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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XC824

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Pier Maintenance Project

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to construction activities as part of a pier maintenance project. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting public comment on its proposal to issue an incidental harassment authorization (IHA) to the Navy to take, by harassment only, two species of marine mammal during the specified activity.

DATES: Comments and information must be received no later than [insert date 30 days after date of publication in the FEDERAL REGISTER].

ADDRESSES: Comments on this proposal should be addressed to Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to ITP.Laws@noaa.gov.

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. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record. All personal identifying information (e.g., name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information. 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 by visiting the internet at: http://www.nmfs.noaa.gov/pr/permits/incidental.htm. In the case of problems accessing these documents, please call the contact listed above.

National Environmental Policy Act

The Navy has prepared a draft Environmental Assessment (Pier 6 Pile Replacement Naval Base Kitsap) in accordance with the National Environmental Policy Act (NEPA) and the regulations published by the Council on Environmental Quality. It is posted at the aforementioned site. NMFS will independently evaluate the EA and determine whether or not to adopt it. We may prepare a separate NEPA analysis and incorporate relevant portions of the Navy's EA by reference. Information in the Navy's application, EA, and this notice collectively provide the environmental information related to proposed issuance of this IHA for public review and comment. We will review all comments submitted in response to this notice as we complete the NEPA process, including a decision of whether to sign a Finding of No Significant Impact (FONSI), prior to a final decision on the incidental take authorization request.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 et seq.) direct the Secretary of Commerce to allow, upon request by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified area, the incidental, but not intentional, taking of small numbers of marine mammals, providing that certain findings are made and the necessary prescriptions are established.

The incidental taking of small numbers of marine mammals may be allowed only if NMFS (through authority delegated by the Secretary) finds that the total taking by the specified activity during the specified time period will (i) have a negligible impact on the species or stock(s) and (ii) not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant). Further, the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking must be set forth, either in specific regulations or in an authorization.

The allowance of such incidental taking under section 101(a)(5)(A), by harassment, serious injury, death or a combination thereof, requires that regulations be established. Subsequently, a Letter of Authorization may be issued pursuant to the prescriptions established in such regulations, providing that the level of taking will be consistent with the findings made for the total taking allowable under the specific regulations. Under section 101(a)(5)(D), NMFS may authorize such incidental taking by harassment only, for periods of not more than 1 year, pursuant to requirements and conditions contained within an Incidental Harassment

Authorization. The establishment of prescriptions through either specific regulations or an authorization requires notice and opportunity for public comment.

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." 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; 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." The former is termed Level A harassment and the latter is termed Level B harassment.

Summary of Request

On May 22, 2013, we received a request from the Navy for authorization of the taking, by Level B harassment only, of marine mammals incidental to pile driving in association with the Pier 6 pile replacement project at Naval Base Kitsap Bremerton, WA (NBKB). Through the consultation process, that request was modified on June 5, 2013, and a final version, which we deemed adequate and complete, was submitted on June 12, 2013. In-water work associated with the project would be conducted over three years and would occur only during the approved in-water work window from June 15 to March 1. This proposed IHA would be valid from December 1, 2013, through March 1, 2014. Two species of marine mammal are expected to be affected by the specified activities: California sea lion (<u>Zalophus californianus californianus</u>) and harbor seal (Phoca vitulina richardii). These species may occur year-round in the action area, although California sea lions are less common and potentially absent in the summer months.

NBKB serves as the homeport for a nuclear aircraft carrier and other Navy vessels and as a shipyard capable of overhauling and repairing all types and sizes of ships. Other significant capabilities include alteration, construction, deactivation, and dry-docking of naval vessels. Pier 6 was completed in 1926 and requires substantial maintenance to maintain readiness. Over the length of the entire project, the Navy proposes to remove up to 400 deteriorating fender piles and to replace them with up to 330 new pre-stressed concrete fender piles. Under this proposed IHA, the Navy proposes to conduct 20 days of vibratory pile removal and 45 days of pile installation with an impact hammer.

Effects to marine mammals from the specified activity are expected to result from underwater sound produced by vibratory and impact pile driving. In order to assess project impacts, the Navy used thresholds recommended by NMFS, outlined later in this document. The Navy assumed practical spreading loss and used empirically-measured source levels from representative pile driving events to estimate potential marine mammal exposures. Predicted exposures are described later in this document. The calculations predict that only Level B harassment would occur associated with pile driving activities, and required mitigation measures further ensure that no more than Level B harassment would occur.

Description of the Specified Activity

Specific Geographic Region and Duration

NBKB is located on the north side of Sinclair Inlet in Puget Sound (see Figures 1-1 and 2-1 of the Navy's application). Sinclair Inlet, an estuary of Puget Sound extending 3.5 miles southwesterly from its connection with the Port Washington Narrows, connects to the main basin of Puget Sound through Port Washington Narrows and then Agate Pass to the north or Rich Passage to the east. Sinclair Inlet has been significantly modified by development activities. Fill associated with transportation, commercial, and residential development of NBKB, the City of Bremerton, and the local ports of Bremerton and Port Orchard has resulted in significant changes to the shoreline. The area surrounding Pier 6 is industrialized, armored and adjacent to railroads and highways. Sinclair Inlet is also the receiving body for a wastewater treatment plant located just west of NBKB. Sinclair Inlet is relatively shallow and does not flush fully despite freshwater stream inputs.

The project is expected to require a maximum of 135 days of in-water impact pile driving work and 65 days of in-water vibratory pile removal work over a 3-year period. In-water work would occur only from June 15 to March 1 of any year. During the timeframe of this proposed IHA (December 1, 2013-March 1, 2014), 45 days of impact pile driving and 20 days of vibratory removal would occur.

Description of Specified Activity

The Navy plans to remove deteriorated fender piles at Pier 6 and replace them with prestressed concrete piles. The entire project calls for the removal of 380 12-in diameter creosoted timber piles and twenty 12-in steel pipe piles. These would be replaced with 240 18-in square concrete piles and 90 24-in square concrete piles. It is not possible to specify accurately the number of piles that might be installed or removed in any given work window, due to various delays that may be expected during construction work and uncertainty inherent to estimating production rates. The Navy assumes a notional production rate of four piles per day in determining the number of days of pile driving expected, and scheduling – as well as exposure analyses – is based on this assumption.

All piles are planned for removal via vibratory driver. The driver is suspended from a barge-mounted crane and positioned on top of a pile. Vibration from the activated driver loosens the pile from the substrate. Once the pile is released, the crane raises the driver and pulls the pile from the sediment. Vibratory extraction is expected to take approximately 5-30 minutes per pile. If piles break during removal, the remaining portion may be removed via direct pull or with a clamshell bucket. Replacement piles would be installed via impact driver and would require approximately 15-60 minutes of driving time per pile, depending on subsurface conditions. Impact driving and/or vibratory removal could occur on any work day during the period of the proposed IHA.

Description of Sound Sources and Distances to Thresholds

Impacts from the specified activity on marine mammals are expected to result from the production of underwater sound; therefore, we provide a brief technical background on sound, the characteristics of certain sound types, and on metrics used in this proposal.

Background

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 of a sound wave; lower frequency sounds have longer wavelengths than higher frequency sounds, and attenuate (decrease) more rapidly in shallower water. Amplitude is the height of the sound pressure wave or the “loudness” of a sound and is typically measured using the decibel (dB) scale. A dB is the ratio between a measured pressure (with sound) and a reference pressure (sound at a constant pressure, established by scientific standards), and is a logarithmic unit that accounts for large variations in amplitude; therefore, relatively small changes in dB ratings correspond to large changes in sound pressure. When referring to sound pressure levels (SPLs; the sound force per unit area), sound is referenced in the context of underwater sound pressure to 1 microPascal (μPa) and in the context of airborne sound pressure to 20 μPa. One pascal is the pressure resulting from a force of one newton exerted over an area of one square meter. The source level (SL) represents the sound level at a distance of 1 m from the source (referenced to 1 μPa). The received level is the sound level at the listener's position.

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Rms 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. Unless otherwise noted, all references to SPLs in this document are in dB rms and are referenced as described above.

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 all directions away from the source (similar to ripples on the surface of a pond), except in cases where the source is directional. 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.

Ambient Sound

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson et al., 1995), and 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., waves, earthquakes, ice, atmospheric sound), biological (e.g., sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (e.g., vessels, dredging, aircraft, construction). A number of sources contribute to ambient sound, including the following (Richardson et al., 1995):

- Wind and waves: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kHz (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf sound becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions.
- Precipitation: Sound from rain and hail impacting the water surface can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times.
- Biological: Marine mammals can contribute significantly to ambient sound levels, as can some fish and shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz.
- Anthropogenic: Sources of ambient sound related to human activity include transportation (surface vessels and aircraft), dredging and construction, oil and gas drilling and

production, seismic surveys, sonar, explosions, and ocean acoustic studies. Shipping sound 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. Sound from identifiable anthropogenic sources other than the activity of interest (e.g., a passing vessel) is sometimes termed background sound, as opposed to ambient sound. Known sound levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 1.

Sound source	**Frequency range (Hz)**	**Underwater sound level (dB re 1 µPa)**	**Reference**
Small vessels	250-1,000	151 dB rms at 1 m	Richardson et al., 1995
Tug docking gravel barge	200-1,000	149 dB rms at 100 m	Blackwell and Greene, 2002
Vibratory driving of 72-in (1.8 m) steel pipe pile	10-1,500	180 dB rms at 10 m	Reyff, 2007
Impact driving of 36-in steel pipe pile	10-1,500	195 dB rms at 10 m	Laughlin, 2007
Impact driving of 66-in cast-in-steel-shell pile	10-1,500	195 dB rms at 10 m	Reviewed in Hastings and Popper, 2005

Table 1. Representative sound levels of anthropogenic sources

The sum of the various natural and anthropogenic sound sources at any given location and time – which comprise "ambient" or "background" sound – depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping 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 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.

