DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 170919913–8186–01]

RIN 0648–BH27

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

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 conducting construction activities related to marine structure maintenance and pile replacement at facilities in Washington, over the course of five years (2018–2023). As required by the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take, and requests comments on the proposed regulations. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorization and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than April 4, 2018.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2018–0032, by any of the following methods:

- *Electronic submission:* Submit all electronic public comments via the federal e-Rulemaking Portal. Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2018-0032,* click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit written comments to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. 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, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Ben Laws, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application and any supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.* In case of problems accessing these documents, please call the contact listed above (see **FOR FURTHER INFORMATION CONTACT**).

Purpose and Need for Regulatory Action

This proposed rule would establish a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to the Navy's construction activities related to marine structure maintenance and pile replacement at facilities in Washington.

We received an application from the Navy requesting five-year regulations and authorization to take multiple species of marine mammals. Take would occur by Level A and Level B harassment incidental to impact and vibratory pile driving. Please see ''Background'' below for definitions of harassment.

Legal Authority for the Proposed Action

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) directs 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 for up to five years if, after notice and public comment, the agency makes certain findings and issues regulations that set forth permissible methods of taking pursuant to that activity and other means of effecting the ''least practicable adverse impact'' on the affected species or stocks and their habitat (see the discussion below in the ''Proposed Mitigation'' section), as well as monitoring and reporting requirements. Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I provide the legal basis for issuing this proposed rule containing five-year regulations, and for any subsequent LOAs. As directed by this legal authority, this proposed rule contains mitigation, monitoring, and reporting requirements.

Summary of Major Provisions Within the Proposed Rule

Following is a summary of the major provisions of this proposed rule regarding Navy construction activities. These measures include:

- Required monitoring of the construction areas to detect the presence of marine mammals before beginning construction activities.
- Shutdown of construction activities under certain circumstances to avoid injury of marine mammals.
- Soft start for impact pile driving to allow marine mammals the opportunity to leave the area prior to beginning impact pile driving at full power.

Background

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1361 *et seq.*) directs the Secretary of Commerce (as delegated to NMFS) 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 if certain findings are made, regulations are issued, and notice is provided to the public.

An authorization for incidental takings 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 (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings 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 MMPA states that the term ''take'' means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate our proposed action (*i.e.,* the promulgation of regulations and subsequent issuance of incidental take authorization) and alternatives with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 of the Companion Manual for NAO 216–6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the proposed action qualifies to be categorically excluded from further NEPA review.

Information in the Navy's application and this notice collectively provide the environmental information related to proposed issuance of these regulations and subsequent incidental take authorization for public review and comment. We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the request for incidental take authorization.

Summary of Request

On July 24, 2017, we received an adequate and complete request from the Navy requesting authorization for take of marine mammals incidental to construction activities related to marine structure maintenance and pile replacement at six Naval installations in Washington inland waters. On August 4, 2017 (82 FR 36359), we published a notice of receipt of the Navy's application in the **Federal Register**, requesting comments and information related to the request for thirty days. We received comments from Whale and Dolphin Conservation (WDC). The comments received from WDC were considered in development of this proposed rule and are available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.*

The Navy proposes to conduct construction necessary for maintenance of existing in-water structures at the following facilities: Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester, Zelatched Point, and Naval Station Everett (NS Everett). These repairs would include use of impact and vibratory pile driving, including installation and removal of steel, concrete, plastic, and timber piles. Hereafter (unless otherwise specified or detailed) we use the term ''pile driving'' to refer to both pile installation and pile removal. The use of both vibratory and impact pile driving is expected to produce underwater sound at levels that have the potential to result in harassment of marine mammals.

The Navy requests authorization to take individuals of 10 species by Level B harassment. Take by Level A harassment was requested only for the harbor seal. The proposed regulations would be valid for five years (2018–2023).

Description of the Specified Activity

Overview

Maintaining existing wharfs and piers is vital to sustaining the Navy's mission and ensuring readiness. To ensure continuance of necessary missions at the six installations, the Navy must conduct annual maintenance and repair activities at existing marine waterfront structures, including removal and replacement of piles of various types and sizes. The Navy refers to this program as the Marine Structure Maintenance and Pile Replacement (MPR) program. Exact timing and amount of necessary in-water work is unknown, but the Navy estimates replacing up to 822 structurally unsound piles over the 5-year period, including individual actions currently planned and estimates for future marine structure repairs. Construction will include use of impact and vibratory pile driving, including removal and installation of steel, concrete, plastic, and timber piles. Aspects of construction activities other than pile driving are not anticipated to have the potential to result in incidental take of marine mammals because they are either above water or do not produce levels of underwater sound with likely potential to result in marine mammal disturbance.

The Navy's waterfront inspection program prioritizes deficiencies in marine structures and plans those maintenance and repairs for design and construction. The Navy's proposed activities include individual projects (where an existing need has been identified and funds have been requested) and estimates for emergent or emergency repairs. The latter are also referred to as contingency repairs. Estimates of activity levels for contingency repairs are based on Navy surveys of existing structures, which provide assessments of structure condition and estimates of numbers of particular pile types that may require replacement (at an assumed 1:1 ratio) over the 5-year duration of these proposed regulations. Additional allowance is made for the likelihood that future waterfront inspections will reveal unexpected damage, or that damage caused by severe weather events and/or incidents caused by vessels will result in need for additional contingency repairs. This regional programmatic approach to MMPA compliance is expected to result in significantly increased efficiency for both the Navy and NMFS, while satisfying the requirements of the MMPA. The regulations proposed here (and any issued LOAs) would replace multiple project-specific incidental take authorization requests for actions that are small in scale, similar in nature, and located within a similar geographic area. The detailed discussion of planned or anticipated projects provided here and in the Navy's application allow for more comprehensive analysis, while providing a reduction in the time and effort necessary to obtain individual incidental take authorizations. LOAs could be issued for projects conducted at any of the six facilities if they fit within the structure of the programmatic analysis provided herein and are able to meet the requirements described in the regulations.

The Navy would meet with NMFS on an annual basis prior to the start of in-water work windows to review upcoming projects, required monitoring plans, and the results of relevant projects conducted in the preceding in-water work window. The intent is to utilize lessons learned to better inform potential effects of future MPR activities and in any follow-up consultations.

Dates and Duration

The proposed regulations would be valid for a period of five years (2018–2023). The specified activities may occur at any time during the five-year period of validity of the proposed regulations, subject to existing timing restrictions. These timing restrictions, or in-water work windows, are typically designed to protect fish species listed under the Endangered Species Act (ESA). For NBK Bangor and Zelatched Point (located in Hood Canal), in-water work may occur from July 16 through January 15. At the remaining four facilities (located in Puget Sound), in-water work may occur from July 16 through February 15.

For many projects the design details are not known; thus, it is not possible to state the number of pile driving days that will be required. Days of pile driving at each site were based on the estimated work days using a slow production rate, *i.e.,* one pile removed per day and one pile installed per day for contingency pile driving and an average production rate of six piles per day for fender pile replacement. These conservative rates give the following estimates of total days at each facility over the 5-year duration: NBK Bangor, 119 days; Zelatched Point, 20 days; NBK Bremerton, 168 days; NBK Keyport, 20 days; NBK Manchester, 50 days; and NS Everett, 78 days. These totals include both extraction and installation of piles, and represent a conservative estimate of pile driving days at each facility. In a real construction situation, pile driving production rates would be maximized when possible and actual daily production rates may be higher, resulting in fewer actual pile driving days.

Specified Geographical Region

The six installations are located within the inland waters of Washington State. Two facilities are located within Hood Canal, while the remainder are located within Puget Sound. Please see Figure 1–1 of the Navy's application for a regional map. For full details regarding the specified geographical region, please see section 2 of the Navy's application. The region is affected by high amounts of runoff from the Fraser River, which stimulates primary productivity, carrying nutrients northwards past Vancouver Island year-round. Puget Sound is one of the largest estuaries in the United States and is a place of great physical and ecological complexity and productivity. The average surface water temperature is 12.8 °C in summer and 7.2 °C in winter (Staubitz *et al.,* 1997), but surface waters frequently exceed 20°C in the summer and fall. With nearly six million people (doubled since the 1960s), Puget Sound is also heavily influenced by human activity.

NBK Bangor is located on the Hood Canal, a long, narrow, fjord-like basin of western Puget Sound. Please see Figure 1–2 of the Navy's application. Oriented northeast to southwest, the portion of the canal from Admiralty Inlet to a large bend, called the Great Bend, at Skokomish, Washington, is 84 kilometers (km) long. East of the Great Bend, the canal extends an additional 15 mi to Belfair. Throughout its 108-km length, the width of the canal varies from 1.6 to 3.2 km and exhibits strong depth/elevation gradients. Hood Canal is characterized by relatively steep sides and irregular seafloor topography. In northern Hood Canal, water depths in the center of the waterway near Admiralty Inlet vary between 91 and 128 meters (m). As the canal extends southwestward toward the Olympic Mountain Range and Thorndyke Bay, water depth decreases to approximately 49 m over a moraine deposit. This deposit forms a sill across the canal in the vicinity of Thorndyke Bay, which limits seawater exchange with the rest of Puget Sound. The NBK Bangor waterfront occupies approximately 8 km of the shoreline within northern Hood Canal (1.7 percent of the entire Hood Canal coastline) and lies just south of the sill feature. Zelatched Point is located on the southwestern end of the Toandos Peninsula on Dabob Bay within Hood Canal. Please see Figure 1–6 of the Navy's application. It is approximately 6.4 km west of the NBK Bangor waterfront on the western facing portion of Toandos Peninsula. Dabob Bay is a 183-m deep fjord-like basin with a 101-m sill at its entrance. It runs north 19 km from its junction with Hood Canal. The width of the Dabob Bay is approximately 4.5 km at the Zelatched Point pier.

NBK Bremerton is located on the north side of Sinclair Inlet in southern Puget Sound. Please see Figure 1–3 of the Navy's application. Sinclair Inlet is located off the main basin of Puget Sound and is about 6.9 long and 1.9 km wide. The inlet is connected to the main basin through Port Orchard Narrows and Rich Passage. Another relatively narrow waterway, Port Washington Narrows, connects Sinclair Inlet to Dyes Inlet. In-water structures, shoreline fill, and erosion protection at NBK Bremerton have resulted in a shoreline geometry and character that is quite different from undisturbed shorelines in Puget Sound. Bathymetry near existing piers and in turning basins immediately offshore has been altered by significant dredging to accommodate aircraft carriers and other Navy vessels. Water depths range from 12 to 14 m, increasing to 14 to 15 m in dredged berthing areas. West of the project sites, further into the inlet, depths gradually decrease to less than 9 m.

NBK Keyport is located on the eastern shore of the Kitsap Peninsula, approximately 24 km due west of Seattle and 16 km north of the city of Bremerton. Please see Figure 1–4 of the Navy's application. Keyport Pier is located along the shores of Liberty Bay, which flows into Port Orchard Bay and then through the narrow Agate Passage to the northeast and Port Orchard Narrows to the south. Liberty Bay and waters adjacent to Keyport are relatively shallow with water depths no greater than 30 m. Water depths increase from the northwest to south/southeast and are greatest in the southern portion of the Port Orchard Narrows.

NBK Manchester is located on Orchard Point, approximately 6.4 km due east of Bremerton. Please see Figure 1–5 of the Navy's application. The installation is bounded by Clam Bay to the northwest, Rich Passage to the northeast, and Puget Sound to the east. NBK Manchester piers are located on the north side of Orchard Point and in a small embayment open on the south side of Orchard Point. In Clam Bay, the bathymetry is gently sloping with depths in the outer portions of the bay of approximately 5.5 m below mean lower low water (MLLW). Depths off Orchard Point drop off dramatically to 18 m below MLLW approximately 150 m from shore and 90 m below MLLW 1.6 km offshore. Rich Passage is a shallow sill, less than 21 m deep.

NS Everett is located in Port Gardner Bay in Puget Sound's Whidbey Basin. Please see Figure 1–7 of the Navy's application. To the west of the installation is the channelized mouth of the Snohomish River bounded by Jetty Island, which is composed of sediment from maintenance dredging and acts as a breakwater for the northwest area along the installation's waterfront. Jetty Island separates Port Gardner Bay and Possession Sound from the Snohomish River channel. The mouth of the Snohomish River channel is a historically industrialized area of highly modified shorelines and dredged waterways that forms a protected harbor within Port Gardner Bay. East of Jetty Island lies the Snohomish River estuary, consisting of a series of interconnected sloughs that flow through the lowlands east and north of the river's main channel. Water depths in Possession Sound range from about 9 m near the industrialized shoreline in Port Gardner to 180 m in mid-channel.

Detailed Description of Activities

As described above, the Navy has requested incidental take regulations for its MPR program, which includes maintenance and repair activities at marine waterfront structures at six installations within Washington inland waters. In order to address identified deficiencies in existing marine structures at the six facilities, the Navy proposes to replace up to 822 structurally unsound piles over the 5-year period using both impact and vibratory pile driving. Existing marine structures at the six facilities are identified in Table 1–2 of the Navy's application. The MPR program includes pile repair, extraction, and installation, all of which may be accomplished through a variety of methods. However, only pile extraction and installation using vibratory and impact pile drivers is expected to have the potential to result in incidental take of marine mammals. Pile repair methods include stubbing, wrapping, pile encapsulation, welding, or coating. These processes do not involve pile driving and are not expected to have the potential to result in elevated noise levels or incidental take of marine mammals. Pile removal may be accomplished via mechanical methods such as cutting/chipping, clamshell removal, or direct pull. Water jetting may also be used to aid in pile installation. Noise levels produced through these activities are not expected to exceed baseline levels produced by other routine activities and operations at the six facilities, and any elevated noise levels produced through these activities are expected to be intermittent, of short duration, and with low peak values. Therefore, only vibratory and impact pile driving are carried forward for further analysis. To minimize underwater noise impacts on marine species, vibratory pile driving will be the primary method used to install new steel piles.

Vibratory hammers, which can be used to either install or extract a pile, contain a system of counter-rotating eccentric weights powered by hydraulic motors, and are designed in such a way that horizontal vibrations cancel out, while vertical vibrations are transmitted into the pile. The pile driving machine is lifted and positioned over the pile by means of an excavator or crane, and is fastened to the pile by a clamp and/or bolts. The vibrations produced cause liquefaction of the substrate surrounding the pile, enabling the pile to be extracted or driven into the ground using the weight of the pile plus the hammer. Impact hammers use a rising and falling piston to repeatedly strike a pile and drive it into the ground. Impact or vibratory driving could occur on any work day within in-water work windows during the period of validity of these proposed regulations.

Steel piles are typically vibratory-driven for their initial embedment depths or to refusal and finished with an impact hammer for proofing or until the pile meets structural requirements, as necessary. Proofing involves striking a driven pile with an impact hammer to verify that it provides the required load-bearing capacity, as indicated by the number of hammer blows per foot of pile advancement. Non-steel piles (concrete, timber, or plastic) are typically impact-driven for their entire embedment depth, in part because non-steel piles are often displacement piles (as opposed to pipe piles) and require some impact to allow substrate penetration. Pile installation can typically take a minute or less to 60 minutes depending on pile type, pile size, and conditions (*i.e.,* bedrock, loose soils, etc.) to reach the required tip elevation.

The most effective and efficient method of pile installation and removal available would be implemented. The method fitting these criteria may vary based on specific project requirements and local conditions. Impact driving, while generally producing higher levels of sound, also minimizes the net amount of active driving time, thus reducing the amount of time during which marine mammals may be exposed to noise. Impact or vibratory pile driving could occur on any day, but would not occur simultaneously. Location-specific pile totals are given in Table 1 and described below. These totals assume a 1:1 replacement ratio; however, the actual number installed may result in a replacement ratio of less than 1:1. Please see Table A–1 of the Navy's application for additional detail regarding expectations for both planned work and possible contingency work.

TABLE 1—PILE TYPES AND MAXIMUM ANTICIPATED NUMBER TO BE REPLACED AT EACH INSTALLATION

Installation	Existing piles to be replaced	Anticipated piles to be installed
NBK Bangor	44 concrete; 75 steel and/or timber	119 steel or concrete.
NBK Bremerton	75 steel and/or timber; 460 timber	100 steel (14-in diameter and sheet piles); 435 concrete.
NBK Keyport	20 steel and/or concrete	20 steel.
NBK Manchester	50 timber and/or plastic	50 concrete, timber, and/or plastic.
Zelatched Point	20 timber	20 steel, concrete, and/or timber.
NS Everett	1 steel, 2 concrete, and 75 timber	1 steel and 77 concrete and/or timber.

Steel piles would be a maximum size of 36-inch (in) diameter except at NBK Bremerton where they would be 14-in diameter. Concrete piles will be a maximum of 24-in diameter and timber/plastic piles will be a maximum of 18-in diameter. For purposes of analysis, it is assumed that any unknown pile type would be steel, since this would give a worst-case scenario in terms of noise levels produced. All concrete, timber, and plastic piles are assumed to be installed entirely by impact pile driver, and all steel piles are assumed to require some use of an impact driver. This is a conservative assumption, as all steel piles would be initially driven with a vibratory driver until they reach a point of refusal (where substrate conditions make use of a vibratory hammer ineffective) or engineering specifications require impact driving to verify load-bearing capacity. Therefore, some steel piles may not in fact require use of the impact driver during installation.

