatic vegetation, and benthic organisms.

Essential Fish Habitat Conservation Recommendations: Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions that would adversely affect EFH. NMFS recommends that the Navy implement the following conservation measures to minimize the potential adverse effects to EFH for Pacific groundfish, coastal pelagic species, and Pacific salmon:

Inventory existing eelgrass beds within the action area and avoid conducting project activities that may disturb or remove portions of the eelgrass beds and thus affect their productivity.
Recover all expended materials in HAPCs to avoid disturbance of sensitive habitats.

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations (MSA (§305(b)(4)(B)) and 50 CFR 600.920(k)). The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

This concludes consultation under the MSA. If the proposed action is modified in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS EFH conservation recommendations, the Navy will need to reinitiate consultation in accordance with the implementing regulations for EFH at 50 CFR 600.920(l).

NMFS appreciates your efforts to comply with requirements under the MSA. If you have questions, please contact Tami Black (Tami.Black@noaa.gov) at the Washington State Habitat Office, (360) 753-6042.

Sincerely,

Barry A. Thom
Acting Regional Administrator

Table 1. Species of fishes with designated EFH occurring in Puget Sound and coastal Washington.

Groundfish Species	chilipepper *S. goodei*	tiger rockfish *S. nigrocinctus*
spiny dogfish *Squalus acanthias*	China rockfish *S. nebulosus*	vermilion rockfish *S. miniatus*
soupfin shark *Galeorhinus galeus*	copper rockfish *S. caurinus*	widow rockfish *S. entomelas*
big skate *Raja binoculata*	darkblotched rockfish *S. crameri*	yelloweye rockfish *S. ruberrimus*
California skate *Raja inornata*	dusky rockfish *S. variabilis*	yellowmouth rockfish *S. reedi*
longnose skate *Raja rhina*	greenspotted rockfish *S. chlorostictus*	yellowtail rockfish *S. flavidus*
ratfish *Hydrolagus colliei*	greenstriped rockfish *S. elongatus*	shortspine thornyhead *Sebastolobus alascanus*
Pacific rattail *Coryphaenoides acrolepis*	harlequin rockfish *S. variegatus*	longspine thornyhead *Sebastolobus altivelis*
Pacific flatnose *Antimora microlepsis*	Pacific ocean perch *S. alutus*	Pacific sanddab *Citharichthys sordidus*
Pacific cod *Gadus macrocephalus*	quillback rockfish *S. maliger*	butter sole *Isopsetta isolepis*
Pacific whiting (hake) *Merluccius productus*	redbanded rockfish *S. babcocki*	curlfin sole *Pleuronichthys decurrens*
kelp greenling *Hexagrammos decagrammus*	redstripe rockfish *S. proriger*	Dover sole *Microstomus pacificus*
sablefish *Anoplopoma fimbria*	rosethorn rockfish *S. helvomaculatus*	English sole *Parophrys vetulus*
cabezon *Scorpaenichthys marmoratus*	rosy rockfish *S. rosaceus*	flathead sole *Hippoglossoides elassodon*
lingcod *Ophiodon elongatus*	rougheye rockfish *S. aleutianus*	petrale sole *Eopsetta jordani*
aurora rockfish *Sebastes aurora*	sharpchin rockfish *S. zacentrus*	rex sole *Glyptocephalus zachirus*
black rockfish *S. melanops*	shortbelly rockfish *S. jordani*	rock sole *Lepidopsetta bilineata*
blue rockfish *S. mystinus*	shortraker rockfish *S. borealis*	sand sole *Psettichthys melanostictus*
bocaccio *S. paucispinis*	silvergray rockfish *S. brevispinis*	starry flounder *Platichthys stellatus*
brown rockfish *S. auriculatus*	splitnose rockfish *S. diploproa*	arrowtooth flounder *Atheresthes stomias*
canary rockfish *S. pinniger*	stripetail rockfish *S. saxicola*	

Table 1. (continued)

Pacific Salmon Species	**Coastal Pelagic Species**	Pacific sardine *Sardinops sagax*
Chinook salmon *Oncorhychus tshawytscha*	jack mackerel *Trachurus symmetricus*	Pacific mackerel *Scomber japonicus*
coho salmon *O. kisutch*	anchovy *Engraulis mordax*	market squid *Loligo opalescens*
Puget Sound pink salmon *O. gorbuscha*		