The underwater acoustic environment in Sinclair Inlet is likely to be dominated by noise from day-to-day port and vessel activities. Normal port activities include vessel traffic from aircraft carriers, large ships, submarines, support vessels, and security boats, and loading and maintenance operations. Other sources of human-generated underwater sound in the area are recreational vessels, industrial ship noise, and ferry traffic at the adjacent Washington State Ferry Terminal. In 2009, the average broadband (100 Hz-20 kHz) underwater noise level at NBK Bangor in the Hood Canal was measured at 114 dB (Slater, 2009), which is within the range of levels reported for a number of sites within the greater Puget Sound region (95-135 dB; e.g., Carlson et al., 2005; Veirs and Veirs, 2006). Measurements near ferry terminals in Puget Sound, such as the Bremerton terminal adjacent to NBKB, resulted in median noise levels (50% cumulative distribution function) between 106 and 133 dB (Laughlin, 2012). Although no specific measurements have been made at NBKB, it is reasonable to believe that levels may generally be higher than at NBK Bangor as there is a greater degree of activity, that levels periodically exceed the 120-dB threshold and, therefore, that the high levels of anthropogenic activity in the area create an environment far different from quieter habitats where behavioral reactions to sounds around the 120-dB threshold have been observed (e.g., Malme et al., 1984, 1988).

Sound Source Characteristics

In-water construction activities associated with the project would include impact pile driving and vibratory pile removal. The sounds produced by these activities fall into one of two sound types: pulsed and non-pulsed (defined in the following). The distinction between these two general 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.

Pulsed sound sources (e.g., explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than 1 sec), broadband, atonal transients (ANSI, 1986; Harris, 1998; NIOSH, 1998; ISO, 2003; ANSI, 2005) 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 non-continuous (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.

Impact hammers operate by repeatedly dropping a heavy piston onto a pile to drive the pile into the substrate. Sound generated by impact hammers is characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper, 2005). Vibratory hammers cause liquefaction of surrounding sediment through vibration, allowing installation as the weight of the hammer push piles down or removal as the crane pulls up. Vibratory hammers produce significantly less sound than impact hammers. Peak SPLs may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Oestman et al., 2009). Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (Nedwell and Edwards, 2002; Carlson et al., 2005).

Sound Thresholds

NMFS currently uses acoustic exposure thresholds as important tools to help better characterize and quantify the effects of human-induced noise on marine mammals. These thresholds have predominantly been presented in the form of single received levels for particular source categories (e.g., impulse, continuous, or explosive) above which an exposed animal would be predicted to incur auditory injury or be behaviorally harassed. Current NMFS practice (in relation to the MMPA) regarding exposure of marine mammals to sound is that cetaceans and pinnipeds exposed to sound levels of 180 and 190 dB rms or above, respectively, are considered to have been taken by Level A (i.e., injurious) harassment, while behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to sounds at or above 120 dB rms for continuous sound (such as will be produced by vibratory pile driving) and 160 dB rms for pulsed sound (produced by impact pile driving), but below injurious thresholds. For airborne sound, pinniped disturbance from haul-outs has been documented at 100 dB (unweighted) for pinnipeds in general, and at 90 dB (unweighted) for harbor seals. NMFS uses these levels as guidelines to estimate when harassment may occur.

NMFS is in the process of revising these acoustic thresholds, with the first step being to identify new auditory injury criteria for all source types and new behavioral criteria for seismic activities (primarily airgun-type sources). For more information on that process, please visit http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.

Distance to Sound Thresholds

Underwater Sound – Pile driving generates underwater noise that can potentially result in disturbance to marine mammals in the project area. In order to estimate the distance at which sound produced by the specified activity would attenuate to relevant thresholds, one must, at minimum, be able to reasonably approximate source levels and transmission loss (TL), which is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. In general, the sound pressure level (SPL) at some distance away from the source (e.g., driven pile) is governed by a measured source level, minus the TL of the energy as it dissipates with distance.

The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, including source depth and frequency, receiver depth, water depth, bottom composition and topography, presence or absence of reflective or absorptive in-water structures, and oceanographic conditions such as temperature, current, and water chemistry. The general formula for underwater TL neglects loss due to scattering and absorption, which is assumed to be zero here. 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]). A practical spreading value of 15 (4.5 dB reduction in sound level for each doubling of distance) is often used under intermediate conditions, and is assumed here.

Source level, or the intensity of pile driving sound, is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. A number of studies have measured sound produced during underwater pile driving projects, primarily during work conducted by the Washington State Department of Transportation and the California Department of Transportation. In order to determine reasonable SPLs and their associated effects on marine mammals that are likely to result from pile driving at NBKB, the Navy evaluated existing data on the basis of pile materials and driver type. Table 2 shows the most appropriate proxy values to use for determining distances to relevant thresholds.

Location	**Method**	**Pile size and material**	**Measured SPLs**
Berth 22, Port of Oakland[1]	Impact	24-in concrete	176 dB at 10 m
Mad River Slough, CA[1]	Vibratory	13-in steel pipe	155 dB at 10 m
Port Townsend, WA[2]	Vibratory (removal)	12-in timber	150 dB at 16 m

Sources: [1]CalTrans, 2012; [2]Laughlin, 2011

Table 2. Summary of proxy measured underwater SPLs

The value from Berth 22 was selected as representative of the largest concrete pile size to be installed and may be conservative when smaller concrete piles are driven. The value from Mad River Slough is for vibratory installation and would likely be conservative when applied to vibratory extraction, which would be expected to produce lower SPLs than vibratory installation of same-sized piles. All calculated distances to and the total area encompassed by the marine mammal sound thresholds are provided in Table 3.

Description	**Distance to threshold (m) and associated area of ensonification (km^2)**

	190 dB	180 dB	160 dB	120 dB
Concrete piles, impact	1.2, <0.0001	5.4, 0.0001	117, 0.04	n/a
Steel piles, vibratory	0	0	n/a	2,154[2], 7.5
Timber piles, vibratory	0	0	n/a	1,585; 5.04

[1] SPLs used for calculations were: 191 dB for impact driving, 170 dB for vibratory removal of steel piles, and 168 dB for vibratory removal of timber piles.

[2] Areas presented take into account attenuation and/or shadowing by land. Please see Figures B-1 and B-2 in the Navy's application.

Table 3. Distances to relevant sound thresholds and areas of ensonification

Sinclair Inlet does not represent open water, or free field, conditions. Therefore, sounds would attenuate according to the shoreline topography. Distances shown in Table 1 are estimated for free-field conditions, but areas are calculated per the actual conditions of the action area. See Figures B-1 and B-2 of the Navy's application for a depiction of areas in which each underwater sound threshold is predicted to occur at the project area due to pile driving.

Airborne Sound – Pile driving can generate airborne sound that could potentially result in disturbance to marine mammals (specifically, pinnipeds) which are hauled out or at the water's surface. As a result, the Navy analyzed the potential for pinnipeds hauled out or swimming at the surface near NBKB to be exposed to airborne SPLs that could result in Level B behavioral harassment. Although there is no official airborne sound threshold, NMFS assumes for purposes of the MMPA that behavioral disturbance can occur upon exposure to sounds above 100 dB re 20 µPa rms (unweighted) for all pinnipeds, except harbor seals. For harbor seals, the threshold is 90 dB re 20 µPa rms (unweighted).

As was discussed for underwater sound from pile driving, 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. As before, measured values from other studies were used as proxy values to determine reasonable airborne SPLs and their associated effects on marine mammals that are likely to result from pile driving at NBKB. There are no measurements known for unweighted airborne sound from either impact driving of concrete piles or for vibratory driving of timber piles.

Location	Method	Pile size and material	Measured SPLs
Test Pile Program, Hood Canal[1]	Impact	24-in steel pipe	89 dB at 15 m
Wahkiakum Ferry Terminal, WA[2]	Vibratory	18-in steel pipe	87.5 dB at 15 m

Sources: [1]Illingworth & Rodkin, Inc., 2012; [2]Laughlin, 2010

Table 4. Summary of proxy measured airborne SPLs

Steel piles generally produce louder source levels than do similarly sized concrete or timber piles. Similarly, the value shown here for the larger steel piles (18-in) would likely be louder than smaller steel piles or timber piles. Therefore, these values will likely overestimate the distances to relevant thresholds. Based on these values and the assumption of spherical spreading loss, distances to relevant thresholds and associated areas of ensonification are presented in Table 5; these areas are depicted in Figure B-3 of the Navy's application.

Group	Threshold, re 20 µPa rms (unweighted)	Distance to threshold (m) and associated area of ensonification (m^2)	
		Impact driving	Vibratory driving
Harbor seals	90 dB	13, 169	11, 121
California sea lions	100 dB	5, 25	4, 16

[1] SPLs used for calculations were: 112.5 dB for impact driving, 111 dB for use of a vibratory hammer.

Table 5. Distances to relevant sound thresholds and areas of ensonification

There are no haul-out opportunities within these small zones, which are encompassed by the zones estimated for underwater sound. Protective measures would be in place out to the distances calculated for the underwater thresholds, and the distances for the airborne thresholds would be covered fully by mitigation and monitoring measures in place for underwater sound thresholds. We recognize that pinnipeds in water that are within the area of ensonification for airborne sound could be incidentally taken by either underwater or airborne sound or both. We consider these incidences of harassment to be accounted for in the take estimates for underwater sound. The effects of airborne sound are not considered further in this document's analysis.

Description of Marine Mammals in the Area of the Specified Activity

There are five marine mammal species with records of occurrence in waters of Sinclair Inlet in the action area. These are the California sea lion, harbor seal, Steller sea lion (eastern stock only; Eumetopias jubatus monteriensis), gray whale (Eschrichtius robustus), and killer whale (Orcinus orca). For the killer whale, both transient (west coast stock) and resident (southern stock) animals, which are currently considered unnamed subspecies (Committee on Taxonomy, 2012), have occurred in the area. However, southern resident animals are known to have occurred only once, with the last confirmed sighting from 1997 in Dyes Inlet. A group of 19 whales from the L-25 subpod entered and stayed in Dyes Inlet, which connects to Sinclair Inlet northeast of NBKB, for 30 days. Dyes Inlet may be reached only by traversing from Sinclair Inlet through the Port Washington Narrows, a narrow connecting body that is crossed by two bridges, and it was speculated at the time that the whales' long stay was the result of a reluctance to traverse back through the Narrows and under the two bridges. There is one other unconfirmed report of a single southern resident animal occurring in the project area, in January

2009. Of these stocks, the Steller sea lion and southern resident killer whales are listed under the Endangered Species Act (ESA), with the eastern stock of Steller sea lions listed as threatened and the southern resident stock of killer whales listed as endangered.