At this time, of 822 piles expected to be installed as replacement piles, 121 have been identified as steel piles. These piles would be installed over the 5-year duration at NBK Bremerton, NBK Keyport, and NS Everett. In addition, another 139 piles that would be installed at NBK Bangor (119) and Zelatched Point (20) have not been identified as to pile type and could be steel, concrete, timber or plastic. For this analysis, it is assumed all 139 of these would be steel piles. Therefore, 260 piles are assumed to be steel, with 100 of these 14-in and the remainder assumed to be 36-in diameter. A total of 435 replacement piles have been identified as concrete (NBK Bremerton). The remaining 127 replacement piles (NBK Manchester and NS Everett) could ultimately be concrete, timber, or plastic, but are assumed for purposes of analysis to be concrete, which is a more conservative noise scenario.

NBK Bangor is the Pacific homeport for the Navy's TRIDENT submarine fleet with the mission to support and maintain a TRIDENT submarine squadron and other ships home-ported or moored at the installation and to maintain and operate administrative and personnel support facilities including security, berthing, messing, and recreational services. NBK Bangor is the only naval installation on the west coast with the specialized infrastructure able to support the TRIDENT program. The specialized infrastructure includes buildings, utilities, and systems used to support missile production shops, missile maintenance, missile component storage, and missile handling cranes, in addition to providing security and operational port facilities.

Pile-supported structures at the NBK Bangor waterfront include: Carderock Pier, Service Pier, Keyport-Bangor (K/B) Dock, Delta Pier, Marginal Wharf, Explosives Handling Wharf #1 (EHW–1), and the Magnetic Silencing Facility (see Figure 1–2 of the Navy's application). Over the 5-year duration, up to 44 piles are anticipated to be replaced at EHW–1 and up to 75 piles could be installed at any of the structures for emergent projects.

Zelatched Point supports test and evaluation operations conducted by the Naval Undersea Warfare Center Keyport within Dabob Bay, and contains a single pier historically used for mooring small craft and float planes during Navy range operations in Dabob Bay (see Figure 1–6 of the Navy's application). Two dolphins are located at the outboard end of the facility, each consisting of three timber piles. Up to 20 piles of any type are anticipated for emergent/emergency repairs during the course of the 5-year duration.

Puget Sound Naval Shipyard and Intermediate Maintenance Facility is the major tenant command of NBK Bremerton. NBK Bremerton contains multiple dry docks, piers, and wharfs and is capable of overhauling and repairing, constructing, deactivating, and dry-docking all types and sizes of ships. It also serves as the homeport for a nuclear aircraft carrier and other Navy vessels.

There are 13 pile-supported structures located at NBK Bremerton (see Figure 1–3 of the Navy's application). Two pile repair and replacement projects are planned for Piers 4 and 5. The project at Pier 4 would involve replacing missing or broken timber fender piles with 80 steel fender piles. Steel piles would be up to 14-in diameter and installed with a vibratory driver and only impact driven if they cannot be advanced to tip elevation using a vibratory driver. Prior projects at Piers 4 and 5 indicate steel piles will be able to be vibratory driven. However, some impact driving may be necessary. The project at Pier 5 would replace an existing primarily timber fendering system, with 360 concrete piles ranging in size up to 24-in diameter. All concrete piles are anticipated to be impact driven. Work on Piers 5, 6, 7, Mooring A, and Dry Dock 5 will involve replacement of up to 20 timber piles with 20 sheet steel piles. In addition, 75 concrete piles are anticipated for emergent/emergency repairs over the 5-year duration. Naval Undersea Warfare Center Keyport is the major tenant command at NBK Keyport and is the Navy's premier provider of cold-water testing and evaluation for undersea warfare systems. In this capacity, NBK Keyport provides depot maintenance and repair, in-service engineering, and fleet industrial support for torpedoes and other undersea warfare systems including mobile mines, unmanned underwater vehicles, and countermeasures.

There is one pier, Keyport Pier, in the northern portion of the NBK Keyport installation (see Figure 1–4 of the Navy's application). There are no planned pile repair and replacement projects at NBK Keyport; however, up to 20 piles are anticipated for emergent/emergency repairs or replacement at the Keyport Pier during the course of the 5-year duration.

NBK Manchester provides bulk fuel and lubricant support to area Navy afloat and shore activities. The primary pile-supported structures at NBK Manchester are the fuel pier and the finger pier with a barge mooring platform and a small boat float (see Figure 1–5 of the Navy's application). There are no planned projects at NBK Manchester. A contingency estimate of 50 concrete, timber, or plastic piles for emergent/emergency repairs at the fuel pier or finger pier is proposed for the 5-year duration.

NS Everett provides homeport ship berthing, industrial support, and a Navy administrative center. Pile-supported structures at NS Everett include Piers A, B, C, D, and E; North Wharf and South Wharf; a recreational marina; and the small boat launch (see Figure 1–7 of the Navy's application). Additionally, there are fender piles along the waterfront areas. Repairs to the North Wharf could require replacement of up to two concrete piles. Additionally, contingency planning estimated up to 75 concrete or timber piles and one steel pile could be repaired or replaced over the 5-year duration.

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed the Navy's species descriptions—which summarize available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species—for accuracy and completeness and refer the reader to Sections 3 and 4 of the Navy's application, instead of reprinting the information here. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SAR; *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS's website (*www.fisheries.noaa.gov/find-species*).

Table 2 lists all species with expected potential for occurrence in the specified geographical region where the Navy proposes to conduct the specified activities and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2017). PBR, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, is considered in concert with known sources of ongoing anthropogenic mortality (as described in NMFS's SARs).

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. All managed stocks in the specified geographical regions are assessed in either NMFS's U.S. Alaska SARs or U.S. Pacific SARs. All values presented in Table 2 are the most recent available at the time of writing and are available in the draft 2017 SARs (available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

Ten species (with 13 managed stocks) are considered to have the potential to co-occur with Navy activities. There are several species or stocks that occur in Washington inland waters, but which are not expected to occur in the vicinity of the six Naval installations. These species may occur in waters of the Strait of Juan de Fuca or in more northerly waters in the vicinity of the San Juan Islands and areas north to the Canadian border, and include the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) and the northern resident stock of killer whales. In addition, the sea otter is found in coastal waters, with the northern (or eastern) sea otter (*Enhydra lutris kenyoni*) found in Washington. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Two populations of gray whales are recognized, eastern and western North Pacific (ENP and WNP). WNP whales are known to feed in the Okhotsk Sea and off of Kamchatka before migrating south to poorly known wintering grounds, possibly in the South China Sea. The two populations have historically been considered geographically isolated from each other; however, data from satellite-tracked whales indicate that there is some overlap between the stocks. Two WNP whales were tracked from Russian foraging areas along the Pacific rim to Baja California (Mate *et al.,* 2011), and, in one case where the satellite tag remained attached to the whale for a longer period, a WNP whale was tracked from Russia to Mexico and back again (IWC, 2012). Between 22–24 WNP whales are known to have occurred in the eastern Pacific through comparisons of ENP and WNP photo-identification catalogs (IWC, 2012; Weller *et al.,* 2011; Burdin *et al.,* 2011). Urban *et al.* (2013) compared catalogs of photo-identified individuals from Mexico with photographs of whales off Russia and reported a total of 21 matches. Therefore, a portion of the WNP population is assumed to migrate, at least in some years, to the eastern Pacific during the winter breeding season.

However, there is no indication that WNP whales occur in waters of Hood Canal or southern Puget Sound, and it is extremely unlikely that a gray whale in close proximity to Navy construction activity would be one of the few WNP whales that have been documented in the eastern Pacific. The likelihood that a WNP whale would be present in the vicinity of Navy construction activities is insignificant and discountable, and WNP gray whales are omitted from further analysis.

TABLE 2—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NAVY CONSTRUCTION ACTIVITIES

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae:						
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-; N	20,990 (0.05; 20,125; 2011).	624	132
Family Balaenopteridae (rorquals):						
Humpback whale	*Megaptera novaeangliae kuzira*	California/Oregon/Washington (CA/OR/WA).	E/D; Y	1,918 (0.03; 1,876; 2014)	[7] 11	≥9.2
Minke whale	*Balaenoptera acutorostrata scammoni.*	CA/OR/WA	-; N	636 (0.72; 369; 2014)	3.5	≥1.3
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Killer whale	*Orcinus orca* [4]	West Coast Transient [5]	-; N	243 (n/a; 2009)	2.4	0
		Eastern North Pacific Southern Resident.	E/D; Y	83 (n/a; 2016)	0.14	0
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena vomerina*	Washington Inland Waters	-; N	11,233 (0.37; 8,308; 2015).	66	≥7.2

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For two stocks of killer whales, the abundance values represent direct counts of individually identifiable animals; therefore there is only a single abundance estimate with no associated CV. For certain stocks of pinnipeds, abundance estimates are based upon observations of animals (often pups) ashore multiplied by some correction factor derived from knowledge of the species' (or similar species') life history to arrive at a best abundance estimate; therefore, there is no associated CV. In these cases, the minimum abundance may represent actual counts of all animals ashore.

[3] These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, subsistence hunting, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value. All M/SI values are as presented in the draft 2017 SARs.

[4] Transient and resident killer whales are considered unnamed subspecies (Committee on Taxonomy, 2017).

[5] The abundance estimate for this stock includes only animals from the ''inner coast'' population occurring in inside waters of southeastern Alaska, British Columbia, and Washington—excluding animals from the ''outer coast'' subpopulation, including animals from California—and therefore should be considered a minimum count. For comparison, the previous abundance estimate for this stock, including counts of animals from California that are now considered outdated, was 354.

[6] Abundance estimates for these stocks are not considered current. PBR is therefore considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates, as these represent the best available information for use in this document.

[7] This stock is known to spend a portion of time outside the U.S. EEZ. Therefore, the PBR presented here is the allocation for U.S. waters only and is a portion of the total. The total PBR for humpback whales is 22 (one half allocation for U.S. waters). Annual M/SI presented for these species is for U.S. waters only.

TABLE 2—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NAVY CONSTRUCTION ACTIVITIES—Continued

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Dall's porpoise	*Phocoenoides dalli dalli*	CA/OR/WA	-; N	25,750 (0.45; 17,954; 2014).	172	0.3
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
California sea lion	*Zalophus californianus*	United States	-; N	296,750 (n/a; 153,337; 2011).	9,200	389
Steller sea lion	*Eumetopias jubatus monteriensis.*	Eastern U.S.	D; Y	41,638 (n/a; 2015)	2,498	108
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina richardii*	Washington Northern Inland Waters.[6]	-; N	11,036 (0.15; 7,213; 1999).	Undet.	9.8
		Southern Puget Sound [6]	-; N	1,568 (0.15; 1,025; 1999)	Undet.	3.4
		Hood Canal [6]	-; N	1,088 (0.15; 711; 1999)	Undet.	0.2
Northern elephant seal	*Mirounga angustirostris*	California Breeding	-; N	179,000 (n/a; 81,368; 2010).	4,882	8.8

Gray Whale

Gray whales are observed in Washington inland waters in all months of the year, with peak numbers from March through June (Calambokidis *et al.,* 2010). Most whales sighted are part of a small regularly occurring group of 6 to 10 whales that use mudflats in the Whidbey Island and Camano Island area as a springtime feeding area (Calambokidis *et al.,* 2010). Observed feeding areas are located in Saratoga Passage between Whidbey and Camano Islands including Crescent Harbor, and in Port Susan Bay located between Camano Island and the mainland north of Everett. Gray whales that are not identified with the regularly occurring feeding group are occasionally sighted in Puget Sound. These whales are not associated with feeding areas and are often emaciated (WDFW, 2012). There are typically from 2 to 10 stranded gray whales per year in Washington (Cascadia Research, 2012).

In the waterways near NBK Bremerton and Keyport (Rich Passage/Sinclair Inlet/Dyes Inlet/Agate Passage), 11 opportunistic sightings of gray whales were reported to Orca Network (a public marine mammal sightings database) between 2003 and 2012. One stranding occurred at NBK Bremerton in 2013. Gray whales have been sighted in Hood Canal south of the Hood Canal Bridge on six occasions since 1999, including a stranded whale. The most recent report was in 2010.

Gray whales are expected to occur in the waters surrounding all of the installations considered here other than those in Hood Canal (*i.e.,* NBK Bangor and Zelatched Point), due to rarity of occurrence. Gray whales are expected to occur primarily from March through June when in-water construction will not occur. Therefore, although some exposure to individual gray whales could occur at four facilities, project timing will help to minimize potential exposures.

Humpback Whale

Prior to 2016, humpback whales were listed under the ESA as an endangered species worldwide. Following a 2015 global status review (Bettridge *et al.,* 2015), NMFS established 14 distinct population segments (DPS) with different listing statuses (81 FR 62259; September 8, 2016) pursuant to the ESA. The DPSs that occur in U.S. waters do not necessarily equate to the existing stocks designated under the MMPA and shown in Table 2. Because MMPA stocks cannot be portioned, *i.e.,* parts managed as ESA-listed while other parts managed as not ESA-listed, until such time as the MMPA stock delineations are reviewed in light of the DPS designations, NMFS considers the existing humpback whale stocks under the MMPA to be endangered and depleted for MMPA management purposes (*e.g.,* selection of a recovery factor, stock status).

Within U.S. west coast waters, three current DPSs may occur: The Hawaii DPS (not listed), Mexico DPS (threatened), and Central America DPS (endangered). According to Wade *et al.* (2016), the probability that whales encountered in Washington waters are from a given DPS are as follows: Hawaii, 52.9% (CV = 0.15); Mexico, 41.9% (0.14); Central America, 5.2% (0.91).

Most humpback whale sightings reported since 2003 were in the main basin of Puget Sound with numerous sightings in the waters between Point No Point and Whidbey Island, Possession Sound, and southern Puget Sound in the vicinity of Point Defiance. Some of the reported sightings were in the vicinity of NS Everett and NBK Manchester. A few sightings of possible humpback whales were reported by Orca Network in the waters near NBK Bremerton and Keyport (Rich Passage to Agate Passage area including Sinclair and Dyes Inlet) between 2003 and 2015. Humpback whales were sighted in the vicinity of Manette Bridge in Bremerton in 2016 and 2017, and a carcass was found under a dock at NBK Bremerton in 2016 (Cascadia Research, 2016).

In Hood Canal, single humpback whales were observed for several weeks in 2012 and 2015. One sighting was reported in 2016. Review of the 2012 sightings information indicated they were of one individual. Prior to the 2012 sightings, there were no confirmed reports of humpback whales entering Hood Canal. The number of humpback whales potentially present near any of the six installations is expected to be very low in any month.

Minke Whale

Sightings of minke whales in Puget Sound are infrequent, with approximately 14 opportunistic sightings recorded between 2005 and 2012, from March through October. No sightings were reported in the vicinity of NBK Bremerton and Keyport (Rich Passage through the Agate Passage including Sinclair Inlet and Dyes Inlet) or in Hood Canal. The number of minke whales potentially present near any of the six installations is expected to be very low in any month and even lower in winter months.

Killer Whale (Transient)

Groups of transient killer whales were observed for lengthy periods in Hood Canal in 2003 (59 days) and 2005 (172 days) (London, 2006), but were not observed again until 2016, when they were seen on a handful of days between March and May (including in Dabob Bay). Transient killer whales have been seen infrequently near NBK Bremerton, including in Dyes Inlet and Sinclair Inlet (*e.g.,* sightings in 2010, 2013, and 2015). Sightings in the vicinity of NBK Keyport have also been infrequent, and no records were found for Rich Passage in the vicinity of NBK Manchester. Transient killer whales have been observed in Possession Sound near NS Everett.

West Coast transient killer whales most often travel in small pods averaging four individuals (Baird and Dill, 1996); however, the most commonly observed group size in Puget Sound (waters east of Admiralty Inlet, including Hood Canal, through South Puget Sound and north to Skagit Bay) from 2004 to 2010 was 6 whales (Houghton *et al.,* 2015).

Killer Whales (Resident)

Critical habitat for southern resident killer whales, designated pursuant to the ESA, includes three specific areas: (1) Summer core area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) Strait of Juan de Fuca (71 FR 69054; November 29, 2006). The primary constituent elements essential for conservation of the habitat are: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging. However, the six naval installations are specifically excluded from the critical habitat designation. A revision to the critical habitat designation is currently under consideration (80 FR 9682; February 24, 2015).

Southern resident killer whales are expected to occur occasionally in the waters surrounding all of the installations except those in Hood Canal, where they have not been reported since 1995 (NMFS, 2006). Southern resident killer whales are rare near NBK Bremerton and Keyport, with the last confirmed sighting in Dyes Inlet in 1997. Southern residents have been observed in Saratoga Passage and Possession Sound near NS Everett.

The stock contains three pods (J, K, and L pods), with pod sizes ranging from approximately 20 (in J pod) to 40 (in L pod) individuals. Group sizes encountered can be smaller or larger if pods temporarily separate or join together. Therefore, some exposure to groups of up to 20 individuals or more could occur over the 5-year duration.

Harbor Porpoise

Sightings in Hood Canal have increased in recent years, and an average of six harbor porpoises were sighted per day in deeper waters during line transect vessel surveys conducted in 2011 near NBK Bangor and Dabob Bay (HDR, 2012). Mean group size of harbor porpoises for each survey season in the 2013–2016 aerial surveys was 1.7 (Smultea *et al.,* 2017). Site-specific information is not available for NBK Bremerton, Keyport, or Manchester, but harbor porpoises have been seen infrequently at NS Everett.

Dall's Porpoise

Dall's porpoise are known to occur in Puget Sound, and have been sighted as far south as Carr Inlet in southern Puget Sound and as far north as Saratoga Passage, north of NS Everett (Nysewander *et al.,* 2005; WDFW, 2008). Dall's porpoise could also occasionally occur in Hood Canal. with the last observation in deeper water near NBK Bangor in 2008 (Tannenbaum *et al.,* 2009). However, Dall's porpoise were not observed during vessel line-transect surveys and other monitoring efforts completed in Hood Canal (including Dabob Bay) in 2011 (HDR, 2012). Dall's porpoises have not been documented in the Rich Passage to Agate Passage area in the vicinity of NBK Bremerton or Keyport, but have been observed in Possession Sound near NS Everett (primarily during winter) (Nysewander *et al.,* 2005; WDFW, 2008). Dall's porpoises could be present in waters in the vicinity of any of the installations considered here, and are considered more likely to occur during winter months than summer months in groups of up to 25 individuals.

The Navy conducts surveys at installations with known pinniped haul-outs, which are located at NBK Bangor, NBK Bremerton, NBK Manchester, and NS Everett (see Figures 4–2, 4–3, 4–4, and 4–5 of the Navy's application). More detail regarding these surveys may be found in Appendix C of the Navy's application.

Steller Sea Lion

Steller sea lions have been seasonally documented during shore-based surveys at NBK Bangor in Hood Canal since 2008, with up to 13 individuals observed hauled out on submarines at Delta Pier. Steller sea lions begin arriving at NBK Bangor in September and depart by the end of May.

Shore-based surveys at NBK Bremerton have not detected Steller sea lions since the surveys were initiated in 2010. A Steller sea lion was sighted on the floating security barrier in 2012 and others were detected during aerial surveys conducted by the Washington Department of Fish and Wildlife (WDFW) in 2013 (Jeffries, 2013).

Steller sea lions haul out on floating platforms in Clam Bay approximately 800 m offshore from the Manchester Fuel Depot's finger pier, approximately 13 km from NBK Bremerton. The Navy conducted surveys of sea lions on the floats from 2012 through 2016; Steller sea lions were seen in all surveyed months except for June, July, and August with as many as 42 individuals present in November 2014. Aerial surveys were conducted by WDFW from March–April 2013, July–August 2013, November 2013, and February 2014. These surveys detected Steller sea lions on the floating platforms during all survey months except July and August, with up to 37 individuals present on one survey in November 2013.

No haul-outs are known in the vicinity of NBK Keyport or Zelatched Point; therefore, no shore-based surveys have been conducted at these installations. No opportunistic sightings have been reported at these installations. The nearest Steller sea lion haul-outs to NBK Keyport are navigation buoys that can support at most two individuals, located over 15 km away in Puget Sound. Therefore, Steller sea lions are not expected to frequent waters off this installation. The only Steller sea lion haul-out in Hood Canal is at NBK Bangor, as described above, which is over 14 km from Zelatched Point.

Shore-based surveys conducted from July 2012 through June 2014 at NS Everett did not detect Steller sea lions. However, occasional observations have been reported from the port security barrier (PSB). Other than these detections on the installation's PSBs, the nearest known Steller sea lion haul-out is 22.5 km away; therefore, Steller sea lions are not expected to occur in waters off this installation.

California Sea Lion

California sea lion haul-outs occur at NBK Bangor, NBK Bremerton, and NS Everett. California sea lions are typically present most of the year except for mid-June through July in Washington inland waters, with peak abundance numbers between October and May (NMFS, 1997; Jeffries *et al.,* 2000). During summer months and associated breeding periods, the inland waters would not be considered a high-use area by California sea lions, as they would be returning to rookeries in California waters. However, as described below, surveys at Bangor indicate that a few individuals are present through mid-June and have arrived as early as August with at least one individual remaining in July 2014. Surveys at NS Everett from 2012 to 2016 indicate a few individuals may remain year-round.

California sea lions have been documented during shore-based surveys at NBK Bangor in Hood Canal since 2008 in all survey months, with as many as 122 individuals observed at one time (November 2013) hauled out on submarines at Delta Pier and on PSB floats.

California sea lions have been documented during shore- and boat-based surveys at NBK Bremerton since 2010, with as many as 315 individuals hauled out at one time (November 2015) on PSB floats.

California sea lions haul out on floating platforms in Clam Bay approximately 800 m offshore from the Manchester Fuel Depot's finger pier, approximately 13 km from NBK Bremerton. The Navy conducted surveys of sea lions on the floats incidental to other surveys from 2012 through 2016. California sea lions were seen in every survey month except July and August, with as many as 130 individuals present in one survey in October 2014. Aerial surveys were conducted by WDFW from March–April 2013, July–August 2013, November 2013, and February 2014. These surveys detected California sea lions on the floating platforms during all survey months except July, with up to 54 individuals present on one survey in November 2013.

California sea lions have been documented during shore-based surveys at NS Everett from 2012 to 2016 in all survey months, with as many as 215 individuals hauled out at one time (April 2016) on PSB floats.

No shore-based surveys have been conducted at NBK Keyport or Zelatched Point and no opportunistic sightings have been reported at these installations. No haul-outs are known in the vicinity of these installations. The nearest California sea lion haul-outs to NBK Keyport are navigation buoys that can support at most two individuals, located over 15 km away in Puget Sound. Therefore, California sea lions are not expected to frequent waters off this installation. The only California sea lion haul-out in Hood Canal is at NBK Bangor, as described above, which is over 14 km from Zelatched Point.

California sea lions are expected to be exposed to noise from project activities at NBK Bangor, Bremerton, Manchester, and NS Everett because haul-outs are at these installations or nearby. Exposure is estimated to occur primarily from August through the end of the in-water work window in mid-January or early March.

Harbor Seal

Harbor seals in Washington inland waters have been divided into three stocks: Hood Canal, Northern Inland Waters, and Southern Puget Sound. The range of the northern inland waters stock includes Puget Sound north of the Tacoma Narrows Bridge, the San Juan Islands, and the Strait of Juan de Fuca, while the southern Puget Sound stock range includes waters south of the Tacoma Narrows Bridge. Therefore, animals present at NBK Bremerton, NBK Keyport, NBK Manchester, and NS Everett are most likely to be from the northern inland waters stock, while those present at NBK Bangor and Zelatched Point are expected to be from the Hood Canal stock.

Harbor seals are expected to occur year-round at all installations, with the greatest numbers expected at installations with nearby haul-out sites. In Hood Canal, known haul-outs occur on the west side of Hood Canal at the mouth of the Dosewallips River and on the western and northern shorelines in Dabob Bay located approximately 13 and 3.7 km away from NBK Bangor and Zelatched Point, respectively. Site-specific surveys have not been conducted at Zelatched Point because no haul-outs are documented in this part of Dabob Bay. Vessel-based surveys conducted from 2007 to 2010 at NBK Bangor observed harbor seals in every month of surveys (Agness and Tannenbaum, 2009; Tannenbaum *et al.,* 2009, 2011). Harbor seals were routinely seen during marine mammal monitoring for two construction projects (HDR, 2012; Hart Crowser, 2013, 2014, 2015). Small numbers of harbor seals have been documented hauling out opportunistically at NBK Bangor (*e.g.,* on the PSB floats, wave screen at Carderock Pier, buoys, barges, marine vessels, and logs) and on man-made floating structures near K/B Dock and Delta Pier. Surveys conducted in August and September 2016 recorded as many as 28 harbor seals hauled out under Marginal Wharf or swimming in adjacent waters. On two occasions, four to six individuals were observed hauled out near Delta Pier. Known harbor seal births include one on the Carderock wave screen in August 2011 and at least one on a small floating dock in fall 2013, and afterbirth reported on a float at Magnetic Silencing Facility. In addition, harbor seal pupping has occurred on a section of the Service Pier since approximately 2001. Harbor seal mother and pup sets were observed in 2014 hauled out on the Carderock wave screen and swimming in nearby waters, and swimming in the vicinity of Delta Pier.

At NS Everett, Navy surveys conducted regularly from 2012 to 2016 have documented up to 491 harbor seals hauling out adjacent to the installation on log rafts in Notch Basin in the East Waterway. Harbor seals occupy the waters and haul-out sites near NS Everett year-round. Based on the survey data, the number of individuals peaks from August to October, with an average maximum number of 343 seals in October. The log rafts are privately owned and their location can vary within the East Waterway, which ranges from approximately 200–300 m wide. Only harbor seals on logs rafts that are within sight distance from NS Everett are counted, and if visible, numbers on floats outside the Notch Basin are noted, but not counted. Therefore, Navy counts of harbor seals hauled out do not necessarily represent the number of hauled out seals in the East Waterway. Pupping is documented on the log rafts; however, no pup counts have been conducted.

No haul-outs have been identified at NBK Bremerton, Keyport, or Manchester. The nearest documented haul-outs to NBK Bremerton are across Sinclair Inlet, approximately 1.1 km away. The nearest documented haul-out to NBK Keyport is in Liberty Bay at the Poulsbo Marina approximately 3.2 km from the Keyport Pier. The nearest documented haul-out to NBK Manchester is Blakely Rocks approximately 5.6 km away on the east side of Bainbridge Island. All haul-outs listed here near the three installations are estimated to have less than 100 individuals.

Northern Elephant Seal

No haul-outs occur in Puget Sound with the exception of individual elephant seals occasionally hauling out for two to four weeks to molt, usually during the spring and summer and typically on sandy beaches (Calambokidis and Baird, 1994). These animals are usually yearlings or subadults and their haul-out locations are unpredictable. One male subadult elephant seal was observed hauled out to molt at Manchester Fuel Depot in 2004. Although regular haul-outs occur in the Strait of Juan de Fuca, the occurrence of elephant seals in Puget Sound is unpredictable and rare.

Unusual Mortality Events (UME)

A UME is defined under the MMPA as ''a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response.'' The only currently ongoing UME investigation involves California sea lions along the west coast. Beginning in January 2013, elevated strandings of California sea lion pups were observed in southern California, with live sea lion strandings nearly three times higher than the historical average. Findings to date indicate that a likely contributor to the large number of stranded, malnourished pups was a change in the availability of sea lion prey for nursing mothers, especially sardines. The causes and mechanisms of this remain under investigation (*www.nmfs.noaa.gov/pr/health/mmume/californiasealions2013.htm;* accessed November 24, 2017).

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2016) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with an exception for lower limits for low-frequency cetaceans where the result was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- Low-frequency cetaceans (mysticetes): Generalized hearing is estimated to occur between approximately 7 Hz and 35 kHz;
- Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): Generalized hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- High-frequency cetaceans (porpoises, river dolphins, and members of the genera *Kogia* and *Cephalorhynchus;* including two members of the genus *Lagenorhynchus,* on the basis of recent echolocation data and genetic data): Generalized hearing is estimated to occur between approximately 275 Hz and 160 kHz;
- Pinnipeds in water; Phocidae (true seals): Functional hearing is estimated to occur between approximately 50 Hz to 86 kHz;
- Pinnipeds in water; Otariidae (eared seals): Functional hearing is estimated to occur between 60 Hz and 39 kHz for Otariidae.

For more detail concerning these groups and associated frequency ranges, please see NMFS (2016) for a review of available information. Ten marine mammal species (six cetacean and four pinniped (two otariid and two phocid) species) have the potential to co-occur with Navy construction activities. Please refer to Table 2. Of the six cetacean species that may be present, three are classified as low-frequency cetaceans (*i.e.,* all mysticete species), one is classified as a mid-frequency cetacean (*i.e.,* killer whales), and two are classified as high-frequency cetaceans (*i.e.,* porpoises).

Potential Effects of the Specified Activity on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The ''Estimated Take'' section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis and Determination'' section considers the content of this section and the material it references, the ''Estimated Take'' section, and the ''Proposed Mitigation'' section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks. In the following discussion, we provide general background information on sound before considering potential effects to marine mammals from sound produced by pile driving.

Description of Sound Sources

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. For general information on sound and its interaction with the marine environment, please see, *e.g.,* Au and Hastings (2008); Richardson *et al.* (1995); Urick (1983).

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the ''loudness'' of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)), and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.,* 100 percent of the acoustic energy). SEL is a cumulative metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for sound produced by the pile driving activity considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al.,* 1995). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.,* wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.,* sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.,* vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly.

The sum of the various natural and anthropogenic sound sources that comprise ambient sound at any given location and time depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10–20 decibels (dB) from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

Underwater ambient sound in Puget Sound is comprised of sounds produced by a number of natural and anthropogenic sources and varies both geographically and temporally. Human-generated sound is a significant contributor to the ambient acoustic environment at the installations considered here. The underwater acoustic environment at each installation will vary depending on the amount of anthropogenic activity, weather conditions, and tidal currents. In high-use installations, such as NBK Bremerton, anthropogenic noise may dominate the ambient soundscape. In areas with less anthropogenic activity (*e.g.,* Zelatched Point), ambient sound is likely to be dominated by sound from natural sources. Under normal weather and traffic conditions, average ambient sound at all installations is assumed to be below 120 dB rms. More detail regarding specific installations is available in section 2.3.1.5 of the Navy's application. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: Pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see Southall *et al.* (2007) for an in-depth discussion of these concepts. The distinction between these two sound types is not always obvious, as certain signals share properties of both pulsed and non-pulsed sounds. A signal near a source could be categorized as a pulse, but due to propagation effects as it moves farther from the source, the signal duration becomes longer (*e.g.,* Greene and Richardson, 1988).

Pulsed sound sources (*e.g.,* airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.,* rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

The impulsive sound generated by impact hammers is characterized by rapid rise times and high peak levels. Vibratory hammers produce non-impulsive, continuous noise at levels significantly lower than those produced by impact hammers. Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (*e.g.,* Nedwell and Edwards, 2002; Carlson *et al.,* 2005).

Acoustic Effects

We previously provided general background information on marine mammal hearing (see ''Description of Marine Mammals in the Area of the Specified Activity''). Here, we discuss the potential effects of sound on marine mammals.

Potential Effects of Underwater Sound—Note that, in the following discussion, we refer in many cases to a review article concerning studies of noise-induced hearing loss conducted from 1996–2015 (*i.e.,* Finneran, 2015). For study-specific citations, please see that work. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: Temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Götz *et al.,* 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to pile driving.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.,* when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.,* certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that pile driving may result in such effects (see below for further discussion). Potential effects from impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.,* 1973). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.,* change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007; Tal *et al.,* 2015). The construction activities considered here do not involve the use of devices such as explosives or mid-frequency tactical sonar that are associated with these types of effects.

Threshold Shift—Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al.,* 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.,* tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.,* 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, and there is no PTS data for cetaceans, but such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above (a 40-dB threshold shift approximates PTS onset; *e.g.,* Kryter *et al.,* 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates TTS onset; *e.g.,* Southall *et al.* 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.,* 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), 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. 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 occurs during a time 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.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) and three species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise) in laboratory settings (Finneran, 2015). TTS was not observed in trained spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al.,* 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2016).

Behavioral Effects—Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.,* 1995; Wartzok *et al.,* 2003; Southall *et al.,* 2007; Weilgart, 2007; Archer *et al.,* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.,* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC, 2003; Wartzok *et al.,* 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007). However, many delphinids approach low-frequency airgun source vessels with no apparent discomfort or obvious behavioral change (*e.g.,* Barkaszi *et al.,* 2012), indicating the importance of frequency output in relation to the species' hearing sensitivity.

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark, 2000; Costa *et al.,* 2003; Ng and Leung, 2003; Nowacek *et al.;* 2004; Goldbogen *et al.,* 2013a, 2013b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.,* 2001; Nowacek *et al.;* 2004; Madsen *et al.,* 2006; Yazvenko *et al.,* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005, 2006; Gailey *et al.,* 2007; Gailey *et al.,* 2016).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from airgun surveys (Malme *et al.,* 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Goold, 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch, 1992; Daan *et al.,* 1996; Bradshaw *et al.,* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure 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). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stress Responses—An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.,* Seyle, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine 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, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.,* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and ''distress'' is the 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 serious fitness consequences. 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 functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.,* 2002b) and, more rarely, studied in wild populations (*e.g.,* Romano *et al.,* 2002a). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

Auditory Masking—Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al.,* 1995; Erbe *et al.,* 2016). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.,* snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.,* shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.,* 2000; Foote *et al.,* 2004; Parks *et al.,* 2007; Di Iorio and Clark, 2009; Holt *et al.,* 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.,* 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (*e.g.,* Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Branstetter *et al.,* 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.,* from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Potential Effects of Navy Activity—As described previously (see ''Description of Active Acoustic Sound Sources''), the Navy proposes to conduct pile driving, including impact and vibratory driving. The effects of pile driving on marine mammals are dependent on several factors, including the size, type, and depth of the animal; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. With both types of pile driving, it is likely that the onset of pile driving could result in temporary, short term changes in an animal's typical behavioral patterns and/or avoidance of the affected area. These behavioral changes may include (Richardson *et al.,* 1995): changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses.