An additional seven species have confirmed occurrence in Puget Sound, but are considered rare to extralimital in Sinclair Inlet and the surrounding waters. These species – the humpback whale (Megaptera novaeangliae), minke whale (Balaenoptera acutorostrata scammoni), Pacific white-sided dolphin (Lagenorhynchus obliquidens), harbor porpoise (Phocoena phocoena vomerina), Dall's porpoise (Phocoenoides dalli dalli), and northern elephant seal (Mirounga angustirostris) – along with the southern resident killer whale, are considered extremely unlikely to occur in the action area or to be affected by the specified activities, and are not considered further in this document. A review of sightings records available from the Orca Network (www.orcanetwork.org; accessed August 15, 2013) confirms that there are no recorded observations of these species in the action area (with the exception of the appearance of southern residents in 1997).

This section summarizes the population status and abundance of these species. We have reviewed the Navy's detailed species descriptions, including life history information, for accuracy and completeness and refer the reader to Sections 3 and 4 of the Navy's application instead of reprinting the information here. Table 5 lists the marine mammal species with expected potential for occurrence in the vicinity of NBKB during the project timeframe. The following information is summarized largely from NMFS Stock Assessment Reports.

Species	**Stock abundance[1] (CV, N_{min})**	**Relative occurrence in Sinclair Inlet**	**Season of occurrence**
California sea lion U.S. Stock	296,750 (n/a, 153,337)	Common	Year-round, excluding July

Harbor seal WA inland waters stock	14,612[2] (0.15, 12,844)	Common	Year-round
Steller sea lion Eastern stock	58,334-72,223 (n/a, 52,847)	Occasional presence	Seasonal (Oct-May)
Killer whale West Coast transient stock	354 (n/a)	Uncommon	Year-round
Gray whale Eastern North Pacific stock	19,126 (0.071, 18,017)	Uncommon	Year-round

Table 6. Marine mammals potentially present in the vicinity of NBKB

[1] NMFS marine mammal stock assessment reports at: http://www.nmfs.noaa.gov/pr/sars/species.htm. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance.

[2] This abundance estimate is greater than eight years old and is therefore not considered current.

Harbor Seal

Harbor seals inhabit coastal and estuarine waters and shoreline areas of the northern hemisphere from temperate to polar regions. The eastern North Pacific subspecies is found from Baja California north to the Aleutian Islands and into the Bering Sea. Multiple lines of evidence support the existence of geographic structure among harbor seal populations from California to Alaska (Carretta et al., 2011). However, because stock boundaries are difficult to meaningfully draw from a biological perspective, three separate harbor seal stocks are recognized for management purposes along the west coast of the continental U.S.: (1) inland waters of Washington (including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery), (2) outer coast of Oregon and Washington, and (3) California (Carretta et al., 2011). Multiple stocks are recognized in Alaska. Samples from Washington, Oregon, and California demonstrate a high level of genetic diversity and indicate that the harbor seals of Washington inland waters possess unique haplotypes not found in seals from the coasts of Washington, Oregon, and California (Lamont et al., 1996). Only the Washington inland waters stock may be found in the project area.

Washington inland waters harbor seals are not protected under the ESA or listed as depleted under the MMPA. Because there is no current abundance estimate for this stock, there is no current estimate of potential biological removal (PBR). However, because annual human-caused mortality (13) is significantly less than the previously calculated PBR (771) the stock is not considered strategic under the MMPA. The stock is considered to be within its optimum sustainable population (OSP) level.

The best abundance estimate of the Washington inland waters stock of harbor seals is 14,612 (CV = 0.15) and the minimum population size of this stock is 12,884 individuals (Carretta et al., 2011). Aerial surveys of harbor seals in Washington were conducted during the pupping season in 1999, during which time the total numbers of hauled-out seals (including pups) were counted (Jeffries et al., 2003). Radio-tagging studies conducted at six locations collected information on harbor seal haul-out patterns in 1991-92, resulting in a correction factor of 1.53 (CV = 0.065) to account for animals in the water which are missed during the aerial surveys (Huber et al., 2001), which, coupled with the aerial survey counts, provides the abundance estimate. Because the estimate is greater than eight years old, NMFS does not consider it current. However, it does represent the best available information regarding stock abundance. Harbor seal counts in Washington State increased at an annual rate of ten percent from 1991-96 (Jeffries et al., 1997). However, a logistic model fit to abundance data from 1978-99 resulted in an estimated maximum net productivity rate of 12.6 percent (95% CI = 9.4-18.7%) and the population is thought to be stable (Jeffries et al., 2003).

Historical levels of harbor seal abundance in Washington are unknown. The population was apparently greatly reduced during the 1940s and 1950s due to a state-financed bounty program and remained low during the 1970s before rebounding to current levels (Carretta et al., 2011). Data from 2004-08 indicate that a minimum of 3.8 harbor seals are killed annually in Washington inland waters commercial fisheries (Carretta et al., 2011). Animals captured east of Cape Flattery are assumed to belong to this stock. The estimate is considered a minimum because there are likely additional animals killed in unobserved fisheries and because not all animals stranding as a result of fisheries interactions are likely to be recorded. Another 9.2 harbor seals per year are estimated to be killed as a result of various non-fisheries human interactions (Carretta et al., 2011). Tribal subsistence takes of this stock may occur, but no data on recent takes are available.

Harbor seal numbers increase from January through April and then decrease from May through August as the harbor seals move to adjacent bays on the outer coast of Washington for the pupping season. From April through mid-July, female harbor seals haul out on the outer coast of Washington at pupping sites to give birth. Harbor seals are expected to occur in Sinclair Inlet and NBKB at all times of the year. No permanent haul-out has been identified at NBKB. The nearest known haul-outs are along the south side of Sinclair Inlet on log breakwaters at several marinas in Port Orchard, approximately 1 mile from Pier 6. An additional haul-out location in Dyes Inlet, approximately 8.5 km north and west (shoreline distance), was believed to support less than 100 seals (Jeffries et al., 2000). Please see Figure 4-2 of the Navy's application.

California Sea Lion

California sea lions range from the Gulf of California north to the Gulf of Alaska, with breeding areas located in the Gulf of California, western Baja California, and southern California. Five genetically distinct geographic populations have been identified: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California and (5) Northern Gulf of California (Schramm et al., 2009). Rookeries for the Pacific

Temperate population are found within U.S. waters and just south of the U.S.-Mexico border, and animals belonging to this population may be found from the Gulf of Alaska to Mexican waters off Baja California. For management purposes, a stock of California sea lions comprising those animals at rookeries within the U.S. is defined (i.e., the U.S. stock of California sea lions) (Carretta et al., 2011). Pup production at the Coronado Islands rookery in Mexican waters is considered an insignificant contribution to the overall size of the Pacific Temperate population (Lowry and Maravilla-Chavez, 2005).

California sea lions are not protected under the ESA or listed as depleted under the MMPA. Total annual human-caused mortality (at least 431) is substantially less than the potential biological removal (PBR, estimated at 9,200 per year); therefore, California sea lions are not considered a strategic stock under the MMPA. There are indications that the California sea lion may have reached or is approaching carrying capacity, although more data are needed to confirm that leveling in growth persists (Carretta et al., 2011).

The best abundance estimate of the U.S. stock of California sea lions is 296,750 and the minimum population size of this stock is 153,337 individuals (Carretta et al., 2011). The entire population cannot be counted because all age and sex classes are never ashore at the same time; therefore, the best abundance estimate is determined from the number of births and the proportion of pups in the population, with censuses conducted in July after all pups have been born. Specifically, the pup count for rookeries in southern California from 2008 was adjusted for pre-census mortality and then multiplied by the inverse of the fraction of newborn pups in the population (Carretta et al., 2011). The minimum population size was determined from counts of all age and sex classes that were ashore at all the major rookeries and haul-out sites in southern and central California during the 2007 breeding season, including all California sea lions counted during the July 2007 census at the Channel Islands in southern California and at haul-out sites located between Point Conception and Point Reyes, California (Carretta et al., 2011). An additional unknown number of California sea lions are at sea or hauled out at locations that were not censused and are not accounted for in the minimum population size.

Trends in pup counts from 1975 through 2008 have been assessed for four rookeries in southern California and for haul-outs in central and northern California. During this time period counts of pups increased at an annual rate of 5.4 percent, excluding six El Nino years when pup production declined dramatically before quickly rebounding (Carretta et al., 2011). The maximum population growth rate was 9.2 percent when pup counts from the El Niño years were removed. However, the apparent growth rate from the population trajectory underestimates the intrinsic growth rate because it does not consider human-caused mortality occurring during the time series; the default maximum net productivity rate for pinnipeds (12 percent per year) is considered appropriate for California sea lions (Carretta et al., 2011).

Historic exploitation of California sea lions include harvest for food by Native Americans in pre-historic times and for oil and hides in the mid-1800s, as well as exploitation for a variety of reasons more recently (Carretta et al., 2011). There are few historical records to document the effects of such exploitation on sea lion abundance (Lowry et al., 1992). Data from 2003-09 indicate that a minimum of 337 (CV = 0.56) California sea lions are killed annually in commercial fisheries. In addition, a summary of stranding database records for 2005-09 shows an annual average of 65 such events, which is likely a gross underestimate because most carcasses are not recovered. California sea lions may also be removed because of predation on endangered salmonids (17 per year, 2008-10) or incidentally captured during scientific research (3 per year, 2005-09) (Carretta et al., 2011). Sea lion mortality has also been linked to the algal-produced neurotoxin domoic acid (Scholin et al., 2000). There is currently an Unusual Mortality Event (UME) declaration in effect for California sea lions. Future mortality may be expected to occur, due to the sporadic occurrence of such harmful algal blooms. Beginning in January 2013, elevated strandings of California sea lion pups have been observed in Southern California, with live sea lion strandings nearly three times higher than the historical average. The causes of this UME are under investigation (http://www.nmfs.noaa.gov/pr/health/mmume/californiasealions2013.htm; accessed August 20, 2013).

California sea lions were not recorded in Puget Sound until approximately 1979 (Steiger and Calambokidis, 1986). Everitt et al. (1980) reported the initial occurrence of large numbers in northern Puget Sound in the spring of that year. Similar sightings and increases in numbers were documented throughout the region after the initial sighting (Steiger and Calambokidis 1986), including urbanized areas such as Elliot Bay near Seattle and heavily used areas of central Puget Sound (Gearin et al., 1986). California sea lions now use haul-out sites within all regions of Washington inland waters (Jeffries et al., 2000). California sea lions migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island during the non-breeding season from September to May and return south the following spring (Mate, 1975; Bonnell et al., 1983). Jeffries et al. (2000) estimated that 3,000 to 5,000 individuals make this trip, with peak numbers of up to 1,000 occurring in Puget Sound during this time period. The California sea lion population has grown substantially, and it is likely that the numbers migrating to Washington inland waters have increased as well.