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, or reproduction. Significant behavioral modifications that could lead to effects on growth, survival, or reproduction, such as drastic changes in diving/surfacing patterns or significant habitat abandonment are extremely unlikely in this area (*i.e.,* shallow waters in modified industrial areas).

The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) and is difficult to predict (Southall *et al.,* 2007).

Whether impact or vibratory driving, sound sources would be active for relatively short durations, with relation to potential for masking. The frequencies output by pile driving activity are lower than those used by most species expected to be regularly present for communication or foraging. We expect insignificant impacts from masking, and any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis.

Anticipated Effects on Marine Mammal Habitat

The proposed activities would not result in permanent impacts to habitats used directly by marine mammals, but may have potential short-term impacts to food sources such as forage fish. The proposed activities could also affect acoustic habitat (see masking discussion above), but meaningful impacts are unlikely. There are no known foraging hotspots, or other ocean bottom structures of significant biological importance to marine mammals present in the marine waters in the vicinity of the project areas. Therefore, the main impact issue associated with the proposed activity would be temporarily elevated sound levels and the associated direct effects on marine mammals, as discussed previously in this preamble. The most likely impact to marine mammal habitat occurs from pile driving effects on likely marine mammal prey (*i.e.,* fish) near the six installations. Impacts to the immediate substrate during installation and removal of piles are anticipated, but these would be limited to minor, temporary suspension of sediments, which could impact water quality and visibility for a short amount of time, but which would not be expected to have any effects on individual marine mammals. Impacts to substrate are therefore not discussed further.

Effects to Prey—Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.,* crustaceans, cephalopods, fish, zooplankton). Marine mammal prey varies by species, season, and location and, for some, is not well documented. Here, we describe studies regarding the effects of noise on known marine mammal prey.

Fish utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (*e.g.,* Zelick *et al.,* 1999; Fay, 2009). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al.,* 2008). The potential effects of noise on fishes depends on the overlapping frequency range, distance from the sound source, water depth of exposure, and species-specific hearing sensitivity, anatomy, and physiology. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality.

Fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to noise depends on the physiological state of the fish, past exposures, motivation (*e.g.,* feeding, spawning, migration), and other environmental factors. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (*e.g.,* Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). Several studies have demonstrated that impulse sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.,* Fewtrell and McCauley, 2012; Pearson *et al.,* 1992; Skalski *et al.,* 1992; Santulli *et al.,* 1999; Paxton *et al.,* 2017). However, some studies have shown no or slight reaction to impulse sounds (*e.g.,* Pena *et al.,* 2013; Wardle *et al.,* 2001; Jorgenson and Gyselman, 2009; Cott *et al.,* 2012). More commonly, though, the impacts of noise on fish are temporary.

SPLs of sufficient strength have been known to cause injury to fish and fish mortality. However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al.* (2012a) showed that a TTS of 4–6 dB was recoverable within 24 hours for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long. Injury caused by barotrauma can range from slight to severe and can cause death, and is most likely for fish with swim bladders. Barotrauma injuries have been documented during controlled exposure to impact pile driving (Halvorsen *et al.,* 2012b; Casper *et al.,* 2013).

The most likely impact to fish from pile driving activities at the project areas would be temporary behavioral avoidance of the area. The duration of fish avoidance of an area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the expected short daily duration of individual pile driving events and the relatively small areas being affected. It is also not expected that the industrial environment of the Naval installations provides important fish habitat or harbors significant amounts of forage fish.

The area likely impacted by the activities is relatively small compared to the available habitat in inland waters in the region. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity. As described in the preceding, the potential for Navy construction to affect the availability of prey to marine mammals or to meaningfully impact the quality of physical or acoustic habitat is considered to be insignificant. Effects to habitat will not be discussed further in this document.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization, which will inform both NMFS's consideration of whether the number of takes is ''small'' and the negligible impact determination.

Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Take of marine mammals incidental to Navy construction activities could occur as a result of Level A or Level B harassment. Below we describe how the potential take is estimated.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to exhibit behavioral disruptions (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment—Although available data are consistent with the basic concept that louder sounds evoke more significant behavioral responses than softer sounds, defining sound levels that disrupt behavioral patterns is difficult because responses depend on the context in which the animal receives the sound, including an animal's behavioral mode when it hears sounds (*e.g.,* feeding, resting, or migrating), prior experience, and biological factors (*e.g.,* age and sex). Some species, such as beaked whales, are known to be more highly sensitive to certain anthropogenic sounds than other species. Other contextual factors, such as signal characteristics, distance from the source, and signal to noise ratio, may also help determine response to a given received level of sound. Therefore, levels at which responses occur are not necessarily consistent and can be difficult to predict (Southall *et al.,* 2007; Ellison *et al.,* 2012; Bain and Williams, 2006).

However, based on the practical need to use a relatively simple threshold based on available information that is both predictable and measurable for most activities, NMFS has historically used a generalized acoustic threshold based on received level to estimate the onset of Level B harassment. These thresholds are 160 dB rms (impulsive sources) and 120 dB rms (continuous sources).

Level A Harassment—NMFS's *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS, 2016) identifies dual criteria to assess the potential for auditory injury (Level A harassment) to occur for different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise. The technical guidance identifies the received levels, or thresholds, above which individual marine mammals are predicted to experience changes in their hearing sensitivity for all underwater anthropogenic sound sources, and reflects the best available science on the potential for noise to affect auditory sensitivity by:

- Dividing sound sources into two groups (*i.e.,* impulsive and non-impulsive) based on their potential to affect hearing sensitivity;
- Choosing metrics that best address the impacts of noise on hearing sensitivity, *i.e.,* peak sound pressure level (peak SPL) (reflects the physical properties of impulsive sound sources to affect hearing sensitivity) and cumulative sound exposure level (cSEL) (accounts for not only level of exposure but also duration of exposure); and
- Dividing marine mammals into hearing groups and developing auditory weighting functions based on the science supporting that not all marine mammals hear and use sound in the same manner.

The premise of the dual criteria approach is that, while there is no definitive answer to the question of which acoustic metric is most appropriate for assessing the potential for injury, both the received level and duration of received signals are important to an understanding of the potential for auditory injury. Therefore, peak SPL is used to define a pressure criterion above which auditory injury is predicted to occur, regardless of exposure duration (*i.e.,* any single exposure at or above this level is considered to cause auditory injury), and cSEL is used to account for the total energy received over the duration of sound exposure (*i.e.,* both received level and duration of exposure) (Southall *et al.,* 2007; NMFS, 2016). As a general principle, whichever criterion is exceeded first (*i.e.,* results in the largest isopleth) would be used as the effective injury criterion (*i.e.,* the more precautionary of the criteria). Note that cSEL acoustic threshold levels incorporate marine mammal auditory weighting functions, while peak pressure thresholds do not (*i.e.,* flat or unweighted). Weighting functions for each hearing group (*e.g.,* low-, mid-, and high-frequency cetaceans) are described in NMFS (2016).

NMFS (2016) recommends 24 hours as a maximum accumulation period relative to cSEL thresholds. These thresholds were developed by compiling and synthesizing the best available science, and are provided in Table 3 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS (2016), which is available online at: *www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.*

TABLE 3—EXPOSURE CRITERIA FOR AUDITORY INJURY

Hearing group	Peak pressure [1] (dB)	Cumulative sound exposure level [2]	
		Impulsive (dB)	Non-impulsive (dB)
Low-frequency cetaceans	219	183	199
Mid-frequency cetaceans	230	185	198
High-frequency cetaceans	202	155	173
Phocid pinnipeds	218	185	201
Otariid pinnipeds	232	203	219

[1] Referenced to 1 µPa; unweighted within generalized hearing range.
[2] Referenced to 1 µPa^2-s; weighted according to appropriate auditory weighting function.

Zones of Ensonification

Sound Propagation—Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$$TL = B * \log_{10}(R_1/R_2)$$

Where:

B = transmission loss coefficient (assumed to be 15)
R_1 = the distance of the modeled SPL from the driven pile, and
R_2 = the distance from the driven pile of the initial measurement.

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source (20 * log(range)). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10 * log(range)). As is common practice in coastal waters, here we assume practical spreading loss (4.5 dB reduction in sound level for each doubling of distance). Practical spreading is a compromise that is often used under conditions where water depth increases as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions.

Sound Source Levels—The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. There are source level measurements available for certain pile types and sizes from the specific environment of several of the installations considered here (*i.e.,* NBK Bangor and NBK Bremerton), but not from all. Numerous studies have examined sound pressure levels (SPLs) recorded from underwater pile driving projects in California (*e.g.,* Caltrans, 2015) and elsewhere in Washington. In order to determine reasonable SPLs and their associated effects on marine mammals that are likely to result from pile driving at the six installations, studies with similar properties to the specified activity were evaluated. Full details are available in Appendix B of the Navy's application, which evaluates available data sources for each pile size and type in order to develop reasonable proxy values.

TABLE 4—ASSUMED SOURCE LEVELS

Method	Type	Size (in)	SPL (rms) [1]	SPL (peak) [1 2]	SEL [1 3]
Impact	Plastic	13	156	Not available	Not available.
	Timber	12/14	170	Not available	Not available.
	Concrete	18	170	184	159.
		24	178	189	166.
	Steel pipe	12/13	177	192	167.
		14	184	200	174.
		24	193	210	181.
		30	195	216	186.
		36	194 (Bangor)	211	181 (Bangor).
			192 (others)		184 (others).
Vibratory	Timber	12	153	n/a	n/a.
		13/14	155	n/a	n/a.
	Steel pipe	13/14	155	n/a	n/a.
		16/24	161	n/a	n/a.
		30/36	166 (Bangor)	n/a	n/a.
			167 (others)		
	Steel sheet	n/a	163	n/a	n/a.

[1] Source levels presented at standard distance of 10 m from the driven pile. Peak source levels are not typically evaluated for vibratory pile driving, as they are lower than the relevant thresholds for auditory injury. SEL source levels for vibratory driving are equivalent to SPL (rms) source levels.

Acoustic measurements were conducted during impact driving of 24- and 36-in steel piles in 2011 at NBK Bangor (Navy, 2012). However, for the 24-in piles only seven strikes from a single pile were measured, and the reported values are lower than those from other projects reviewed. Therefore, these data were not considered in the selection of the most appropriate proxy value. For 36-in piles, the reported values from this study are directly used in evaluating similar pile driving at NBK Bangor. For 24-in piles, data from projects conducted by the Washington State Department of Transportation (WSDOT) at Bainbridge Island and Friday Harbor, as well as data from several projects conducted in California and Oregon were considered. The two Washington projects were used in developing the proxy value, as these locations were considered to be representative of substrate conditions likely encountered in other locations in Puget Sound (WSDOT, 2005a, 2005b). For 30-in piles, data from projects conducted by WSDOT at three locations—Bainbridge Island, Friday Harbor, and Vashon Island (WSDOT, 2005b, 2008, 2010b; Jasco, 2005)—as well as from one project in California were considered. The three Washington projects were again used in developing the proxy value, for the same reasons. For impact driving of 36-in piles, data from the Navy project at NBK Bangor (Navy, 2012), from two WSDOT projects (at Mukilteo and Anacortes) (WSDOT, 2007a, 2007b), and from one project in California were considered. The three projects conducted in Washington inland waters were used in developing the proxy value. Values for impact driving of small diameter steel pipe piles were taken from the summary value tables provided by Caltrans (2015) (see Table I.2–1 in that publication). No values are provided for 13-in steel piles; therefore, we assume that source levels for 12-in piles would apply to 13-in piles. While values for both 12-in and 14-in piles are provided, we believe that the 12-in values are more appropriate as the water depth for these measurements is closer to what would be encountered at the Navy project sites. No SEL source level is provided; therefore, we assume that the SEL source level is 10 dB less than the SPL (rms) source level. This is a conservative assumption, as the average difference between SPL (rms) and SEL source levels given in the Caltrans (2015) summary table is 11.5 dB.

The 2011 Navy study described above provided data from measurements of vibratory driving of 36-in steel piles (Navy, 2012), while a separate 2011 project at NBK Bangor provided measurements from vibratory driving of 30-in piles (Miner, 2012). These projects together provide directly applicable data for use in evaluating vibratory driving of 30- and 36-in steel piles at NBK Bangor. For vibratory driving of 30- and 36-in steel piles at other locations, data from a variety of additional studies from other locations in Washington (Coupeville, Edmonds, Vashon Island, Port Townsend, and Anacortes) (WSDOT 2010c, 2010d, 2010e, 2011b, 2012) were considered and, with the two Navy studies, used in developing a proxy value for 30- and 36-in piles. The same 2011 NBK Bangor study provided limited data for vibratory driving of 24-in piles, while the separate 2012 NBK Bangor provided data from vibratory driving of 16-in piles. These were considered together with a WSDOT study from Friday Harbor (WSDOT, 2010a) and with data from a project at the Trinidad Bay in Humboldt County, CA (Caltrans, 2015) to develop a generally applicable proxy value for 16- and 24-in piles. The proxy source level for vibratory driving of 13-in steel piles is taken from a study at the Mad River Slough in Arcata, CA, and is assumed to be applicable to 14-in piles as well (Caltrans, 2015). Caltrans (2015) also provides a summary value of 155 dB rms for vibratory driving of 12-in steel piles. For vibratory driving of sheet piles, data from multiple projects conducted in Oakland, CA (Berth 23, Berth 30, and Berth 35/37 at Port of Oakland; Caltrans, 2015) were considered in developing an appropriate proxy value. Values for vibratory installation are conservatively assumed to apply to vibratory extraction of same-sized piles.

Acoustic measurements were conducted during impact driving of 24-in concrete piles in 2015 at NBK Bremerton (Navy, 2016). These measurements provide a proxy value for use during impact driving of 24-in concrete piles at all facilities. For impact driving of smaller concrete piles, data from three projects conducted at Concord, CA and Berkeley, CA and involving impact driving of 16- and 18-in piles (Caltrans, 2015) were evaluated and used in developing a proxy value.

Relatively few data are available for timber and plastic piles. The proxy value for impact driving of plastic piles is from a project conducted in Solano County, CA (Illingworth and Rodkin, 2008). For impact driving of timber piles, data from one study in Alameda, CA, provides the proxy source level (Caltrans, 2015). However, we assume that the assumed source level for impact driving of 14-in steel piles is a suitable proxy for impact driving of larger diameter timber piles (18-in). For vibratory extraction of timber piles, the Navy considered measured values from NBK Bremerton (Navy, 2016) as well as data from a WSDOT project at Port Townsend involving removal of 12-in timber piles (WSDOT, 2011a). Source levels for vibratory driving of 13/14-in timber piles is assumed as a reasonable proxy for vibratory removal of timber and plastic piles up to 18-in diameter.

The Navy proposes to use bubble curtains when impact driving steel piles of 24-in diameter and greater, except at NBK Bremerton and NBK Keyport (see Proposed Mitigation for further discussion). For the reasons described in the next paragraph, we assume here that use of the bubble curtain would result in a reduction of 8 dB from the assumed SPL (rms) and SPL (peak) source levels for these pile sizes, and reduce the applied source levels accordingly. For determining distances to the cumulative SEL injury thresholds, auditory weighting functions were applied to the attenuated one-second SEL spectra for steel pipe piles (see Appendix E of the Navy's application).

During the 2011 study at NBK Bangor, the Navy conducted comparative measurements of source levels when impact driving steel piles with and without a bubble curtain. Across all piles (36- and 48-in) and all metrics (rms, peak, SEL), the weighted average effective attenuation was 9 dB. The Navy also reviewed unconfined bubble curtain attenuation rates from available reports from projects in Washington, California, and Oregon that impact drove steel pipe piles of up to 48-in diameter. These results are summarized in Table 3–2 of Appendix A in the Navy's application. Of the studies reviewed, significant variability in attenuation occurred; however, an average of at least 8 dB of peak SPL attenuation was achieved on ten of the twelve projects. Some of the lower attenuation levels reported were attributed to failures in setting up or operating the bubble curtain system (*e.g.,* bottom ring not seated on the substrate, poor airflow). While proper set-up and operation of the system is critical, and variability in performance should be expected, we believe that in the circumstances evaluated here an effective attenuation performance of 8 dB is a reasonable assumption.

Level A Harassment—In order to assess the potential for injury on the basis of the cumulative SEL metric, one must estimate the total strikes per day (impact driving) or the total driving duration per day (vibratory driving). To provide a general estimate of pile driving daily durations/strikes, the Navy reviewed information from past projects (Table 5). Navy geotechnical and engineering staff used data from a large wharf construction project at NBK Bangor to estimate pile driving time and strikes needed to install steel piles using impact hammers. Vibratory installation was estimated to take a median time of 10 minutes per pile with 45 minutes estimated as a maximum.

For steel piles that are ''proofed,'' a median of approximately 600 strikes per pile was estimated. However, not all projects will require proofing every pile. Some projects will require only a subset of piles be proofed and some projects, such as those installing fender piles, may not require any proofing because the structure is not load-bearing. Other piles may encounter difficult substrate and need to be advanced further with an impact driver. For piles that cannot be advanced with a vibratory driver, less than approximately 1,300 strikes was conservatively estimated to complete installation. Based on these estimates, no more than 4,000 strikes are estimated to occur on any one day. This estimate would account for approximately six steel piles installed with a median time of 14 minutes per pile (~1.5 hours of drive time) or three steel piles needing extended driving. Estimates of concrete pile impact driving durations are based on data for the installation of fender piles at NBK Bremerton. For purposes of analysis, impact pile driving of concrete piles is estimated to take a maximum of 4 hours or an average of 1.5 hours in a day.

Actual driving duration at any of the project sites will vary due to substrate conditions and the type and energy of impact hammers. For example, during a past project at NBK Bangor (where most of the steel pile work will occur), four piles were installed with a vibratory driver and impact proofed in 61 minutes total (vibratory and impact driving) with an average of 172 strikes/pile. Additionally, some of the anticipated pile driving is contingent on emergent needs or emergencies that could potentially never occur. Therefore, estimates of marine mammal exposure based on the maximum strike numbers would be too conservative for this programmatic analysis of all potential project sites. Table 5 presents an estimate of average strikes per day; average strikes per day and average daily duration values are used in the exposure analyses. For vibratory driving of piles less than 16-in, a daily duration of 0.5 hours was assumed; for vibratory driving of larger piles a daily duration of 2.25 hours was assumed.

TABLE 5—ESTIMATED DAILY STRIKES AND DRIVING DURATION

Pile type and method	Installation rate per day	Estimated duration	
		Average strikes/day	Average daily duration
14-in steel; impact	No data	[1] <<1,000	No data.
24- to 30-in steel; impact	1–6	1,000	4.5 minutes to 1.5 hours.
18- to 24-in concrete; impact	1–11	[2] 4,000	3 minutes to 4 hours.
13-in steel; vibratory	2–17	n/a	0–31 minutes. [3]
24- to 30-in steel; vibratory	1–6	n/a	10 minutes to 4.5 hours. [4]

[1] All 14-in piles are expected to be vibratory driven for full embedment depth. In the event that conditions requiring impact driving are encountered, very few strikes are expected to be necessary.
[2] Estimate based on data from 272 piles installed at NBK Bremerton.
[3] Estimate based on data from 70 piles installed at NBK Bremerton.
[4] Estimate based on data from 809 piles installed at NBK Bangor. Maximum assumes six piles advanced at a rate of 45 minutes per pile.

Delineation of potential injury zones on the basis of the peak pressure metric was performed using the SPL(peak) values provided in Table 4 above. As described previously, source levels for peak pressure are unweighted within the generalized hearing range, while SEL source levels are weighted according to the appropriate auditory weighting function. Delineation of potential injury zones on the basis of the cumulative SEL metric for vibratory driving was performed using a single-frequency weighting factor adjustment (WFA) of 2.5 kHz, as recommended by the NMFS User Spreadsheet, described in Appendix D of NMFS's Technical Guidance (NMFS, 2016). In order to assist in simple application of the auditory weighting functions, NMFS recommends WFAs for use with specific types of activities that produce broadband or narrowband noise. WFAs consider marine mammal auditory weighting functions by focusing on a single frequency. This will typically result in higher predicted exposures for broadband sounds, since only one frequency is being considered, compared to exposures associated with the ability to fully incorporate the Technical Guidance's weighting functions.

Because use of the WFA typically results in an overestimate of zone size, the Navy took an alternative approach to delineating potential injury zones for impact driving of 24- and 36-in steel piles and 24-in concrete piles. Note that, because data is not available for all pile sizes and types, we conservatively assume the following in using the available data for 24- and 36-in steel piles and 24-in concrete piles: (1) Injury zones for impact driving 14-in piles are equivalent to the zones for 24-in piles with no bubble curtain; (2) injury zones for impact driving plastic and timber piles and for 18-in concrete piles are equivalent to the zones for 24-in concrete piles; and (3) injury zones for impact driving 30-in steel piles are equivalent to the zones calculated for 36-in piles (both with and without bubble curtain).

This approach, described in detail in Appendix E of the Navy's application, incorporated frequency weighting adjustments by applying the auditory weighting function over the entire one-second SEL spectral data sets from impact pile driving. If this information for a particular pile size was not available, the next highest source level was used to produce a conservative estimate of areas above threshold values. Sound level measurements from construction activities during the 2011 Test Pile Program at NBK Bangor were used for evaluation of impact-driven steel piles, and sound level measurements from construction activities during the 2015 Intermediate Maintenance Facility Pier 6 Fender Pile Replacement Project at NBK Bremerton were used for evaluation of impact-driven concrete piles.

In consideration of the assumptions relating to propagation, sound source levels, and the methodology applied by the Navy towards incorporating frequency weighting adjustments for delineation of cumulative SEL injury zones for impact driving of steel and concrete piles, notional radial distances to relevant thresholds were calculated (Table 6). However, these distances are sometimes constrained by topography. Actual notional ensonified zones at each facility are shown in Tables 6–1 to 6–6b of the Navy's application. These zones are modeled on the basis of a notional pile located at the seaward end of a given structure in order to provide a conservative estimate of ensonified area.

TABLE 6—CALCULATED DISTANCES TO LEVEL A HARASSMENT ZONES

Pile	Driver	PW		OW		LF		MF		HF	
		pk	cSEL	pk	cSEL	pk	cSEL	pk	cSEL	pk	cSEL
24-in concrete [1]	Impact	0	34	0	2	0	216	0	3	1	136
24-in steel [2]	Impact; BC	1	25	0	1.4	1	136	0	3	10	185
24-in steel [2]	Impact; no BC	3	86	0	5	3	159	0	6	34	342
36-in steel [2]	Impact; BC	1	158	0	9	1	736	0	10	12	541
36-in steel [2]	Impact; no BC	3	736	0	46	3	2,512	1	63	40	2,512
12- to 14-in timber [3]	Vibratory	n/a	1	n/a	<1	n/a	2	n/a	<1	n/a	3
16- and 24-in steel [4]	Vibratory	n/a	7	n/a	1	n/a	12	n/a	1	n/a	17
30- and 36-in steel (Bangor) [4]	Vibratory	n/a	15	n/a	11	n/a	25	n/a	2	n/a	37
30- and 36-in steel (others) [4]	Vibratory	n/a	18	n/a	1	n/a	30	n/a	3	n/a	43
Sheet steel [4]	Vibratory	n/a	10	n/a	1	n/a	16	n/a	1	n/a	24

PW=Phocid; OW=Otariid; LF=low frequency; MF=mid frequency; HF=high frequency; pk=peak pressure; cSEL=cumulative SEL; BC=bubble curtain.
[1] Assumes 4,000 strikes per day.
[2] Assumes 1,000 strikes per day. Bubble curtain will be used for 24-, 30-, and 36-in steel piles except at NBK Bremerton and NBK Keyport. Steel piles will not be installed at NBK Manchester.
[3] Assumes 30 minute daily driving duration.
[4] Assumes 2.25 hour daily driving duration.

Airborne Noise—Although pinnipeds are known to haul-out regularly on man-made objects in the vicinity of some of the potential project sites, we believe that incidents of take resulting solely from airborne sound are unlikely. There is a possibility that an animal could surface in-water, but with head out, within the area in which airborne sound exceeds relevant thresholds and thereby be exposed to levels of airborne sound that we associate with harassment, but any such occurrence would likely be accounted for in our estimation of incidental take from underwater sound.

Certain locations where pinnipeds may haul-out may be within an airborne noise harassment zone. We generally recognize that pinnipeds occurring within an estimated airborne harassment zone, whether in the water or hauled out, could be exposed to airborne sound that may result in behavioral harassment. However, any animal exposed to airborne sound above the behavioral harassment threshold is likely to also be exposed to underwater sound above relevant thresholds (which are typically in all cases larger zones than those associated with airborne sound). Thus, the behavioral harassment of these animals is already accounted for in these estimates of potential take. Multiple incidents of exposure to sound above NMFS's thresholds for behavioral harassment are not believed to result in increased behavioral disturbance, in either nature or intensity of disturbance reaction. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here. Further information regarding anticipated airborne noise from pile driving may be found in section 6.8 of the Navy's application.

Summary—Here, we summarize facility-specific information about piles to be removed and installed. In general, it is likely that pile removals may be accomplished via a combination of methods (*e.g.,* vibratory driver, cut at mudline, direct pull). However, for purposes of analysis we assume that all removals would be via vibratory driver. In addition, we assume that installation of all steel piles larger than 14-in would require use of both impact and vibratory drivers, although it is likely that some of these piles would be installed solely via use of the vibratory driver. All concrete, timber, and plastic piles would be installed solely via impact driver. Steel sheet piles and steel pipe piles of 14-in diameter and smaller would be installed solely via vibratory driver. All piles removed are assumed to be replaced at a 1:1 ratio, although it is likely that a lesser number of replacement piles would be required. For full details, please see Appendix A of the Navy's application.

- NBK Bangor: The Navy anticipates ongoing maintenance work at the older Explosives Handling Wharf (EHW–1), including removal and replacement of up to 44 piles. Replacement of up to 75 piles is anticipated for contingency repairs at any existing structure. Piles to be removed would be steel, timber, and/or concrete, and replacement piles would be steel and/or concrete. As a conservative scenario, all piles are assumed to be 36-in steel for purposes of analysis.
- Zelatched Point: Replacement of up to 20 piles is anticipated for contingency repairs. Piles to be removed would be 12-in timber piles, while replacement piles could be steel, timber, and/or concrete. As a conservative scenario, all replacement piles are assumed to be 36-in steel for purposes of analysis.
- NBK Bremerton: The Navy anticipates ongoing maintenance work at multiple existing structures. At Pier 5, 360 timber fender piles would be removed and replaced with concrete piles. Timber piles are assumed to be 14-in diameter, and concrete piles are assumed to be 24-in. At Pier 4, 80 timber fender piles would be replaced with steel piles—timber and steel piles are assumed to be 14-in diameter. Anticipated repairs to other piers would require removal of up to 20 timber piles, followed by installation of steel sheet piles. Replacement of up to 75 piles is anticipated for contingency repairs at any existing structure. Piles to be removed would be steel and/or timber, and replacement piles would be 24-in concrete. The largest estimated Level B ZOI results from vibratory driving of sheet piles, which is expected to occur for only twenty of the estimated total of 168 activity days. The Navy has elected to assume this largest estimated ZOI for all 168 activity days as a conservative scenario.
- NBK Keyport: Replacement of up to 20 piles is anticipated for contingency repairs. Piles to be removed would be steel and/or concrete (up to 18-in), while replacement piles would be steel. As a conservative scenario, all replacement piles are assumed to be 36-in steel for purposes of analysis.
- NBK Manchester: Replacement of up to 50 piles is anticipated for contingency repairs. Piles to be removed would be timber and/or plastic (up to 18-in), while replacement piles could be timber, plastic, and/or concrete. As a conservative scenario, all replacement piles are assumed to be 24-in concrete for purposes of analysis.
- NS Everett: The Navy anticipates minor repairs at the North Wharf, requiring replacement of two concrete piles (assumed to be 24-in). Replacement of up to 76 piles is anticipated for contingency repairs. Piles to be removed would include one steel pile and 75 timber piles. The one steel pile would be replaced by a 36-in steel pile, while the timber piles could be replaced by concrete and/or timber piles. As a conservative scenario, these replacement piles are assumed to be 24-in concrete for purposes of analysis.

Behavioral harassment zones and associated areas of ensonification are identified in Table 7 below. Although not all zones are applied to the exposure analysis, these may be effected as part of the required monitoring. Ensonified areas vary based on topography in the vicinity of the facility and are provided for each relevant facility.

TABLE 7—RADIAL DISTANCES TO RELEVANT BEHAVIORAL ISOPLETHS AND ASSOCIATED ENSONIFIED AREAS

Pile size and type	Impact (160-dB rms) [1]	Ensonified area [2]	Vibratory (120-dB) [3]	Ensonified area [2]
Plastic (13-in)	5	0.001	n/a	n/a.
Timber (12-in)	46	0.01	1.6	3.8 (Manchester Finger Pier); 4.6 (Manchester Fuel Pier).
Timber (13/14-in) [4]	46	0.01	2.2	6.8 (Bremerton); 5.9 (Manchester Finger Pier); 7.8 (Manchester Fuel Pier); [6] 9.4 (Everett)
Concrete (24-in) [4]	159	0.08	n/a	n/a.
Steel (14-in)	398	0.5 (Bremerton)	2.2	6.8 (Bremerton).

TABLE 7—RADIAL DISTANCES TO RELEVANT BEHAVIORAL ISOPLETHS AND ASSOCIATED ENSONIFIED AREAS—Continued

Pile size and type	Impact (160-dB rms) [1]	Ensonified area [2]	Vibratory (120-dB) [3]	Ensonified area [2]
Steel (24-in; BC)	464	0.54 (Bangor) 0.48 (Zelatched Point)	n/a	n/a.
Steel (24-in; no BC) [5]	1,585	2.09 (Keyport)	5.4	26.8 (Bangor); 4.9 (Keyport); 37.9 (Zelatched Point).
Steel (30-in; BC)	631	0.91 (Bangor); 0.85 (Zelatched Point); 1.2 (Everett).	n/a	n/a.
Steel (30-in; no BC)	2,154	1.94 (Keyport)	Same as 36-in	Same as 36-in.
Steel (36-in; BC)	541 (Bangor); 398 (others)	0.7 (Bangor); 0.36 (Zelatched Point); 0.5 (Everett).	n/a	n/a.
Steel (36-in; no BC)	1,359	0.42 (Keyport)	11.7 (Bangor); 13.6 (others)	4.9 (Keyport); 75.24 (Zelatched Point); 117.8 (Everett); 40.9 (Bangor).
Sheet steel	n/a	n/a	7.4	15.0 (Bremerton).

BC=bubble curtain.
[1] Radial distance to threshold in meters.
[2] Ensonified area in square kilometers.
[3] Radial distance to threshold in kilometers.
[4] Zones for impact driving of 18-in concrete piles are equivalent to those for impact driving of timber piles. Zones for vibratory removal of up to 18-in diameter plastic/timber piles are assumed to be equivalent to those for 13/14-in timber piles.
[5] Zones for vibratory driving of 16-in steel piles assumed equivalent to those for 24-in steel piles.
[6] Worst-case values for vibratory extraction of timber/plastic piles at NBK Manchester, where piles to be removed are a maximum 18-in diameter.

Marine Mammal Occurrence

Available information regarding marine mammal occurrence in the vicinity of the six installations includes density information aggregated in the Navy's Marine Mammal Species Density Database (NMSDD; Navy, 2015) or site-specific survey information from particular installations (*e.g.,* local pinniped counts). More recent density estimates for harbor porpoise are available in Smultea *et al.* (2017). The latter of these is described in Appendix C of the Navy's application. First, for each installation we describe anticipated frequency of occurrence and the information deemed most appropriate for the exposure estimates. For all facilities, large whales (humpback whale, minke whale, and gray whale), killer whales (transient and resident), and the elephant seal are considered as occurring only rarely and unpredictably, on the basis of past sighting records. For these species, average group size is considered in concert with expected frequency of occurrence to develop the most realistic exposure estimate. Although certain species are not expected to occur at all at some facilities—for example, resident killer whales are not expected to occur in Hood Canal—the Navy has developed an overall take estimate and request for these species that would apply to activities occurring over the 5-year duration at all six installations.

- NBK Bangor: In addition to the species described above, the Dall's porpoise is considered as a rare, unpredictably occurring species. A density-based analysis is used for the harbor porpoise, while data from site-specific abundance surveys is used for the California sea lion, Steller sea lion, and harbor seal.
- Zelatched Point: In addition to the species described above, the Dall's porpoise is considered as a rare, unpredictably occurring species. A density-based analysis is used for the harbor porpoise, California sea lion, Steller sea lion, and harbor seal.
- NBK Bremerton: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and Steller sea lion, while data from site-specific abundance surveys is used for the California sea lion and harbor seal.
- NBK Keyport: A density-based analysis is used for the harbor porpoise, Dall's porpoise, California sea lion, Steller sea lion, and harbor seal.
- NBK Manchester: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and harbor seal, while data from site-specific abundance surveys is used for the California sea lion and Steller sea lion.
- NS Everett: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and Steller sea lion, while data from site-specific abundance surveys is used for the California sea lion and harbor seal.

TABLE 8—MARINE MAMMAL DENSITIES

Species	Region	Density (June–February)
Harbor porpoise	Hood Canal (Bangor, Zelatched Point)	0.44
	East Whidbey (Everett)	0.75
	Bainbridge (Bremerton, Keyport)	0.53
	Vashon (Manchester)	0.25
Dall's porpoise	Puget Sound	0.039
Steller sea lion	Puget Sound	0.0368
	Dabob Bay	0.0251
California sea lion	Puget Sound	0.1266
	Dabob Bay	0.279
Harbor seal	Everett	2.2062
	Keyport/Manchester	1.219

TABLE 8—MARINE MAMMAL DENSITIES—Continued

Species	Region	Density (June–February)
	Dabob Bay	9.918

Sources: Navy, 2015; Smultea *et al.,* 2017 (harbor porpoise).