Occurrence in Puget Sound is typically between September and June with peak abundance between September and May. During summer months (June through August) and associated breeding periods, California sea lions are largely returning to rookeries in California and are not present in large numbers in Washington inland waters. They are known to utilize a diversity of man-made structures for hauling out (Riedman, 1990) and, although there are no regular California sea lion haul-outs known within Sinclair Inlet (Jeffries et al., 2000), they are frequently observed hauled out at several opportune areas at NBKB (e.g., floating security fence; see Figures 4-1 and 4-2 of the Navy's application). The next nearest recorded haul-outs are navigation buoys and net pens in Rich Passage, approximately 10 km east of NBKB (Jeffries et al., 2000).

Steller Sea Lion

Steller sea lions are distributed mainly around the coasts to the outer continental shelf along the North Pacific rim from northern Hokkaido, Japan through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, southern coast of Alaska and south to California. Based on distribution, population response, phenotypic, and genotypic data, two separate stocks of Steller sea lions are recognized within U. S. waters, with the population divided into western and eastern distinct population segments (DPSs) at 144°W (Cape Suckling, Alaska) (Loughlin, 1997). The eastern DPS extends from California to Alaska, including the Gulf of Alaska, and is the only stock that may occur in the Hood Canal.

Steller sea lions were listed as threatened range-wide under the ESA in 1990. After division into two stocks, the western stock was listed as endangered in 1997, while the eastern stock remained classified as threatened. NMFS proposed on April 18, 2012, that the eastern stock is recovered and should be delisted. Pending a final decision on that proposal, the stock remains designated as depleted under the MMPA by default due to its threatened status under the ESA. However, the minimum estimated annual level of human-caused mortality (59.1) is significantly less than the calculated potential biological removal (PBR) of 2,378 animals. The stock has shown a consistent, long-term rate of increase, which may indicate that it is reaching optimum sustainable population (OSP) size (Allen and Angliss, 2013).

The most recent population estimate for the eastern stock is estimated to be within the range 58,334 to 72,223 (Allen and Angliss, 2013). Calkins and Pitcher (1982) and Pitcher et al., (2007) concluded that the total Steller sea lion population could be estimated by multiplying pup counts by a factor based on the birth rate, sex and age structure, and growth rate of the population. This range is determined by multiplying the most recent pup counts available by region, from 2006 (British Columbia) and 2009 (U.S.), by pup multipliers of either 4.2 or 5.2 (Pitcher et al., 2007). The pup multipliers varied depending on the vital rate parameter that resulted in the growth rate: as low as 4.2 if it were due to high fecundity, and as high as 5.2 if it were due to low juvenile mortality. These are not minimum population estimates, since they are extrapolated from pup counts from photographs taken in 2006-2009, and demographic parameters are estimated for an increasing population. The minimum population, which is estimated at 52,847 individuals, was calculated by adding the most recent non-pup and pup counts from all sites surveyed; this estimate is not corrected for animals at sea. The most recent minimum count for Steller sea lions in Washington was 516 in 2001 (Pitcher et al., 2007).

The abundance of the Eastern DPS of Steller sea lions is increasing throughout the northern portion of its range (Southeast Alaska and British Columbia; Merrick et al., 1992; Sease et al., 2001; Olesiuk and Trites, 2003; Olesiuk, 2008; NMFS, 2008), and stable or increasing slowly in the central portion (Oregon through central California; NMFS, 2008). In the southern end of its range (Channel Islands in southern California; Le Boeuf et al., 1991), it has declined significantly since the late 1930s, and several rookeries and haul-outs have been abandoned.

Changes in ocean conditions (e.g., warmer temperatures) may be contributing to habitat changes that favor California sea lions over Steller sea lions in the southern portion of the Steller's range (NMFS, 2008). Between the 1970s and 2002, the average annual population growth rate of eastern Steller sea lions was 3.1 percent (Pitcher et al., 2007). Pitcher et al. (2007) concluded this rate did not represent a maximum rate of increase, though, and the maximum theoretical net productivity rate for pinnipeds (12 percent) is considered appropriate (Allen and Angliss, 2013).

Data from 2005-10 show a total mean annual mortality rate of 5.71 (CV = 0.23) sea lions per year from observed fisheries and 11.25 reported takes per year that could not be assigned to specific fisheries, for a total from all fisheries of 17 eastern Steller sea lions (Allen and Angliss, 2013). In addition, opportunistic observations and stranding data indicate that an additional 28.8 animals are killed or seriously injured each year through interaction with commercial and recreational troll fisheries and by entanglement. For the most recent years from which data are available (2004-08), 11.9 animals were taken per year by subsistence harvest in Alaska. Sea lion deaths are also known to occur because of illegal shooting, vessel strikes, or capture in research gear and other traps, totaling 1.4 animals per year from 2006-10. The total annual human-caused mortality is a minimum estimate because takes via fisheries interactions and subsistence harvest in Canada are poorly known, although are believed to be small.

The eastern stock breeds in rookeries located in southeast Alaska, British Columbia, Oregon, and California. There are no known breeding rookeries in Washington (Allen and Angliss, 2013) but eastern stock Steller sea lions are present year-round along the outer coast of Washington, including immature animals or non-breeding adults of both sexes. In Washington, Steller sea lions primarily occur at haul-out sites along the outer coast from the Columbia River to Cape Flattery and in inland waters sites along the Vancouver Island coastline of the Strait of

Juan de Fuca (Jeffries et al., 2000; Olesiuk and Trites, 2003; Olesiuk, 2008). Numbers vary seasonally in Washington waters with peak numbers present during the fall and winter months (Jeffries et al., 2000). More recently, five winter haul-out sites used by adult and subadult Steller sea lions have been identified in Puget Sound (see Figure 4-2 of the Navy's application). Numbers of animals observed at all of these sites combined were less than 200 individuals. The closest haul-out, with approximately 30 to 50 individuals near the Navy's Manchester Fuel Depot, occurs approximately 6.5 mi from the project site but is physically separated by various land masses and waterways. However, one Steller sea lion was observed hauled out on the floating security barrier at NBKB in November 2012. No permanent haul-out has been identified in the project area and Steller sea lion presence is considered to be rare and seasonal.

Killer Whale

Killer whales are one of the most cosmopolitan marine mammals, found in all oceans with no apparent restrictions on temperature or depth, although they do occur at higher densities in colder, more productive waters at high latitudes and are more common in nearshore waters (Leatherwood and Dahlheim, 1978; Forney and Wade, 2006; Allen and Angliss, 2011). Killer whales are found throughout the North Pacific, including the entire Alaska coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California. On the basis of differences in morphology, ecology, genetics, and behavior, populations of killer whales have largely been classified as "resident", "transient", or "offshore" (e.g., Dahlheim et al., 2008). Several studies have also provided evidence that these ecotypes are genetically distinct, and that further genetic differentiation is present between subpopulations of the resident and transient ecotypes (e.g., Barrett-Lennard, 2000). The taxonomy of killer whales is unresolved, with expert opinion generally following one of two lines: killer whales are either

(1) a single highly variable species, with locally differentiated ecotypes representing recently evolved and relatively ephemeral forms not deserving species status, or (2) multiple species, supported by the congruence of several lines of evidence for the distinctness of sympatrically occurring forms (Krahn et al., 2004). Resident and transient whales are currently considered to be unnamed subspecies (Committee on Taxonomy, 2011).

The resident and transient populations have been divided further into different subpopulations on the basis of genetic analyses, distribution, and other factors. Recognized stocks in the North Pacific include Alaska Residents, Northern Residents, Southern Residents, Gulf of Alaska, Aleutian Islands, and Bering Sea Transients, and West Coast Transients, along with a single offshore stock. West coast transient killer whales, which occur from California through southeastern Alaska, are the only type expected to potentially occur in the project area.

West coast transient killer whales are not protected under the ESA or listed as depleted under the MMPA. The estimated annual level of human-caused mortality (0) does not exceed the calculated PBR (3.5); therefore, West Coast Transient killer whales are not considered a strategic stock under the MMPA. It is thought that the stock grew rapidly from the mid-1970s to mid-1990s as a result of a combination of high birth rate, survival, as well as greater immigration of animals into the nearshore study area (DFO, 2009). The rapid growth of the population during this period coincided with a dramatic increase in the abundance of the whales' primary prey, harbor seals, in nearshore waters. Population growth began slowing in the mid-1990s and has continued to slow in recent years (DFO, 2009). Population trends and status of this stock relative to its OSP level are currently unknown, as is the actual maximum productivity rate. Analyses in DFO (2009) estimated a rate of increase of about six percent per year from 1975 to 2006, but this included recruitment of non-calf whales into the population. The default maximum net growth rate for cetaceans (4 percent) is considered appropriate pending additional information (Carretta et al., 2011).

The West Coast transient stock is a trans-boundary stock, with minimum counts for the population of transient killer whales coming from various photographic datasets. Combining these counts of cataloged transient whales gives an abundance estimate of 354 individuals for the West Coast transient stock (Allen and Angliss, 2011). Although this direct count of individually identifiable animals does not necessarily represent the number of live animals, it is considered a conservative minimum estimate (Allen and Angliss, 2011). However, the number in Washington waters at any one time is probably fewer than twenty individuals (Wiles, 2004). The West Coast transient killer whale stock is not designated as depleted under the MMPA or listed under the ESA. The estimated annual level of human-caused mortality and serious injury does not exceed the PBR. Therefore, the West Coast Transient stock of killer whales is not classified as a strategic stock.

The estimated minimum mortality rate incidental to U.S. commercial fisheries is zero animals per year (Allen and Angliss, 2011). However, this could represent an underestimate as regards total fisheries-related mortality due to a lack of data concerning marine mammal interactions in Canadian commercial fisheries known to have potential for interaction with killer whales. Any such interactions are thought to be few in number (Allen and Angliss, 2011). Other mortality, as a result of shootings or ship strikes, has been of concern in the past. However, no ship strikes have been reported for this stock, and shooting of transients is thought to be minimal because their diet is based on marine mammals rather than fish. There are no reports of a subsistence harvest of killer whales in Alaska or Canada.