Exposure Estimates

To quantitatively assess exposure of marine mammals to noise from pile driving activities, the Navy proposed three methods, to be used depending on the species' spatial and temporal occurrence. For species with rare or infrequent occurrence at a given installation during the in-water work window, the likelihood of interaction was reviewed on the basis of past records of occurrence (described in Description of Marine Mammals in the Area of the Specified Activity) and the potential maximum duration of work days at each installation, as well as total work days for all installations. Occurrence of the species in this category (*i.e.,* large whales, killer whales, elephant seal (all installations), and Dall's porpoise (Hood Canal)) would not be anticipated to extend for multiple days. For the large whales and killer whales, the duration of occurrence was set to two days, expected to be roughly equivalent to one transit in the vicinity of a project site. The calculation for species with rare or infrequent occurrence is:

Exposure estimate = expected group size × probable duration

For species that occur regularly but for which site-specific abundance information is not available, density estimates (Table 8) were used to determine the number of animals potentially exposed on any one day of pile driving or extraction. The calculation for density-based analysis of species with regular occurrence is:

Exposure estimate = N (density) × ZOI (area) × maximum days of pile driving

For remaining species, site-specific abundance information (*i.e.,* average monthly maximum over the time period when pile driving will occur) was used:

Exposure estimate = Abundance × maximum days of pile driving

Large Whales—For each species of large whale (*i.e.,* humpback whale, minke whale, and gray whale), we assume rare and infrequent occurrence at all installations. For all three species, if observed, they typically occur singly or in pairs. Therefore, for all three species, we assume that a pair of whales may occur in the vicinity of an installation for a total of two days. We do not expect that this would happen multiple times, and cannot predict where such an occurrence may happen, so propose to authorize a total of four takes of each species in total for the 5-year duration (across all installations).

It is important to note that the Navy proposes to implement a shutdown of pile driving activity if any large whale is observed within any defined harassment zone (see Proposed Mitigation). Therefore, the proposed take authorization is intended to provide insurance against the event that whales occur within Level B harassment zones that cannot be fully observed by monitors. As a result of this proposed mitigation, we do not believe that Level A harassment is a likely outcome upon occurrence of any large whale. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–736 m for other impact driving scenarios), this requires that a whale be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a large whale, and the likelihood that the presence of a large whale in the vicinity of any Navy installation would be known due to reporting via Orca Network, we do not expect that any whale would be present within a Level A harassment zone for sufficient duration to actually experience PTS.

Killer Whales—For killer whales, the proposed take authorization is derived via the same thought process described above for large whales. For transient killer whales, we assume an average group size of six whales occurring for a period of two days. The resulting total proposed take authorization of 12 would also account for the low probability that a larger group occurred once. For resident killer whales, we assume an average group size of 20 whales occurring for two days. This is equivalent to the expected pod size for J pod, which is most likely to occur in the vicinity of Navy installations, but would also account for the unlikely occurrence of L pod (with a size of approximately 40 whales) once in the vicinity of any Navy installation.

Similar to large whales, the Navy proposes to implement shutdown of pile driving activity at any time that any killer whale is observed within any calculated harassment zone. We expect this to minimize the extent and duration of any behavioral harassment. Given the small size of calculated Level A harassment zones—maximum of 63 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–10 m—we do not anticipate any potential for Level A harassment of killer whales.

Dall's Porpoise—Using the density given in Table 8, the largest appropriate ZOI for each of the four installations in Puget Sound, and the number of days associated with each of these installations (as indicated in harbor porpoise section below), the total estimated exposure of Dall's porpoises above Level B harassment thresholds is 146. Dall's porpoises are not expected to occur in Hood Canal. Dall's porpoises are not expected to occur frequently in the vicinity of Navy installations and have not been reported in recent years. This total proposed take authorization (146) is applied to all installations over the 5-year duration.

The Navy proposes to implement shutdown of pile driving activity at any time if a Dall's porpoise is observed in any harassment zone. Therefore, the take estimate is precautionary in accounting for potential occurrence in areas that cannot be visually observed or in the event that porpoises appear within behavioral harassment zones before shutdown can be implemented. As was described for large whales, as a result of this proposed mitigation, we do not believe that Level A harassment is a likely outcome. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–541 m for other impact driving scenarios), this requires that a porpoise be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a porpoise, and the likelihood that a porpoise would engage in aversive behavior prior to experiencing PTS, we do not expect that any porpoise would be present within a Level A harassment zone for sufficient duration to actually experience PTS.

Harbor Porpoise—Level B exposure estimates for harbor porpoise were calculated for each installation using the appropriate density given in Table 8, the largest appropriate ZOI for each installation, and the appropriate number of days.

• NBK Bangor: Using the Hood Canal sub-region density, 119 days of pile driving, and the largest ZOI calculated for pile driving at this location (40.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 2,142 incidents of Level B exposure for harbor porpoise.

• Zelatched Point: Using the Hood Canal sub-region density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 662 incidents of Level B exposure for harbor porpoise.

• NBK Bremerton: Using the Bainbridge sub-region density, 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km^2 for vibratory installation of sheet steel piles) produces an estimate of 1,336 incidents of Level B exposure for harbor porpoise.

• NBK Keyport: Using the Bainbridge sub-region density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 52 incidents of Level B exposure for harbor porpoise.

• NBK Manchester: Using the Vashon sub-region density, 50 days of pile driving, and the largest ZOI calculated for vibratory removal of timber piles (7.8 km^2 for vibratory extraction of timber piles) produces an estimate of 98 incidents of Level B exposure for harbor porpoise.

• NS Everett: Using the East Whidbey sub-region density, 78 days of pile driving, and the largest ZOI calculated for vibratory extraction of timber piles (9.4 km^2) produces an estimate of 552 incidents of Level B exposure for harbor porpoise. Although some vibratory installation is anticipated for a single steel pile, we anticipate this would occur for only a brief period. Therefore, use of the assumed zone for vibratory extraction of timber piles is appropriate in accounting for reasonably expected marine mammal exposure at this location.

The Navy proposes to implement shutdown of pile driving activity at any time if a harbor porpoise is observed in any harassment zone. Therefore, the take estimate is precautionary in accounting for potential occurrence in areas that cannot be visually observed or in the event that porpoises appear within behavioral harassment zones before shutdown can be implemented. As was described for large whales, as a result of this proposed mitigation, we do not believe that Level A harassment is a likely outcome. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–541 m for other impact driving scenarios), this requires that a porpoise be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a porpoise, and the likelihood that a porpoise would engage in aversive behavior prior to experiencing PTS, we do not expect that any porpoise would be present within a Level A harassment zone for sufficient duration to actually experience PTS.

Steller Sea Lion—Level B exposure estimates for Steller sea lions were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Please see Appendix C of the Navy's application for details of site-specific abundance information.

• NBK Bangor: Steller sea lions are routinely seen hauled out from mid-September through May, with a maximum daily haul-out count of 13 individuals in November 2014. Because the daily average number of Steller sea lions hauled out at Bangor has increased since 2013 compared to prior years, the Navy relied on 2013–2016 monitoring data to determine the average of the maximum count of hauled out Steller sea lions for each month in the in-water work window. The average of the monthly maximum counts during the in-water work window provides an estimate of three sea lions present per day. Using this value for 119 days results in an estimate of 357 incidents of Level B exposure.

• Zelatched Point: Using the Dabob Bay density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 38 incidents of Level B exposure for Steller sea lions.

• NBK Bremerton: Using the Puget Sound density value, 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km^2 for vibratory installation of sheet steel piles) produces an estimate of 93 incidents of Level B exposure for Steller sea lions.

• NBK Keyport: Using the Puget Sound density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of four incidents of Level B exposure for Steller sea lions.

• NBK Manchester: Sea lions haul out on floats approximately 800 m offshore. Based on shore-based observations conducted intermittently in 2012–2013 and more frequently in 2014–2016, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014, the Navy estimates that 10 Steller sea lions may be present on any given day. Using this average value for 50 days results in an estimate of 500 incidents of Level B exposure.

• NS Everett: Using the Puget Sound density value, 78 days of pile driving, and the largest ZOI calculated for this location (9.4 km^2) produces an estimate of 27 incidents of Level B exposure for harbor porpoise.

Given the small size of calculated Level A harassment zones—maximum of 43 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–11 m—we do not anticipate any potential for Level A harassment of Steller sea lions.

California Sea Lions—Level B exposure estimates for California sea lions were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Please see Appendix C of the Navy's application for details of site-specific abundance information.

• NBK Bangor: California sea lions are routinely seen hauled out in all months other than July. Because the daily average number of California sea lions hauled out at Bangor has increased since 2013 compared to prior years, the Navy relied on 2013–2016 monitoring data to determine the average of the maximum count of hauled out California sea lions for each month in the in-water work window. The average of the monthly maximum counts during the in-water work window provides an estimate of 49 sea lions per day. Using this value for 119 days results in an estimate of 5,831 incidents of Level B exposure.

• Zelatched Point: Using the Dabob Bay density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or

36-in steel piles) produces an estimate of 420 incidents of Level B exposure for California sea lions.

• NBK Bremerton: California sea lions are routinely seen hauled out on floats at NBK Bremerton. Survey data from 2012–2016 indicate as many as 144 animals hauled out each day during this time period, with the majority of animals observed August through May and the greatest numbers observed in November. The average of the monthly maximum counts during the in-water work window provides an estimate of 69 sea lions per day. Using this value for 168 days results in an estimate of 11,592 incidents of Level B exposure.

• NBK Keyport: Using the Puget Sound density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 12 incidents of Level B exposure for California sea lions.

• NBK Manchester: Sea lions haul out on floats approximately 800 m offshore. Based on shore-based observations conducted intermittently in 2012–2013 and more frequently in 2014–2016, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014, the Navy estimates that 43 California sea lions may be present on any given day. Using this average value for 50 days results in a Level B exposure estimate of 2,150 incidents of Level B exposure.

• NS Everett: California sea lions are routinely seen hauled out on floats at NS Everett. Survey data from 2012–2016 indicate as many as 130 animals hauled out each day during this time period, with the majority of animals observed July through February and the greatest numbers observed in November. The average of the monthly maximum counts during the in-water work window provides an estimate of 67 sea lions per day. Using this value for 78 days results in an estimate of 5,148 incidents of Level B exposure.

Given the small size of calculated Level A harassment zones—maximum of 43 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–11 m—we do not anticipate any potential for Level A harassment of California sea lions.

Harbor Seal—Harbor seals are expected to occur year-round at all installations, with the greatest numbers expected at installations with nearby haul-out sites. Level B exposure estimates for harbor seals were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Please see Appendix C of the Navy's application for details of site-specific abundance information.

Harbor seals are expected to be the most abundant marine mammal at all installations, often occurring in and around existing in-water structures in a way that may restrict observers' ability to adequately observe seals and subsequently implement shutdowns. In addition, the calculated Level A harassment zones are significantly larger than those for sea lions, which may also be abundant at various installations at certain times of year. For harbor seals, the largest calculated Level A harassment zone is 736 m (compared with a maximum zone of 43 m for sea lions), calculated for the worst-case scenario of impact-driven 36-in steel piles without use of the bubble curtain. Other scenarios range from 25–158 m. Therefore, we assume that some Level A harassment is likely to occur for harbor seals and provide installation-specific estimates below.

• NBK Bangor: The closest major haul-outs to NBK Bangor that are regularly used by harbor seals are located approximately 13.2 km away. However, a small haul-out occurs under Marginal Wharf and small numbers of harbor seals are known to routinely haul out around the Carderock pier. Boat-based surveys and monitoring indicate that harbor seals regularly swim in the waters at NBK Bangor. Surveys conducted in August and September 2016 recorded as many as 28 harbor seals hauled out per day under Marginal Wharf or swimming in adjacent waters. Assuming a few other individuals may be present elsewhere on the Bangor waterfront, the Navy estimates that 35 harbor seals may be present per day near the installation during summer and early fall, which are expected to be months with greatest abundance of seals. Using this value for 119 days results in an estimate of 4,165 incidents of Level B exposure.

Considering the largest Level A harassment zone expected to typically occur at NBK Bangor (158 m), and assuming as a precaution that one seal per day could remain within the calculated zone for a sufficient period to accumulate enough energy to result in PTS, we propose to authorize 119 incidents of take by Level A harassment. It is important to note that the estimate of potential Level A harassment for NBK Bangor is expected to be an overestimate, as planned projects are not expected to occur near Marginal Wharf—the location where most harbor seal activity occurs.

• Zelatched Point: Using the Dabob Bay density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 14,925 incidents of Level B exposure for harbor seals. The largest calculated Level A harassment zone at Zelatched Point would be 158 m. However, because harbor seals are not known to haul-out or congregate in the vicinity of in-water structures, as is the case at NBK Bangor, we do not anticipate that Level A harassment will occur at Zelatched Point and do not propose to authorize such take.

• NBK Bremerton: Harbor seals do not typically haul out at NBK Bremerton, but are commonly present in the nearby vicinity within Sinclair Inlet. Marine mammal surveys conducted nearby during the construction of the Manette Bridge (WSDOT, 2011, 2012) indicate that approximately 11 animals may be present per day. Using this value for 168 days results in an estimate of 1,848 incidents of Level B exposure. The largest Level A harassment zone at NBK Bremerton would be 86 m and, given the lack of regular presence of harbor seals in close proximity to existing in-water structures, we do not anticipate that Level A harassment will occur at NBK Bremerton and do not propose to authorize such take.

• NBK Keyport: No harbor seal haul-outs have been identified at this installation. Using the Puget Sound density value, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 119 incidents of Level B exposure for harbor seals. Given the lack of haul-outs and of regular harbor seal presence at this installation, we do not anticipate that Level A harassment will occur at NBK Keyport and do not propose to authorize such take.

• NBK Manchester: No harbor seal haul-outs have been identified at this installation. Using the appropriate density value, 50 days of pile driving, and the largest ZOI calculated for vibratory extraction of timber piles (7.8 km^2) produces an estimate of 477 incidents of Level B exposure for harbor seals. Given the lack of haul-outs and of regular harbor seal presence at this installation, we do not anticipate that Level A harassment will occur at NBK Manchester and do not propose to authorize such take.

• NS Everett: Harbor seals haul out year-round on log rafts adjacent to NS Everett. Surveys from 2012–2016 indicate as many as 491 animals hauled out each day during the in-water work period from July through January with the maximum number observed in September and October. The average of the monthly maximum counts during the in-water work window provides an estimate of 212 seals per day. Using this value for 78 days results in an estimate of 16,536 incidents of Level B exposure.

The largest Level A harassment zone calculated for NS Everett (158 m) would occur for only one day during impact driving of the single 36-in steel pile. During the remainder of pile driving at this installation, the largest Level A zone would be 34 m (impact driving of 24-in concrete piles). Given the abundant seal population at this site, we assume that some portion of the seal population may be present and unobserved within these zones for a sufficient period to accumulate enough energy to result in PTS. For the larger zone, the Navy assumes that five percent of animals present (11) may occur within the Level A zone for such a duration, while for the smaller zone associated with concrete piles, the Navy assumes that one percent (2) of the population may occur within the zone for such a duration. Therefore, we propose to authorize 165 incidents of take by Level A harassment (*i.e.,* two seals on each of the 77 concrete pile driving days in addition to 11 seals on the one day on which a steel pile would be installed).

Northern Elephant Seal—Northern elephant seals are considered rare visitors to Puget Sound. However, solitary juvenile elephant seals have been known to sporadically haul out to molt in Puget Sound during spring and summer months. Because there are occasional sightings in Puget Sound, the Navy reasons that exposure of up to one seal to noise above Level B harassment thresholds could occur for a two-day duration. This event could occur at any installation over the 5-year duration.

The total proposed take authorization for all species and installations is summarized in Table 9 below. No authorization of take by Level A harassment is proposed for authorization, except a total of 286 such incidents for harbor seals (anticipated to occur at NBK Bangor and NS Everett only).

TABLE 9—PROPOSED TAKE AUTHORIZATION BY LEVEL B HARASSMENT

Species	Bangor	Zelatched Point	Bremerton	Keyport	Manchester	Everett	Total	Percent [1]
Humpback whale	Applies across all installations						4	0.2
Minke whale	Applies across all installations						4	0.02
Gray whale	Applies across all installations						4	0.6
Killer whale (transient)	Applies across all installations						12	4.9
Killer whale (resident)	Applies across all installations						40	48.2
Dall's porpoise	Applies across all installations						146	0.6
Harbor porpoise	2,142	662	1,336	52	98	552	4,842	43.1
Steller sea lion	357	38	93	4	500	27	1,019	2.4
California sea lion	5,831	420	11,592	12	2,150	5,148	25,153	8.5
Harbor seal	4,680	14,925	1,848	119	477	16,536	38,585	n/a
Elephant seal	Applies across all installations						2	0.001

[1] Please see Small Numbers Analysis for more details about these percentages.

Proposed Mitigation

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, and on the availability of such species or stock for taking for certain subsistence uses (''least practicable adverse impact''). NMFS does not have a regulatory definition for ''least practicable adverse impact.'' However, NMFS's implementing regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, implementation of the measure(s) is expected to reduce impacts to marine mammal species or stocks, their habitat, and their availability for subsistence uses. This analysis will consider such things as the nature of the potential adverse impact (such as likelihood, scope, and range), the likelihood that the measure will be effective if implemented, and the likelihood of successful implementation.

(2) The practicability of the measure for applicant implementation. Practicability of implementation may consider such things as cost, impact on operations, personnel safety, and practicality of implementation.

The mitigation strategies described below largely follow those required and successfully implemented under previous incidental take authorizations issued in association with similar construction activities. Measurements from similar pile driving events were coupled with practical spreading loss and other relevant information to estimate zones of influence (ZOI; see ''Estimated Take''); these ZOI values were used to develop mitigation measures for pile driving activities at the six installations. Background discussion related to underwater sound concepts and terminology is provided in the section on ''Description of Sound Sources,'' earlier in this preamble. The ZOIs were used to inform the mitigation zones that would be established to prevent Level A harassment and to minimize Level B harassment for all cetacean species, while providing estimates of the areas within which Level B harassment might occur.

During installation of steel piles, the Navy would use vibratory driving to the maximum extent practicable. In addition to the specific measures described later in this section, the Navy would conduct briefings for construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures. Other mitigation requirements committed to by the Navy but not relating to marine mammals (*e.g.,* construction best management practices) are described in section 11 of the Navy's application.

Timing

As described previously, the Navy would adhere to in-water work windows designed for the protection of fish. These timing windows would also benefit marine mammals by limiting the annual duration of construction activities. At NBK Bangor and Zelatched Point, the Navy would adhere to a July 16 through January 15 window, while at the remaining facilities this window is extended to February 15.

On a daily basis, in-water construction activities will occur only during daylight hours (sunrise to sunset) except from July 16 to September 15 when impact pile driving will only occur starting two hours after sunrise and ending two hours before sunset in order to protect marbled murrelets (*Brachyramphus marmoratus*) during the nesting season.

Monitoring and Shutdown for Pile Driving

The following measures would apply to the Navy's mitigation through shutdown and disturbance zones:

Shutdown Zone—The purpose of a shutdown zone is to define an area within which shutdown of activity would occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area), thus preventing some undesirable outcome, such as auditory injury or behavioral disturbance of sensitive species (serious injury or death are unlikely outcomes even in the absence of mitigation measures). For all pile driving activities, the Navy would establish a minimum shutdown zone with a radial distance of 10 m. This minimum zone is intended to prevent the already unlikely possibility of physical interaction with construction equipment and to establish a precautionary minimum zone with regard to acoustic effects.

Using NMFS's user spreadsheet, an optional companion spreadsheet associated with the alternative implementation methodology provided in Appendix D of NMFS's acoustic guidance (NMFS, 2016), pile type, size, and pile driving methodology-specific zones within which auditory injury (*i.e.,* Level A harassment) could occur were calculated. For larger steel piles and concrete piles, an alternative methodology (described in greater detail in ''Estimated Take'' and in Appendix E of the Navy's application) was used. The user spreadsheet is publicly available online at *www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.* In using the spreadsheet, practical spreading loss was used in addition to information regarding assumed number of pile strikes per day (for impact pile driving) and daily duration of pile driving (for vibratory pile driving). Relevant information was provided in Tables 3–5 and calculated zones were provided in Table 6.

In many cases, especially for vibratory driving, the minimum shutdown zone of 10 m is expected to contain the area in which auditory injury could occur. In all circumstances where the predicted Level A harassment zone exceeds the minimum zone, the Navy proposes to implement a shutdown zone equal to the predicted Level A harassment zone (see Table 6). In all cases, predicted injury zones are calculated on the basis of cumulative sound exposure, as peak pressure source levels produce smaller predicted zones. In addition, the Navy proposes to implement shutdown upon observation of any cetacean within a calculated Level B harassment zone (see Table 7).

Injury zone predictions generated using the optional user spreadsheet are precautionary due to a number of simplifying assumptions. For example, the spreadsheet tool assumes that marine mammals remain stationary during the activity and does not account for potential recovery between intermittent sounds. In addition, the tool incorporates the acoustic guidance's weighting functions through use of a single-frequency weighting factor adjustment intended to represent the signal's 95 percent frequency contour percentile (*i.e.,* upper frequency below which 95 percent of total cumulative energy is contained; Charif *et al.,* 2010). This will typically result in higher predicted exposures for broadband sounds, since only one frequency is being considered, compared to exposures associated with the ability to fully incorporate the guidance's weighting functions. Note that the caveats related to WFA do not apply to the alternative method used by the Navy and applied to impact driving of 24- and 36-in steel piles and 24-in concrete piles.

Disturbance Zone—Disturbance zones are the areas in which sound pressure levels equal or exceed 160 and 120 dB rms (for impact and vibratory pile driving, respectively). Disturbance zones provide utility for monitoring conducted for mitigation purposes (*i.e.,* shutdown zone monitoring) by establishing monitoring protocols for areas adjacent to the shutdown zones and, as noted above, the disturbance zones act as de facto shutdown zones for cetaceans. Monitoring of disturbance zones enables observers to be aware of and communicate the presence of marine mammals in the project area but outside the shutdown zone, and thus prepare for potential shutdowns of activity. For cetaceans, the Navy would implement shutdowns upon observation of any cetacean within a disturbance zone (while acknowledging that some disturbance zones are too large to practicably monitor)—these would also be recorded as incidents of harassment. For pinnipeds, the primary purpose of disturbance zone monitoring is for documenting incidents of Level B harassment; disturbance zone monitoring is discussed in greater detail later (see ''Proposed Monitoring and Reporting''). Nominal radial distances for disturbance zones are shown in Table 7.

In order to document observed incidents of harassment, monitors record all marine mammal observations, regardless of location. The observer's location and the location of the pile being driven are known, and the location of the animal may be estimated as a distance from the observer and then compared to the location from the pile. It may then be estimated whether the animal was exposed to sound levels constituting incidental harassment on the basis of predicted distances to relevant thresholds in post-processing of observational data, and a precise accounting of observed incidents of harassment created. This information may then be used to extrapolate observed takes to reach an approximate understanding of actual total takes, in cases where the entire zone was not monitored.

Monitoring Protocols—Monitoring would be conducted before, during, and after pile driving activities. In addition, observers will record all incidents of marine mammal occurrence, regardless of distance from activity, and monitors will document any behavioral reactions in concert with distance from piles being driven. Observations made outside the shutdown zone will not result in shutdown; that pile segment will be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point all pile driving activities would be halted. Monitoring will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving activities. Pile driving activities include the time to install or remove a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes.

The following additional measures apply to visual monitoring:

(1) Monitoring will be conducted by qualified, trained protected species observers, who will be placed at the best vantage point(s) practicable (*i.e.,* from a small boat, construction barges, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. Observers would have no other construction-related tasks while conducting monitoring. Observers should have the following minimum qualifications:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target;
- Ability to conduct field observations and collect data according to assigned protocols;
- Experience or training in the field identification of marine mammals, including the identification of behaviors;
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;
- Writing skills sufficient to document observations including, but not limited to: The number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury of marine mammals from construction noise within a defined shutdown zone; and marine mammal behavior; and
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

Observer teams employed by the Navy in satisfaction of the mitigation and monitoring requirements described herein must meet the following additional requirements:

- Independent observers (*i.e.,* not construction personnel) are required.
- At least one observer must have prior experience working as an observer.
- Other observers may substitute education (degree in biological science or related field) or training for experience.
- Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.
- We will require submission and approval of observer CVs.

(2) Prior to the start of pile driving activity, the shutdown zone will be monitored for 15 minutes to ensure that it is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals; animals will be allowed to remain in the shutdown zone (*i.e.,* must leave of their own volition), and their behavior will be monitored and documented. The shutdown zone may only be declared clear, and pile driving started, when the entire shutdown zone is visible (*i.e.,* when not obscured by dark, rain, fog, etc.). In addition, if such conditions should arise during impact pile driving that is already underway, the activity would be halted.

(3) If a marine mammal approaches or enters the shutdown zone during the course of pile driving operations, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of the animal. Monitoring will be conducted throughout the time required to drive a pile and for thirty minutes following the conclusion of pile driving.

Soft Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning marine mammals or providing them with a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. This procedure is repeated two additional times. It is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in ''bouncing'' of the hammer as it strikes the pile, resulting in multiple ''strikes.'' The Navy will utilize soft start techniques for impact pile driving. We require an initial set of three strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then 2 subsequent 3-strike sets. Soft start will be required at the beginning of each day's impact pile driving work and at any time following a cessation of impact pile driving of thirty minutes or longer; the requirement to implement soft start for impact driving is independent of whether vibratory driving has occurred within the prior 30 minutes.

Bubble Curtain

Sound levels can be greatly reduced during impact pile driving using sound attenuation devices, including bubble curtains, which create a column of air bubbles rising around a pile from the substrate to the water surface. The air bubbles absorb and scatter sound waves emanating from the pile, thereby reducing the sound energy. Bubble curtains may be confined or unconfined. Cushion blocks are also commonly used by construction contractors in order to protect equipment and the driven pile; use of cushion blocks typically reduces emitted sound pressure levels to some extent.

The literature presents a wide array of observed attenuation results for bubble curtains (see Appendix B of the Navy's application). The variability in attenuation levels is due to variation in design, as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. As a general rule, reductions of greater than 10 dB cannot be reliably predicted. Prior monitoring by the Navy during a project at NBK Bangor reported a range of measured values for realized attenuation mostly within 6 to 12 dB, but with an overall average of 9 dB in effective attenuation (Illingworth and Rodkin, 2012).

The Navy would use a bubble curtain during impact driving of all steel piles greater than 14-in diameter in water depths greater than 2 ft (0.67 m), except at NBK Bremerton and Keyport. Bubble curtains are not proposed for use during impact driving of smaller steel piles or other pile types due to the relatively low source levels, as the requirement to deploy the curtain system at each driven pile results in a significantly lower production rate. Where a bubble curtain is used, the contractor would be required to turn it on prior to the soft start in order to flush fish from the area closest to the driven pile.

Bubble curtains cannot be used at NBK Bremerton and Keyport due to the risk of disturbing contaminated sediments at these sites. Sediment contamination within Sinclair Inlet, including the project areas at NBK Bremerton, includes a variety of metals and organic chemicals originating from human sources. The marine sediments have been affected by past shipyard operations, leaching from creosote-treated piles, and other activities in Sinclair Inlet. Sediments at the project sites and adjacent to the piers at Bremerton have a pollution control plan for various metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and other semivolatile organic compounds (SVOC), and active cleanup is occurring pursuant to the terms of an agreement developed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in cooperation with the U.S. Environmental Protection Agency and the Washington Department of Ecology. The sediment at and near Keyport in Liberty Bay also has a pollution control plan, for multiple heavy metals, polychlorinated aromatic hydrocarbons, phthalates, and various other SVOCs.

To avoid loss of attenuation from design and implementation errors, the Navy will require specific bubble curtain design specifications, including testing requirements for air pressure and flow at each manifold ring prior to initial impact hammer use, and a requirement for placement on the substrate. The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact. The contractor shall also train personnel in the proper balancing of air flow to the bubblers, and must submit an inspection/performance report to the Navy for approval within 72 hours following the performance test. Corrections to the noise attenuation device to meet the performance standards shall occur prior to use for impact driving.

We have carefully evaluated the Navy's proposed mitigation measures and considered a range of other measures in the context of ensuring that we prescribed the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of these measures, we have preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses.

Proposed Monitoring and Reporting

In order to issue an LOA 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 the authorized taking. NMFS's MMPA implementing regulations further describe the information that an applicant should provide when requesting an authorization (50 CFR 216.104(a)(13)), including the means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and the level of taking or impacts on populations of marine mammals.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of significant interactions with marine mammal species in action area (*e.g.,* animals that came close to the vessel, contacted the gear, or are otherwise rare or displaying unusual behavior).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Coordination and Plan Development

An installation-specific marine mammal monitoring plan for each year's anticipated work will be developed by the Navy and presented in March of each year for approval by NMFS prior to the start of construction. Final monitoring plans will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft plans from NMFS. Please see Appendix D of the Navy's application for a marine mammal monitoring plan template. During each in-water work period covered by an LOA, the Navy would update NMFS every two months on the progress of ongoing projects (September 15, November 15, and January 15).

Visual Marine Mammal Observations

The Navy will collect sighting data and behavioral responses to pile driving activity for marine mammal species observed in the region of activity during the period of activity. The number and location of required observers would be determined specific to each installation on an annual basis, depending on the nature of work anticipated (including the size of zones to be monitored). All observers will be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. The Navy would monitor all shutdown zones at all times, and would monitor disturbance zones to the extent practicable (some zones are too large to fully observe (Table 7)). The Navy would conduct monitoring before, during, and after pile driving, with observers located at the best practicable vantage points.

As described in ''Proposed Mitigation'' and based on our requirements, the Navy would implement the following procedures for pile driving:

- Marine mammal observers would be located at the best vantage point(s) in order to properly see the entire shutdown zone and as much of the disturbance zone as possible.
- During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals.
- If the shutdown zones are obscured by fog or poor lighting conditions, pile driving at that location will not be initiated until that zone is visible. Should such conditions arise while impact driving is underway, the activity would be halted.
- The shutdown zone around the pile would be monitored for the presence of marine mammals before, during, and

after all pile driving activity, while disturbance zone monitoring would be implemented according to the schedule proposed here.

Individuals implementing the monitoring protocol will assess its effectiveness using an adaptive approach. Monitoring biologists will use their best professional judgment throughout implementation and seek improvements to these methods when deemed appropriate. Any modifications to the protocol will be coordinated between NMFS and the Navy.

Data Collection

We require that observers use standardized data forms. Among other pieces of information, the Navy will record detailed information about any implementation of shutdowns, including the distance of animals to the pile and a description of specific actions that ensued and resulting behavior of the animal, if any. We require that, at a minimum, the following information be collected on the sighting forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility);
- Water conditions (*e.g.,* sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;
- Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (*e.g.,* shutdown or delay).
- Locations of all marine mammal observations; and
- Other human activity in the area.

The Navy will note in behavioral observations, to the extent practicable, if an animal has remained in the area during construction activities. Therefore, it may be possible to identify if the same animal or different individuals are being exposed.

Acoustic Monitoring

The Navy will conduct hydroacoustic monitoring for a subset of impact-driven steel piles for projects including more than three piles where a bubble curtain is used. The USFWS has imposed requirements relating to impact driving of steel piles, including restrictions on unattenuated driving of such piles, as a result of concern regarding impacts to the ESA-listed marbled murrelet. If USFWS allows the Navy to conduct minimal driving of steel piles without the use of the bubble curtain, baseline sound measurements of steel pile driving will occur prior to the implementation of noise attenuation to evaluate the performance of the device. Impact pile driving without noise attenuation would be limited to the number of piles necessary to obtain an adequate sample size for each project.

Marine Mammal Surveys

Subject to funding availability, the Navy would continue pinniped haul-out survey counts at specific installations. Biologists conduct counts of seals and sea lions at NBK Bremerton, Bangor, Manchester, and NS Everett. Counts are conducted several times per month, depending on the installation. All animals are identified to species where possible. This information aids in determination of seasonal use of each site and trends in the number of animals.

Reporting

A draft report would be submitted to NMFS within 90 days of the completion of monitoring for each installation's in-water work window. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days, and will also provide descriptions of any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report. The Navy would also submit a comprehensive annual summary report covering all activities conducted under the incidental take regulations.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact 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 (50 CFR 216.103). 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 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'' by mortality, serious injury, and Level A or Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (*e.g.,* intensity, duration), the context of any such responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, and specific consideration of take by M/SI previously authorized for other NMFS research activities).

Pile driving activities associated with the maintenance projects, as described previously, have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment (behavioral disturbance) only (for all species other than the harbor seal) from underwater sounds generated from pile driving. Potential takes could occur if individual marine mammals are present in the ensonified zone when pile driving is happening.

No serious injury or mortality would be expected even in the absence of the proposed mitigation measures. For all species other than the harbor seal, no Level A harassment is anticipated given the nature of the activities, *i.e.,* much of the anticipated activity would involve vibratory driving and/or installation of small-diameter, non-steel piles, and measures designed to minimize the possibility of injury. The potential for injury is small for cetaceans and sea lions, and is expected to be essentially eliminated through implementation of the planned mitigation measures—use of the bubble curtain for larger steel piles at most installations, soft start (for impact driving), and shutdown zones. Impact driving, as compared with vibratory driving, has source characteristics (short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks) that are potentially injurious or more likely to produce severe behavioral reactions. Given sufficient notice through use of soft start, marine mammals are expected to move away from a sound source that is annoying prior to its becoming potentially injurious or resulting in more severe behavioral reactions. Environmental conditions in inland waters are expected to generally be good, with calm sea states, and we expect conditions would allow a high marine mammal detection capability, enabling a high rate of success in implementation of shutdowns to avoid injury.

As described previously, there are multiple species that should be considered rare in the proposed project areas and for which we propose to authorize only nominal and precautionary take of a single group for a minimal period of time (two days). Therefore, we do not expect meaningful impacts to these species (*i.e.,* humpback whale, gray whale, minke whale, transient and resident killer whales, and northern elephant seal) and preliminarily find that the total marine mammal take from each of the specified activities will have a negligible impact on these marine mammal species.

For remaining species, we discuss the likely effects of the specified activities in greater detail. Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.,* Thorson and Reyff, 2006; HDR, Inc., 2012; Lerma, 2014). Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving, although even this reaction has been observed primarily only in association with impact pile driving. The pile driving activities analyzed here are similar to, or less impactful than, numerous other construction activities conducted in San Francisco Bay and in the Puget Sound region, which have taken place with no known long-term adverse consequences from behavioral harassment.