Transient occurrence in inland waters appears to peak during August and September which is the peak time for harbor seal pupping, weaning, and post-weaning (Baird and Dill, 1995). The number of west coast transients in Washington inland waters at any one time was considered likely to be fewer than twenty individuals by Wiles (2004), although more recent information (2004-10) suggests that transient use of inland waters has increased, possibly due to increasing prey abundance (Houghton et al., in prep.). However, Sinclair Inlet is a shallow bay located approximately eight miles through various waterways from the main open waters of Puget Sound, where killer whales occur more frequently, and killer whale occurrence in Sinclair Inlet is uncommon. From December 2002 to January 2013, there were two reports of transient killer whales transiting through the area around NBKB, with both reports occurring in May (a group of up to 12 in 2004 and a group of up to 5 in 2012; www.orcanetwork.org).

Gray Whale

Gray whales are found in shallow coastal waters, migrating between summer feeding areas in the north and winter breeding areas in the south. Gray whales were historically common throughout the northern hemisphere but are now found only in the Pacific, where two populations are recognized, Eastern and Western North Pacific (ENP and WNP). ENP whales breed and calve primarily in areas off Baja California and in the Gulf of California. From February to May, whales typically migrate northbound to summer/fall feeding areas in the Chukchi and northern Bering Seas, with the southbound return to calving areas typically occurring in November and December. 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, recent data from satellite-tracked whales indicates 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), and WNP animals comprised 8.1 percent of gray whales identified during a recent field season off of Vancouver Island (Weller et al., 2012). In addition, two genetic matches of WNP whales have been recorded off of Santa Barbara, CA (Lang et al., 2011a). 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, no WNP whales are known to have occurred in Washington inland waters. The likelihood of any gray whale being exposed to project sound to the degree considered in this document is already low, given the uncommon occurrence of gray whales in the project area. In the event that a gray whale did occur in the project area, it is extremely unlikely that it would be one of the approximately twenty WNP whales that have been documented in the eastern Pacific (less than one percent probability). The likelihood that a WNP whale would be present in the action area is insignificant and discountable.

In addition, recent studies provide new information on gray whale stock structure within the ENP, with emphasis on whales that feed during summer off the Pacific coast between northern California and southeastern Alaska, occasionally as far north as Kodiak Island, Alaska (Gosho et al., 2011). These whales, collectively known as the Pacific Coast Feeding Group

(PCFG), are a trans-boundary population with the U.S. and Canada and are defined by the International Whaling Commission (IWC) as follows: gray whales observed between June 1 to November 30 within the region between northern California and northern Vancouver Island (from 41°N to 52°N) and photo-identified within this area during two or more years (Carretta et al., 2013). Photo-identification and satellite tagging studies provide data on abundance, population structure, and movements of PCFG whales (Calambokidis et al., 2010; Mate et al; 2010; Gosho et al., 2011). These data in conjunction with genetic studies (e.g., Frasier et al., 2011; Lang et al., 2011b) indicate that the PCFG may be a demographically distinct feeding aggregation, and may warrant consideration as a distinct stock (Carretta et al., 2013). Therefore, abundance for the PCFG (as a component of the broader ENP stock) was calculated by NMFS. It is unknown whether PCFG whales would be encountered in Washington inland waters.

The ENP population of gray whales, which is managed as a stock, was removed from ESA protection in 1994, is not currently protected under the ESA, and is not listed as depleted under the MMPA. Punt and Wade (2010) estimated the ENP population was at 91 percent of carrying capacity and at 129 percent of the maximum net productivity level and therefore within the range of its optimum sustainable population. The ENP stock of gray whales is not classified as a strategic stock under the MMPA because the estimated annual level of human-caused mortality (128) is less than the calculated PBR (558) (Carretta et al., 2013). PCFG whales do not currently have a formal status under the MMPA, although the estimated annual level of human-caused mortality (0.6) is less than the calculated PBR (2.8) (Carretta et al., 2013). The WNP population is listed as endangered under the ESA and depleted under the MMPA as a foreign stock.

The best abundance estimate of the ENP stock of gray whales is 19,126 (CV = 0.071) and the minimum population size of this stock is 18,017 individuals (Carretta et al., 2013). Systematic counts of gray whales migrating south along the central California coast have been conducted by shore-based observers since 1967. The best and minimum abundance estimates were calculated from 2006-07 survey data, the first year in which improved counting techniques and a more consistent approach to abundance estimation were used (Carretta et al., 2013). The population size of the ENP gray whale stock has been increasing over the past several decades despite a west coast UME (unexplained causes) from 1999-2001. The estimated annual rate of increase from 1967-88, based on the revised abundance time series from Laake et al. (2009), is 3.2 percent (Punt and Wade, 2010). Based on the same analyses, the best estimate of the maximum productivity rate for gray whales is considered to be 6.2 percent. The best abundance estimate for PCFG whales is 194 (SE = 17.0), as determined through photographic mark-recapture studies (Calambokidis et al., 2010). The most recent estimate of WNP gray whale abundance is 137 individuals (IWC, 2012).

As noted above, gray whale numbers were significantly reduced by whaling, becoming extirpated from the Atlantic by the early 1700s and listed as an endangered species in the Pacific. The ENP stock has since recovered sufficiently to be delisted from the ESA. Gray whales remain subject to occasional fisheries-related mortality and death from ship strikes. Based on stranding network data for the period 2006-10, there are an average of 0.2 deaths per year from the former and 2.2 per year from the latter. In addition, subsistence hunting of gray whales by hunters in Russia and the U.S. is approved by the IWC, although none is currently authorized in the U.S. From 2006-10, the annual Russian subsistence harvest was 123 whales (Carretta et al., 2013). Climate change is considered a significant habitat concern for gray whales, as prey composition and distribution is likely to be altered and human activity in the whales' summer feeding grounds increases (Carretta et al., 2013).

Gray whales generally migrate southbound past Washington in late December and January, and transit past Washington on the northbound return in March to May. Gray whales do not generally make use of Washington inland waters, but have been observed in certain portions of those waters in all months of the year, with most records occurring from March through June (Calambokidis et al., 2010; www.orcanetwork.org) and associated with regular feeding areas. Usually fewer than twenty gray whales visit the inner marine waters of Washington and British Columbia beginning in about January, with some staying until summer. Six to ten of these are PCFG whales that return most years to feeding sites near Whidbey and Camano Islands in northern Puget Sound. The remaining individuals occurring in any given year generally appear unfamiliar with feeding areas, often arrive emaciated, and commonly die of starvation (WDFW, 2012). From December 2002 to January 2013, the Orca Network sightings database reports four occurrences of gray whales in the project area during the in-water work window (www.orcanetwork.org). Three sightings occurred during the winter of 2008-09, and one stranding was reported in January 2013. The necropsy of the whale indicated that it was a juvenile male in poor nutritional health. Two other strandings have been recorded in the project area, in May 2005 and July 2011.

Potential Effects of the Specified Activity on Marine Mammals

We have determined that pile driving, as outlined in the project description, has the potential to result in behavioral harassment of marine mammals that may be present in the project vicinity while construction activity is being conducted. In theory, impact pile driving could result in injury of marine mammals although, for reasons described later in this document, we do not believe such an outcome to be likely or even possible in some cases. The full range of potential effects of sound on marine mammals, and pile driving in particular, are described in this section.

Marine Mammal Hearing

Effects on marine mammals anticipated from the specified activities would be expected to result primarily from exposure of animals to underwater sound. Hearing is the most important sensory modality for marine mammals, and exposure to sound can have deleterious effects. To appropriately assess these potential effects, 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 (Richardson et al., 1995; Wartzok and Ketten, 1999). To reflect this, Southall et al. (2007) recommended that marine mammals be divided into functional hearing groups based on measured or estimated hearing ranges on the basis of available behavioral data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. The lower and/or upper frequencies for some of these functional hearing groups have been modified from those designated by Southall et al. (2007). The functional groups and the associated frequencies are indicated below (note that these frequency ranges do not necessarily correspond to the range of best hearing, which varies by species):

- Low-frequency cetaceans (mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 30 kHz (extended from 22 kHz on the basis of data indicating some mysticetes can hear above 22 kHz; Au et al., 2006; Lucifredi and Stein, 2007; Ketten and Mountain, 2009; Tubelli et al., 2012);

- Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): functional 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): functional hearing is estimated to occur between approximately 200 Hz and 180 kHz; and

- Pinnipeds in water: functional hearing is estimated to occur between approximately 75 Hz to 100 kHz for Phocidae (true seals) and between 100 Hz and 40 kHz for Otariidae (eared seals), with the greatest sensitivity between approximately 700 Hz and 20 kHz. The pinniped functional hearing group was modified from Southall et al. (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemila et al., 2006; Mulsow et al., 2011).

Three pinniped and two cetacean species could potentially occur in the proposed project area during the project timeframe. The harbor seal is a phocid species, while both sea lions are otariid species. Of the cetacean species that may occur in the project area, the killer whale is classified as mid-frequency and the gray whale is classified as low-frequency (Southall et al., 2007).

Underwater Sound Effects

Potential Effects of Pile Driving Sound – The effects of sounds from pile driving might result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson et al., 1995; Gordon et al., 2003; Nowacek et al., 2007; Southall et al., 2007). 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. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (e.g., sand) would absorb or attenuate the sound more readily than hard substrates (e.g., rock) which may reflect the acoustic wave. Soft porous substrates would also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

In the absence of mitigation, impacts to marine species may result from physiological and behavioral responses to both the type and strength of the acoustic signature (Viada et al., 2008). The type and severity of behavioral impacts are more difficult to define due to limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range in severity, ranging from effects such as behavioral disturbance, tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to mortality (Yelverton et al., 1973).

Hearing Impairment and Other Physical Effects – Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak et al., 1999; Schlundt et al., 2000; Finneran et al., 2002, 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall et al., 2007). Marine mammals depend on acoustic cues for vital biological functions, (e.g., orientation, communication, finding prey, avoiding predators); thus, TTS may result in reduced fitness in survival and reproduction. However, this depends on the frequency and duration of TTS, as well as the biological context in which it occurs. TTS of limited duration, occurring in a frequency range that does not coincide with that used for recognition of important acoustic cues, would have little to no effect on an animal's fitness. Repeated sound exposure that leads to TTS could cause PTS. PTS, in the unlikely event that it occurred, would constitute injury, but TTS is not considered injury (Southall et al., 2007). It is unlikely that the project would result in any cases of temporary or especially permanent hearing impairment or any significant non-auditory physical or physiological effects for reasons discussed later in this document. Some behavioral disturbance is expected, but it is likely that this would be localized and short-term because of the short project duration.

Several aspects of the planned monitoring and mitigation measures for this project (see the "Proposed Mitigation" and "Proposed Monitoring and Reporting" sections later in this document) are designed to detect marine mammals occurring near the pile driving to avoid exposing them to sound pulses that might, in theory, cause hearing impairment. In addition, many cetaceans are likely to show some avoidance of the area where received levels of pile driving sound are high enough that hearing impairment could potentially occur. In those cases, the avoidance responses of the animals themselves would reduce or (most likely) avoid any possibility of hearing impairment. Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. It is especially unlikely that any effects of these types would occur during the present project given the brief duration of exposure for any given individual and the planned monitoring and mitigation measures. The following subsections discuss in somewhat more detail the possibilities of TTS, PTS, and non-auditory physical effects.

Temporary Threshold Shift – TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be stronger in order to be heard. In terrestrial mammals, TTS can last from minutes or hours to days (in cases of strong TTS). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals 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, and none of the published data concern TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in Southall et al. (2007).

Given the available data, the received level of a single pulse (with no frequency weighting) might need to be approximately 186 dB re 1 μPa^2-s (i.e., 186 dB sound exposure level [SEL] or approximately 221-226 dB pk-pk) in order to produce brief, mild TTS. Exposure to several strong pulses that each have received levels near 190 dB re 1 µPa rms (175-180 dB SEL) might result in cumulative exposure of approximately 186 dB SEL and thus slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. Levels greater than or equal to 190 dB re 1 µPa rms are expected to be restricted to radii no more than 5 m (16 ft) from the pile driving. For an odontocete closer to the surface, the maximum radius with greater than or equal to 190 dB re 1 µPa rms would be smaller.

The above TTS information for odontocetes is derived from studies on the bottlenose dolphin (Tursiops truncatus) and beluga whale (Delphinapterus leucas). There is no published TTS information for other species of cetaceans. However, preliminary evidence from a harbor porpoise exposed to pulsed sound suggests that its TTS threshold may have been lower (Lucke et al., 2009). To avoid the potential for injury, NMFS' current policy is that cetaceans should not be exposed to pulsed underwater sound at received levels exceeding 180 dB re 1 μPa rms. As summarized above, data that are now available imply that TTS is unlikely to occur unless odontocetes are exposed to pile driving pulses stronger than 180 dB re 1 μPa rms.

Permanent Threshold Shift – When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, while in other cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985). There is no specific evidence that exposure to pulses of sound can cause PTS in any marine mammal. However, given the possibility that mammals close to pile driving activity might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to pile driving might incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS.

Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise time. Based on data from terrestrial mammals, a precautionary assumption is that the PTS threshold for impulse sounds (such as pile driving pulses as received close to the source) is at least 6 dB higher than the TTS threshold on a peak-pressure basis and probably greater than 6 dB (Southall et al., 2007). On an SEL basis, Southall et al. (2007) estimated that received levels would need to exceed the TTS threshold by at least 15 dB for there to be risk of PTS. Thus, for cetaceans, Southall et al. (2007) estimate that the PTS threshold might be an M-weighted SEL (for the sequence of received pulses) of approximately 198 dB re 1 μPa^2-s (15 dB higher than the TTS threshold for an impulse). Given the higher level of sound necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

Measured source levels from impact pile driving can be as high as 214 dB re 1 μPa at 1 m. Although no marine mammals have been shown to experience TTS or PTS as a result of being exposed to pile driving activities, captive bottlenose dolphins and beluga whales exhibited changes in behavior when exposed to strong pulsed sounds (Finneran et al., 2000, 2002, 2005). The animals tolerated high received levels of sound before exhibiting aversive behaviors. Experiments on a beluga whale showed that exposure to a single watergun impulse at a received level of 207 kPa (30 psi) p-p, which is equivalent to 228 dB p-p re 1 μPa, resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within four minutes of the exposure (Finneran et al., 2002). Although the source level of pile driving from one hammer strike is expected to be much lower than the single watergun impulse cited here, animals being exposed for a prolonged period to repeated hammer strikes could receive more sound exposure in terms of SEL than from the single watergun impulse (estimated at 188 dB re 1 μPa^2-s) in the aforementioned experiment (Finneran et al., 2002). However, in order for marine mammals to experience TTS or PTS, the animals have to be close enough to be exposed to high intensity sound levels for a prolonged period of time. Based on the best scientific information available, these SPLs are far below the thresholds that could cause TTS or the onset of PTS.

Non-auditory Physiological Effects – Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox et al., 2006; Southall et al., 2007). Studies examining such effects are limited. In general, little is known about the potential for pile driving to cause auditory impairment or other physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would presumably be limited to short distances from the sound source and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall et al., 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of pile driving, including some odontocetes and some pinnipeds, are especially unlikely to incur auditory impairment or non-auditory physical effects.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Behavioral responses to sound are highly variable and context-specific and reactions, if any, depend on species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day, and many other factors (Richardson et al., 1995; Wartzok et al., 2003; Southall et al., 2007).

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. 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. Behavioral state may affect the type of response as well. 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 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 seismic guns or acoustic harassment devices, but also including impact pile driving) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; Thorson and Reyff, 2006; see also Gordon et al., 2004; Wartzok et al., 2003; Nowacek et al., 2007). Responses to non-pulsed sources, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds.

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 behavior 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 (e.g., pinnipeds flushing into water from haul-outs or rookeries). Since pile driving would likely only occur for a few hours a day, over a short period of time, it is unlikely to result in permanent displacement. Any potential impacts from pile driving activities could be experienced by individual marine mammals, but would not be likely to cause population level impacts, or affect the long-term fitness of the species.

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 potentially lead to effects on growth, survival, or reproduction include:

- Drastic changes in diving/surfacing patterns (such as those thought to be causing beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Habitat abandonment due to loss of desirable acoustic environment; and
- Cessation of feeding or social interaction.

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).

Auditory Masking

Natural and artificial sounds can disrupt behavior by masking, or interfering with, a marine mammal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher levels. Chronic exposure to excessive, though not high-intensity, sound could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions. Masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction. If the coincident (masking) sound were man-made, it could be potentially harassing if it disrupted hearing-related behavior. 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. Because sound generated from in-water pile driving is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds made by porpoises. However, lower frequency man-made sounds are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey sound. It may also affect communication signals when they occur near the sound band and thus reduce the communication space of animals (e.g., Clark et al., 2009) and cause increased stress levels (e.g., Foote et al., 2004; Holt et al., 2009).

Masking has the potential to impact species at population, community, or even ecosystem levels, as well as at individual levels. Masking affects both senders and receivers of the signals and can potentially have long-term chronic effects on marine mammal species and populations. Recent research suggests that 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, and that most of these increases are from distant shipping (Hildebrand, 2009). All anthropogenic sound sources, such as those from vessel traffic, pile driving, and dredging activities, contribute to the elevated ambient sound levels, thus intensifying masking. However, much of the sound from the proposed activities is confined in an area of inland waters (Sinclair Inlet) that is bounded by landmass and far removed from more open waters of Puget Sound; therefore, the sound generated is not expected to contribute significantly to increased ocean ambient sound.

The most intense underwater sounds in the proposed action are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would likely be within the audible range of marine mammals present in the project area. Impact pile driving activity is relatively short-term, with rapid pulses occurring for the duration of the driving event. The probability for impact pile driving resulting from this proposed action masking acoustic signals important to the behavior and survival of marine mammal species is likely to be discountable. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for the duration of the driving event, which is likely to be short for this project. It is possible that vibratory pile driving resulting from this proposed action may mask acoustic signals important to the behavior and survival of marine mammal species, but the short-term duration and limited affected area would result in insignificant impacts from masking. 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.

Airborne Sound Effects

Marine mammals that occur in the project area could be exposed to airborne sounds associated with pile driving that have the potential to cause harassment, depending on their distance from pile driving activities. Airborne pile driving sound would have less impact on cetaceans than pinnipeds because sound from atmospheric sources does not transmit well underwater (Richardson et al., 1995); thus, airborne sound would only be an issue for pinnipeds in the project area, whether hauled-out or in the water with heads in the air. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their habitat and move further from the source. Studies by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 dB peak and 96 dB rms.

Anticipated Effects on Habitat

The proposed activities at NBKB 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 and salmonids, and may affect acoustic habitat (see masking discussion above). There are no rookeries or major haul-out sites, no known foraging hotspots, or other ocean bottom structure of significant biological importance to marine mammals present in the marine waters in the vicinity of the project area. 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 document. The most likely impact to marine mammal habitat occurs from pile driving effects on likely marine mammal prey (i.e., fish) near NBKB and minor impacts to the immediate substrate during installation and removal of piles during the pier maintenance project.

Pile Driving Effects on Potential Prey (Fish)

Construction activities may produce both pulsed (i.e., impact pile driving) and continuous (i.e., vibratory pile driving) sounds. Fish react to sounds which are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) and Hastings (2009) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving (or other types of sounds) 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). Sound pulses at received levels of 160 dB re 1 μPa may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson et al., 1992; Skalski et al., 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality. The most likely impact to fish from pile driving activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this 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 short timeframe for the project. However, adverse impacts may occur to a few species of fish which may still be present in the project area despite operating in a reduced work window in an attempt to avoid important fish spawning time periods.

Pile Driving Effects on Potential Foraging Habitat

The area likely impacted by the project is relatively small compared to the available habitat in inland waters in the region. Avoidance by potential prey (i.e., fish) of the immediate area due to the temporary loss of this foraging habitat is also possible. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. 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.

Given the short daily duration of sound associated with individual pile driving events and the relatively small areas being affected, pile driving activities associated with the proposed action are not likely to have a permanent, adverse effect on any fish habitat, or populations of fish species. Therefore, pile driving is not likely to have a permanent, adverse effect on marine mammal foraging habitat at the project area. The area around NBKB, including the adjacent ferry terminal and nearby marinas, is heavily altered with significant levels of industrial and recreational activity, and is unlikely to harbor significant amounts of forage fish.