The Navy has conducted multi-year activities potentially affecting marine mammals, and typically involving greater levels of activity than is contemplated here in various locations such as San Diego Bay and some of the installations considered herein (NBK Bangor and NBK Bremerton). Reporting from these activities has similarly reported no apparently consequential behavioral reactions or long-term effects on marine mammal populations (Lerma, 2014; Navy, 2016). Repeated exposures of individuals to relatively low levels of sound outside of preferred habitat areas are unlikely to significantly disrupt critical behaviors. Thus, even repeated Level B harassment of some small subset of the overall stock is unlikely to result in any significant realized decrease in viability for the affected individuals, and thus would not result in any adverse impact to the stock as a whole. Level B harassment will be reduced to the level of least practicable adverse impact through use of mitigation measures described herein and, if sound produced by project activities is sufficiently disturbing, animals are likely to simply avoid the area while the activity is occurring. While vibratory driving associated with some project components may produce sound at distances of many kilometers from the pile driving site, thus intruding on higher-quality habitat, the project sites themselves and the majority of sound fields produced by the specified activities are within industrialized areas. Therefore, we expect that animals annoyed by project sound would simply avoid the area and use more-preferred habitats.

In addition to the expected effects resulting from authorized Level B harassment, we anticipate that harbor seals may sustain some limited Level A harassment in the form of auditory injury at two locations (NBK Bangor and NS Everett), assuming they remain within a given distance of the pile driving activity for the full number of pile strikes. However, seals in these locations that experience PTS would likely only receive slight PTS, *i.e.* minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving, *i.e.* the low-frequency region below 2 kHz, not severe hearing impairment or impairment in the regions of greatest hearing sensitivity. If hearing impairment occurs, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. As described above, we expect that marine mammals would be likely to move away from a sound source that represents an aversive stimulus, especially at levels that would be expected to result in PTS, given sufficient notice through use of soft start.

In summary, this negligible impact analysis is founded on the following factors: (1) The possibility of serious injury or mortality may reasonably be considered discountable; (2) as a result of the nature of the activity in concert with the planned mitigation requirements, injury is not anticipated for any species other than the harbor seal; (3) the anticipated incidents of Level B harassment consist of, at worst, temporary modifications in behavior; (4) the additional impact of PTS of a slight degree to few individual harbor seals at two locations is not anticipated to increase individual impacts to a point where any population-level impacts might be expected; (5) the absence of any significant habitat within the industrialized project areas, including known areas or features of special significance for foraging or reproduction; and (6) the presumed efficacy of the proposed mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact.

In addition, although affected humpback whales may be from DPSs that are listed under the ESA, and southern resident killer whales are depleted under the MMPA as well as listed as endangered under the ESA, it is unlikely that minor noise effects in a small, localized area of sub-optimal habitat would have any effect on the stocks' ability to recover. In combination, we believe that these factors, as well as the available body of evidence from other similar activities, demonstrate that the potential effects of the specified activities will have only minor, short-term effects on individuals. The specified activities are not expected to impact rates of recruitment or survival and will therefore not result in population-level impacts.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, we preliminarily find that the total marine mammal take from the Navy's maintenance construction activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(A) of the MMPA for specified activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

Please see Table 9 for information relating to this small numbers analysis. We propose to authorize incidental take of 12 marine mammal stocks. The total amount of taking proposed for authorization is less than one percent for five of these, less than five percent for an additional two stocks, and less than ten percent for another stock, all of which we consider relatively small percentages and we preliminarily find are small numbers of marine mammals relative to the estimated overall population abundances for those stocks.

For the southern resident killer whale (in addition to the humpback whale, gray whale, minke whale, transient killer whale, and northern elephant seal), we propose to authorize take resulting from a brief exposure of one group of the stock. We believe that a single incident of take of one group of any of these species represents take of small numbers for that species.

For the two affected stocks of harbor seal (Hood Canal and Northern Inland Waters), no valid abundance estimate is available. The most recent abundance estimates for harbor seals in Washington inland waters are from 1999, and it is generally believed that harbor seal populations have increased significantly during the intervening years (*e.g.,* Mapes, 2013). However, we anticipate that takes estimated to occur for harbor seals are likely to occur only within some portion of the relevant populations, rather than to animals from the stock as a whole. For example, takes anticipated to occur at NBK Bangor or at NS Everett would be expected to accrue to the same individual seals that routinely occur on haul-outs at these locations, rather than occurring to new seals on each construction day. Similarly, at Zelatched Point in Hood Canal many known haul-outs are at locations elsewhere in Hood Canal and, although a density estimate rather than haul-out count is used to inform the exposure estimate for Zelatched Point, we expect that exposed individuals would comprise some limited portion of the overall stock abundance. In summary, harbor seals taken as a result of the specified activities at each of the six installations are expected to comprise only a limited portion of individuals comprising the overall relevant stock abundance. Therefore, we preliminarily find that small numbers of marine mammals will be taken relative to the population size of both the Hood Canal and Northern Inland Waters stocks of harbor seal.

The estimated taking for harbor porpoise comprises greater than one-third of the best available stock abundance. However, due to the nature of the specified activity—construction activities occurring at six specific locations, rather than a mobile activity occurring throughout the stock range—the available information shows that only a portion of the stock would likely be impacted. Recent aerial surveys (2013–2016) that inform the current abundance estimate for harbor porpoise involved effort broken down by region and subregion. According to the data available as a result of these surveys, the vast majority of harbor porpoise abundance occurs in the ''northern waters'' region, including the San Juan Islands and Strait of Juan de Fuca, where no Navy construction activity is proposed to occur. The six installations considered here occur within the Hood Canal, North Puget Sound, and South Puget Sound regions, which contain approximately 24 percent of stock-wide harbor porpoise abundance (Jefferson *et al.,* 2016). Therefore, we assume that affected individuals would most likely be from the 24 percent of the stock expected to occur in these regions. This figure itself may be an overestimate, as Navy facilities are located within only three of seven subregions within the North and South Puget Sound regions (*i.e.,* East Whidbey, Bainbridge, and Vashon). However, at this finer scale, it is possible that harbor porpoise individuals transit across subregions. In consideration of this conservative scenario, *i.e.,* that 24 percent of the stock abundance is taken, we preliminarily find that small numbers of marine mammals will be taken relative to the population size of the Washington inland waters stock of harbor porpoise.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population sizes of the affected species or stocks.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There are no relevant subsistence uses of marine mammals implicated by these actions. Therefore, we have determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Adaptive Management

The regulations governing the take of marine mammals incidental to Navy maintenance construction activities would contain an adaptive management component.

The reporting requirements associated with this proposed rule are designed to provide NMFS with monitoring data from the previous year to allow consideration of whether any changes are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from the Navy regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring reports, as required by MMPA authorizations; (2) results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

Endangered Species Act (ESA)

The southern resident killer whale, as well as multiple DPSs of humpback whale, are listed under the ESA (see Table 3). The proposed authorization of incidental take pursuant to the Navy's specified activity would not affect any designated critical habitat. OPR has initiated consultation with NMFS's West Coast Regional Office under section 7 of the ESA on the promulgation of five-year regulations and the subsequent issuance of LOAs to the Navy under section 101(a)(5)(A) of the MMPA. This consultation will be concluded prior to issuing any final rule.

Request for Information

NMFS requests interested persons to submit comments, information, and suggestions concerning the Navy request and the proposed regulations (see **ADDRESSES**). All comments will be reviewed and evaluated as we prepare a final rule and make final determinations on whether to issue the requested authorization. This notice and referenced documents provide all environmental information relating to our proposed action for public review.

Classification

Pursuant to the procedures established to implement Executive

Order 12866, the Office of Management and Budget has determined that this proposed rule is not significant. Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), 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 proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The U.S. Navy is the sole entity that would be subject to the requirements in these proposed regulations, and the Navy is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

This proposed rule does not contain a collection-of-information requirement subject to the provisions of the Paperwork Reduction Act (PRA) because the applicant is a federal agency. Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the PRA unless that collection of information displays a currently valid OMB control number. These requirements have been approved by OMB under control number 0648–0151 and include applications for regulations, subsequent LOAs, and reports.

List of Subjects in 50 CFR Part 218

Exports, Fish, Imports, Indians, Labeling, Marine mammals, Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: February 23, 2018.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, 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. Add subpart C to part 218 to read as follows:

Subpart C—Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

Sec.

§ 218.20 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the U.S. Navy (Navy) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the areas outlined in paragraph (b) of this section and that occurs incidental to maintenance construction activities.

(b) The taking of marine mammals by the Navy may be authorized in a Letter of Authorization (LOA) only if it occurs within Washington inland waters in the vicinity of one of the following six naval installations: Naval Base Kitsap Bangor, Zelatched Point, Naval Base Kitsap Bremerton, Naval Base Kitsap Keyport, Naval Base Kitsap Manchester, and Naval Station Everett.

§ 218.21 Effective dates.

Regulations in this subpart are effective from [EFFECTIVE DATE OF FINAL RULE] through [DATE 5 YEARS AFTER EFFECTIVE DATE OF FINAL RULE].

§ 218.22 Permissible methods of taking.

Under LOAs issued pursuant to § 216.106 of this chapter and § 218.26, the Holder of the LOA (hereinafter ''Navy'') may incidentally, but not intentionally, take marine mammals within the area described in § 218.20(b) by Level A or Level B harassment associated with maintenance construction activities, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

§ 218.23 Prohibitions.

Notwithstanding takings contemplated in § 218.22 and authorized by a LOA issued under § 216.106 of this chapter and § 218.26, no person in connection with the activities described in § 218.20 may:

(a) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under § 216.106 of this chapter and § 218.26;

(b) Take any marine mammal not specified in such LOAs;

(c) Take any marine mammal specified in such LOAs in any manner other than as specified;

(d) Take a marine mammal specified in such LOAs if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(e) Take a marine mammal specified in such LOAs if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses.

§ 218.24 Mitigation requirements.

When conducting the activities identified in § 218.20(a), the mitigation measures contained in any LOA issued under § 216.106 of this chapter and § 218.26 must be implemented. These mitigation measures shall include but are not limited to:

(a) General conditions:

(1) A copy of any issued LOA must be in the possession of the Navy, its designees, and work crew personnel operating under the authority of the issued LOA.

(2) The Navy shall conduct briefings for construction supervisors and crews, the monitoring team, and Navy staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.

(b) Shutdown zones:

(1) For all pile driving activity, the Navy shall implement a minimum shutdown zone of a 10 m radius around the pile. If a marine mammal comes within or approaches the shutdown zone, such operations shall cease.

(2) For all pile driving activity, the Navy shall implement shutdown zones with radial distances as identified in any LOA issued under § 216.106 of this chapter and § 218.26. If a marine mammal comes within or approaches the shutdown zone, such operations shall cease.

(3) For all pile driving activity, the Navy shall designate monitoring zones with radial distances as identified in any LOA issued under § 216.106 of this chapter and § 218.26. Anticipated observable zones within the designated monitoring zones shall be identified in annual Marine Mammal Monitoring Plans, subject to approval by NMFS. If

any cetacean is observed outside the shutdown zone identified pursuant to § 218.24(b)(1)–(2) of this subpart, but within the designated monitoring zone, such operations shall cease.

(c) Shutdown protocols:

(1) The Navy shall deploy marine mammal observers as indicated in annual Marine Mammal Monitoring Plans, which shall be subject to approval by NMFS, and as described in § 218.25.

(2) For all pile driving activities, a minimum of one observer shall be stationed at the active pile driving rig or in reasonable proximity in order to monitor the shutdown zone.

(3) Monitoring shall take place from 15 minutes prior to initiation of pile driving activity through 30 minutes post-completion of pile driving activity. Pre-activity monitoring shall be conducted for 15 minutes to ensure that the shutdown zone is clear of marine mammals, and pile driving may commence when observers have declared the shutdown zone clear of marine mammals. In the event of a delay or shutdown of activity resulting from marine mammals in the shutdown zone, animals shall be allowed to remain in the shutdown zone (*i.e.,* must leave of their own volition) and their behavior shall be monitored and documented. Monitoring shall occur throughout the time required to drive a pile. A determination that the shutdown zone is clear must be made during a period of good visibility (*i.e.,* the entire shutdown zone and surrounding waters must be visible to the naked eye).

(4) If a marine mammal approaches or enters the shutdown zone, all pile driving activities at that location shall be halted. If pile driving is halted or delayed due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of the animal.

(5) Monitoring shall be conducted by trained observers, who shall have no other assigned tasks during monitoring periods. Trained observers shall be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator. The Navy shall adhere to the following additional observer qualifications:

(i) Independent observers (*i.e.,* not construction personnel) are required.

(ii) At least one observer must have prior experience working as an observer.

(iii) Other observers may substitute education (degree in biological science or related field) or training for experience.

(iv) Where a team of three or more observers are required, one observer shall be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

(v) The Navy shall submit observer CVs for approval by NMFS.

(d) The Navy shall use soft start techniques for impact pile driving. Soft start for impact drivers requires contractors to provide an initial set of three strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy three-strike sets. Soft start shall be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.

(e) The Navy shall employ a bubble curtain (or other sound attenuation device with proven typical performance of at least 8 decibels effective attenuation) during impact pile driving of steel piles greater than 14 inches diameter in water depths greater than 2 feet, except at Naval Base Kitsap Bremerton and Naval Base Kitsap Keyport. In addition, the Navy shall implement the following performance standards:

(1) The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column.

(2) The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact.

(3) The Navy shall require that construction contractors train personnel in the proper balancing of air flow to the bubblers, and shall require that construction contractors submit an inspection/performance report for approval by the Navy within 72 hours following the performance test. Corrections to the attenuation device to meet the performance standards shall occur prior to impact driving.

§ 218.25 Requirements for monitoring and reporting.

(a) Not later than March 1 of each year, the Navy shall develop and submit for NMFS's approval an installation-specific Marine Mammal Monitoring Plan for each year's anticipated work. Final monitoring plans shall be prepared and submitted to NMFS within 30 days following receipt of comments on the draft plans from NMFS.

(b) During each in-water work period, the Navy shall update NMFS every two months on the progress of ongoing projects.

(c) Trained observers shall receive a general environmental awareness briefing conducted by Navy staff. At minimum, training shall include identification of marine mammals that may occur in the project vicinity and relevant mitigation and monitoring requirements. All observers shall have no other construction-related tasks while conducting monitoring.

(d) For shutdown zone monitoring, the Navy shall report on implementation of shutdown or delay procedures, including whether the procedures were not implemented and why (when relevant).

(e) The Navy shall deploy additional observers to monitor disturbance zones according to the minimum requirements defined in annual Marine Mammal Monitoring Plans, subject to approval by NMFS. These observers shall collect sighting data and behavioral responses to pile driving for marine mammal species observed in the region of activity during the period of activity, and shall communicate with the shutdown zone observer as appropriate with regard to the presence of marine mammals. All observers shall be trained in identification and reporting of marine mammal behaviors.

(f) Reporting:

(1) Annual reporting:

(i) Navy shall submit an annual summary report to NMFS not later than 90 days following the end of construction during each in-water work period. Navy shall provide a final report within 30 days following resolution of comments on the draft report.

(ii) These reports shall contain, at minimum, the following:

(A) Date and time that monitored activity begins or ends;

(B) Construction activities occurring during each observation period;

(C) Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility);

(D) Water conditions (*e.g.,* sea state, tide state);

(E) Species, numbers, and, if possible, sex and age class of marine mammals;

(F) Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;

(G) Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;

(H) Description of implementation of mitigation measures (*e.g.,* shutdown or delay);

(I) Locations of all marine mammal observations; and

(J) Other human activity in the area.

(2) Navy shall submit a comprehensive summary report to NMFS not later than ninety days following the conclusion of marine mammal monitoring efforts described in this subpart.

(g) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 218.20 clearly causes the take of a marine mammal in a prohibited manner, Navy shall immediately cease such activity and report the incident to the Office of Protected Resources (OPR), NMFS, and to the West Coast Regional Stranding Coordinator, NMFS. Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Navy to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Navy may not resume their activities until notified by NMFS. The report must include the following information:

(i) Time, date, and location (latitude/longitude) of the incident;

(ii) Description of the incident;

(iii) Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility);

(iv) Description of all marine mammal observations in the 24 hours preceding the incident;

(v) Species identification or description of the animal(s) involved;

(vi) Fate of the animal(s); and

(vii) Photographs or video footage of the animal(s). Photographs may be taken once the animal has been moved from the waterfront area.

(2) In the event that Navy discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.,* in less than a moderate state of decomposition), Navy shall immediately report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS. The report must include the information identified in paragraph (g)(1) of this section. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Navy to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that Navy discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 218.20 (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), Navy shall report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. Navy shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. Photographs may be taken once the animal has been moved from the waterfront area.

§ 218.26 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, the Navy must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, the Navy may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, the Navy must apply for and obtain a modification of the LOA as described in § 218.27.

(e) The LOA shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.

(g) Notice of issuance or denial of an LOA shall be published in the **Federal Register** within thirty days of a determination.

§ 218.27 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under § 216.106 of this chapter and § 218.26 for the activity identified in § 218.20(a) shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section), and

(2) NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), NMFS may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under § 216.106 of this chapter and § 218.26 for the activity identified in § 218.20(a) may be modified by NMFS under the following circumstances:

(1) Adaptive Management—NMFS may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with the Navy regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from the Navy's monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS will publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) Emergencies—If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in LOAs issued pursuant to § 216.106 of this chapter and § 218.26, an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within thirty days of the action.

§ 218.28 [Reserved]

§ 218.29 [Reserved]

[FR Doc. 2018–04148 Filed 3–2–18; 8:45 am]
BILLING CODE 3510–22–P