Proposed Mitigation

In order to issue an incidental take authorization (ITA) under section 101(a)(5)(D) of the MMPA, we must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable 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 (where relevant).

Measurements from proxy pile driving events were coupled with practical spreading loss to estimate zones of influence (ZOIs; see “Estimated Take by Incidental Harassment”); these values were used to develop mitigation measures for pile driving activities at NBKB. The ZOIs effectively represent the mitigation zone that would be established around each pile to prevent Level A harassment to marine mammals, while providing estimates of the areas within which Level B harassment might occur. In addition to the specific measures described later in this section, the Navy would conduct briefings between construction supervisors and crews, 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, marine mammal monitoring protocol, and operational procedures.

Monitoring and Shutdown for Pile Driving

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

Shutdown Zone – For all pile driving and removal activities, the Navy will establish a shutdown zone intended to contain the area in which SPLs equal or exceed the 190 dB rms acoustic injury criteria. 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 injury, serious injury, or death of marine mammals. Radial distances for shutdown zones are shown in Table 3. However, a minimum shutdown zone of 10 m (which is larger than the maximum predicted injury zone) will be established during all pile driving activities, regardless of the estimated zone. Vibratory pile driving activities are not predicted to produce sound exceeding the Level A standard, but these precautionary measures are intended to prevent the already unlikely possibility of physical interaction with construction equipment and to further reduce any possibility of acoustic injury.

Disturbance Zone – Disturbance zones are the areas in which SPLs equal or exceed 160 and 120 dB rms (for pulsed and non-pulsed sound, 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. 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. However, 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 3.

In order to document observed incidences of harassment, monitors record all marine mammal observations, regardless of location. The observer’s location, as well as the location of the pile being driven, is known from a GPS. The location of the animal is estimated as a distance from the observer, which is 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 and acoustic data, and a precise accounting of observed incidences of harassment created. This information may then be used to extrapolate observed takes to reach an approximate understanding of actual total takes.

Monitoring Protocols – Monitoring would be conducted before, during, and after pile driving activities. In addition, observers shall record all incidences of marine mammal occurrence, regardless of distance from activity, and shall 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 would be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point all pile driving activities would be halted. Please see the Monitoring Plan (Appendix C in the Navy’s application), developed by the Navy in agreement with NMFS, for full details of the monitoring protocols. 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 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 observers, who will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. Qualified observers are trained biologists, with 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;
- Advanced education in biological science, wildlife management, mammalogy, or related fields (bachelor's degree or higher is required);
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience);
- 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 prepare a report of 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 from construction sound of marine mammals observed 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.

(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 15 minutes have passed without re-detection of the animal. Monitoring will be conducted throughout the time required to drive a pile.

<u>Special Conditions</u>

The Navy has not requested the authorization of incidental take for Steller sea lions, killer whales, or gray whales (see discussion in Estimated Take by Incidental Harassment). Therefore, shutdown would be implemented in the event that a Steller sea lion or any cetacean is observed upon sighting within (or in anticipation of entering) the defined disturbance zone. As described later in this document, we believe that occurrence of any of these species during the in-water work window would be uncommon. For gray and killer whales, in particular, the occurrence of an individual or group would likely be highly noticeable and would attract significant attention in local media and with local whale watchers and interested citizens.

Prior to the start of pile driving on any day, the Navy would contact and/or review the latest sightings data from the Orca Network and/or Center for Whale Research to determine the location of the nearest marine mammal sightings. The Orca Sightings Network consists of a list of over 600 residents, scientists, and government agency personnel in the U.S. and Canada, and includes passive acoustic detections. The presence of a killer whale or gray whale in the southern reaches of Puget Sound would be a notable event, drawing public attention and media scrutiny. With this level of coordination in the region of activity, the Navy should be able to effectively receive real-time information on the presence or absence of whales, sufficient to inform the day's activities. Pile removal or driving would not occur if there was the risk of incidental harassment of a species for which incidental take was not authorized.

Prior to beginning pile driving on each day, monitors would scan the floating security barrier to ensure that no Steller sea lions are present. During vibratory pile removal, four land-based observers will monitor the area; these would be positioned with two at the pier work site, one at the eastern extent of the ZOI in the Manette neighborhood of Bremerton, and one at the southern extent of the ZOI near the Annapolis ferry landing in Port Orchard (please see Figure 1 of Appendix C in the Navy's application). Additionally, one vessel-based observer will travel through the monitoring area, completing an entire loop approximately every 30 minutes. If any killer whales, grey whales, or Steller sea lions are detected, activity would not begin or would shut down.

Timing Restrictions

In the project area, designated timing restrictions exist to avoid in-water work when salmonids and other spawning forage fish are likely to be present. The in-water work window is June 15-March 1. All in-water construction activities would occur only during daylight hours (sunrise to sunset).

Soft Start

The use of a soft-start procedure is believed to provide additional protection to marine mammals by warning or providing a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from vibratory hammers for fifteen seconds at reduced energy followed by a 30-second waiting period. This procedure is repeated two additional times. However, implementation of soft start for vibratory pile driving during previous pile driving work conducted by the Navy at another location has led to equipment failure and serious human safety concerns. Therefore, vibratory soft start is not proposed as a mitigation measure for this project, as we have determined it not to be practicable. We have further determined this measure unnecessary to providing the means of effecting the least practicable impact on marine mammals and their habitat. Prior to issuing any further IHAs to the Navy for pile driving activities in 2014 and beyond, we plan to facilitate consultation between the Navy and other practitioners (e.g., Washington State Department of Transportation and/or the California Department of Transportation) in order to determine whether the potentially significant human safety issue is inherent to implementation of the measure or is due to operator error. For impact driving, soft start will be required, and contractors will provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a 30-second waiting period, then two subsequent three-strike sets.

We have carefully evaluated the applicant's proposed mitigation measures and considered a range of other measures in the context of ensuring that we prescribe the means of effecting the least practicable impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: (1) the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals; (2) the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

Based on our evaluation of the applicant's proposed measures, as well as any other potential measures that may be relevant to the specified activity, we have preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an ITA for an activity, section 101(a)(5)(D) of the MMPA states that we must set forth "requirements pertaining to the monitoring and reporting of such taking". The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for ITAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. The Navy's proposed monitoring and reporting is also described in their Marine Mammal Monitoring Plan (Appendix C of the Navy's application).

Visual Marine Mammal Observations

The Navy will collect sighting data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of activity. 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 will monitor the shutdown zone and disturbance zone before, during, and after pile driving, with observers located at the best practicable vantage points. Based on our requirements, the Navy would implement the following procedures for pile driving:

- MMOs 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 and disturbance zones around the pile will be monitored for the presence of marine mammals before, during, and after any pile driving or removal activity.

During vibratory pile removal, four observers would be deployed as described under Proposed Mitigation, including four land-based observers and one-vessel-based observer traversing the extent of the Level B harassment zone. During impact driving, one observer would be positioned at or near the pile to observe the much smaller disturbance zone.

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 protocol will be coordinated between NMFS and the Navy.

Data Collection

We require that observers use approved 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 description of specific actions that ensued and resulting behavior of the animal, if any. In addition, the Navy will attempt to distinguish between the number of individual animals taken and the number of incidences of take. 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., percent 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 if possible, the correlation to SPLs;
- Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
- Locations of all marine mammal observations; and
- Other human activity in the area.
- Description of implementation of mitigation measures (e.g., shutdown or delay).

Reporting

A draft report would be submitted to NMFS within 45 days of the completion of marine mammal monitoring, or 60 days prior to the issuance of any subsequent IHA for this project, whichever comes first. 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 adverse responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and a refined take estimate based on the number of marine mammals observed during the course of construction. A final report would be prepared and submitted within 30 days following resolution of comments on the draft report.

Estimated Take by Incidental Harassment

With respect to the activities described 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].” All anticipated takes would be by Level B harassment, involving temporary changes in behavior. The proposed mitigation and monitoring measures are expected to minimize the possibility of injurious or lethal takes such that take by Level A harassment, serious injury, or mortality is considered discountable. However, it is unlikely that injurious or lethal takes would occur even in the absence of the proposed mitigation and monitoring measures.

If a marine mammal responds to a stimulus by changing its behavior (e.g., through relatively minor changes in locomotion direction/speed or vocalization behavior), the response may or may not constitute taking at the individual level, and is unlikely to affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals or on the stock or species could potentially be significant (Lusseau and Bejder, 2007; Weilgart, 2007). Given the many uncertainties in predicting the quantity and types of impacts of sound on marine mammals, it is common practice to estimate how many animals are likely to be present within a particular distance of a given activity, or exposed to a particular level of sound. This practice potentially overestimates the numbers of marine mammals taken. In addition, it is often difficult to distinguish between the individuals harassed and incidences of harassment. In particular, for stationary activities, it is more likely that some smaller number of individuals may accrue a number of incidences of harassment per individual than for each incidence to accrue to a new individual.

The project area is not believed to be particularly important habitat for marine mammals, nor is it considered an area frequented by marine mammals, although harbor seals may be present year-round and sea lions are known to haul-out on man-made objects at the NBKB waterfront. Sightings of other species are rare. Therefore, behavioral disturbances that could result from anthropogenic sound associated with these activities are expected to affect only a relatively small number of individual marine mammals, although those effects could be recurring over the life of the project if the same individuals remain in the project vicinity. The Navy has requested authorization for the incidental taking of small numbers of harbor seals and California sea lions in Sinclair Inlet and nearby waters that may be ensonified by project activities.

<u>Marine Mammal Densities</u>

For all species, the best scientific information available was used to derive density estimates and the maximum appropriate density value for each species was considered for use in the marine mammal take assessment calculations. These values, shown in Table 7 below, were derived or confirmed by experts convened to develop such information for use in Navy environmental compliance efforts in the Pacific Northwest, including Washington inland waters. The Navy Marine Species Density Database (NMSDD) density estimates were recently finalized, and use data from local marine mammal data sets, expert opinion, and survey data from Navy biologists and other agencies. A technical report documenting methodologies used to derive these densities and relevant background data is still in development (DoN, in prep.). These data are generally considered the best available information for Washington inland waters, except where specific local abundance information is available. At NBKB, the Navy began collecting opportunistic observational data of animals hauled-out on the floating security barrier. These surveys began in February 2010 and have been conducted approximately monthly from September 2010 through present (DoN, 2013). In addition, the Washington State Department of Transportation (WSDOT) recently conducted in-water pile driving over the course of multiple work windows as part of the Manette Bridge construction project in the nearby Port Washington Narrows. WSDOT conducted required marine mammal monitoring as part of this project (WSDOT, 2011, 2012; Rand, 2011). We determined, for both harbor seals and California sea lions, that these sources of local abundance information comprise the best available data for use in the take assessment calculations, as described below.

Species	**Density (Sinclair Inlet), #/km^2**
Harbor seal	0.4267
California sea lion	0.13
Steller sea lion	0.037
Transient killer whale	0.0024
Gray whale	0.0005

Table 7. Maximum marine mammal density estimates for NBKB (Sinclair Inlet)

<u>Description of Take Calculation</u>

The take calculations presented here rely on the best data currently available for marine mammal populations in Puget Sound. The following assumptions are made when estimating potential incidences of take:

- All marine mammal individuals potentially available are assumed to be present within the relevant area, and thus incidentally taken;
- An individual can only be taken once during a 24-h period; and,
- There will be 20 total days of vibratory driving and 45 days of impact pile driving.
- Exposures to sound levels above the relevant thresholds equate to take, as defined by the MMPA.

The calculation for marine mammal takes is estimated by:

Exposure estimate = (n * ZOI) * days of total activity

where:

n = density estimate used for each species/season

ZOI = sound threshold ZOI impact area; the area encompassed by all locations where the SPLs equal or exceed the threshold being evaluated

n * ZOI produces an estimate of the abundance of animals that could be present in the area for exposure, and is rounded to the nearest whole number before multiplying by days of total activity.

The ZOI impact area is the estimated range of impact to the sound criteria. The distances specified in Table 3 and 5 were used to calculate ZOIs around each pile. The ZOI impact area calculations took into consideration the possible affected area with attenuation due to topographical constraints of Sinclair Inlet, and the radial distances to thresholds are not always reached.

While pile driving can occur any day, and the analysis is conducted on a per day basis, only a fraction of that time (typically a matter of hours on any given day) is actually spent pile driving. The exposure assessment methodology is an estimate of the numbers of individuals exposed to the effects of pile driving activities exceeding NMFS-established thresholds. Of note in these exposure estimates, mitigation methods (i.e., visual monitoring and the use of shutdown zones; soft start for impact pile driving) were not quantified within the assessment and successful implementation of mitigation is not reflected in exposure estimates. In addition, equating exposure with response (i.e., a behavioral response meeting the definition of take under the MMPA) is a simplistic and conservative assumption. For these reasons, results from this acoustic exposure assessment likely overestimate take estimates to some unquantifiable degree.

Airborne Sound – No incidents of incidental take resulting solely from airborne sound are likely, as distances to the harassment thresholds will not reach areas where pinnipeds may haul out. Harbor seals can haul out at a variety of natural or manmade locations, but Navy waterfront surveys have found it rare for harbor seals to haul out along the NBKB waterfront (DoN, 2013). Individual sea lions are frequently observed hauled out on pontoons of the floating security fence within the restricted areas of NBKB, but this area is not within the airborne disturbance ZOI. We recognize that pinnipeds in the water could be exposed to airborne sound that may result in behavioral harassment when looking with heads above water. However, these animals will previously have been ‘taken’ as a result of exposure to underwater sound above the behavioral harassment thresholds, which are in all cases larger 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' 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.

Harbor Seal – While no harbor seal haul-outs are present in the action area or in the immediate vicinity of NBKB, haul-outs are present elsewhere in Sinclair Inlet and in other nearby waters and harbor seals may haul out on available objects opportunistically. Use of the NMSDD density value (0.4267 animals/km^2; corrected for proportion of animals hauled-out at any given time) would result in an estimate of 2-3 incidences of harassment per day; it is likely that this would not adequately represent the potential presence of harbor seals given observed occurrence at other nearby construction projects. Marine mammal monitoring conducted during pile driving work on the Manette Bridge showed variable numbers of harbor seals (but generally greater than indicated by the NMSDD density). During the first year of construction (in-water work window only), an average of 3.7 harbor seals were observed per day of monitoring with a maximum of 59 observed in October 2011 (WSDOT, 2011; Rand, 2011). During the most recent construction period (July-November 2012), an average of eleven harbor seals per monitoring day was observed, though some animals were likely counted multiple times (WSDOT, 2012). Given the potential for similar occurrence of harbor seals in the vicinity of NBKB during the in-water construction period, we determined it appropriate to use this most recent, local abundance information in the take assessment calculation.

California Sea Lion – Similar to harbor seals, it is not likely that use of the NMSDD density value for California sea lions (0.13 animals/km^2) would adequately represent their potential occurrence in the project area. California sea lions are commonly observed hauled out on the floating security barrier which is in close proximity to Pier 6; counts from 34 surveys (March 2010-June 2013) showed an average of 42 individuals per survey day (range 0-144; DoN, 2013). These counts represent the best local abundance data available and were used in the take assessment calculation.

Steller Sea Lion – No Steller sea lion haul-outs are present within or near the action area, and Steller sea lions have not been observed during Navy waterfront surveys or during monitoring associated with the Manette Bridge construction project. It is assumed that the possibility exists that a Steller sea lion could occur in the project area, but there is no known attractant in Sinclair Inlet, which is a relatively muddy, industrialized area, and the floating security barrier that California sea lions use as an opportunistic haul-out cannot generally accommodate the larger adult Steller sea lions (juveniles could haul-out on the barrier). Use of the NMSDD density estimate (0.037 animals/km^2) results in an estimate of zero exposures, and there are no existing data to indicate that Steller sea lions would occur more frequently locally. Therefore, the Navy has not requested the authorization of incidental take for Steller sea lions and we do not propose such authorization. The Navy would not begin activity or would shut down upon report of a Steller sea lion present within or approaching the relevant ZOI.

Killer Whale – Transient killer whales are rarely observed in the project area, with records since 2002 showing one group transiting through the area in May 2004 and a subsequent, similar observation in May 2010. No other observations have occurred during Navy surveys or during project monitoring for Manette Bridge. Use of the NMSDD density estimate (0.0024 animals/km^2) results in an estimate of zero exposures, and there are no existing data to indicate that killer whales would occur more frequently locally. Therefore, the Navy has not requested the authorization of incidental take for transient killer whales and we do not propose such authorization. The Navy would not begin activity or would shut down upon report of a killer whale present within or approaching the relevant ZOI.

Gray Whale – Gray whales are rarely observed in the project area, and the majority of in-water work would occur when whales are relatively less likely to occur (i.e., outside of March-May). Since 2002 and during the in-water work window, there are observational records of three whales (all during winter 2008-09) and a stranding record of a fourth whale (January 2013). No other observations have occurred during Navy surveys or during project monitoring for Manette Bridge. Use of the NMSDD density estimate (0.0005 animals/km^2) results in an estimate of zero exposures, and there are no existing data to indicate that gray whales would occur more frequently locally. Therefore, the Navy has not requested the authorization of incidental take for gray whales and we do not propose such authorization. The Navy would not begin activity or would shut down upon report of a gray whale present within or approaching the relevant ZOI.

Species	**Exposure estimate**
Harbor seal[1]	715
California sea lion[2]	2,730
Steller sea lion	0
Transient killer whale	0
Gray whale	0

[1] Use of NMSDD density results in estimated range of potential exposures of 130-195. Local abundance data were used in exposure assessment, i.e., 11 harbor seals potentially exposed per day for 65 days of pile driving.

[2] Use of NMSDD density results in estimated potential exposures of 65. Local abundance data were used in exposure assessment, i.e., 42 California sea lions potentially exposed per day for 65 days of pile driving.

Table 8. Number of potential incidental takes of marine mammals

For the Steller sea lion, transient killer whale, and gray whale, available information indicates that presence of these species is sufficiently rare to make exposure unlikely. Further, the Navy's proposed monitoring plan further mitigates any such possibility to the point that we consider it discountable and do not propose to authorize incidental take for these three species.

Negligible Impact and Small Numbers Analyses and Preliminary Determinations

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." In making a negligible impact determination, we consider a variety of factors, including but not limited to: (1) the number of anticipated mortalities; (2) the number and nature of anticipated injuries; (3) the number, nature, intensity, and duration of Level B harassment; and (4) the context in which the take occurs.

Small Numbers Analysis

The number of incidences of take proposed for authorization for harbor seals and California sea lions would be considered small relative to the relevant stocks or populations (less than five percent and one percent, respectively) even if each estimated taking occurred to a new individual. This is an extremely unlikely scenario as, for pinnipeds in estuarine/inland waters, there is likely to be some overlap in individuals present day-to-day.

Negligible Impact Analysis

Pile driving activities associated with the Navy's pier maintenance project, as outlined 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, from underwater sounds generated from pile driving and removal. Potential takes could occur if individuals of these species are present in the ensonified zone when the specified activity is occurring.

No injury, serious injury, or mortality is anticipated given the nature of the activity and measures designed to minimize the possibility of injury to marine mammals. The potential for these outcomes is minimized through the construction method and the implementation of the planned mitigation measures. Specifically, piles would be removed via vibratory means – an activity that does not have the potential to cause injury to marine mammals due to the relatively low source levels produced (less than 180 dB) and the lack of potentially injurious source characteristics – and, while impact pile driving produces short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks, only small diameter concrete piles are planned for impact driving. Predicted source levels for such impact driving events are significantly lower than those typical of impact driving of steel piles and/or larger diameter piles. In addition, implementation of soft start and shutdown zones significantly reduces any possibility of injury. Given sufficient "notice" through use of soft start (for impact driving), marine mammals are expected to move away from a sound source that is annoying prior to its becoming potentially injurious. Environmental conditions in Sinclair Inlet are expected to generally be good, with calm sea states, although Sinclair Inlet waters may be more turbid than those further north in Puget Sound or in Hood Canal. Nevertheless, we expect conditions in Sinclair Inlet would allow a high marine mammal detection capability for the trained observers required, enabling a high rate of success in implementation of shutdowns to avoid injury, serious injury, or mortality. In addition, the topography of Sinclair Inlet should allow for placement of observers sufficient to detect cetaceans, should any occur (see Figure 1 of Appendix C in the Navy's application).

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). 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 reported injuries or mortality to marine mammals, and no known long-term adverse consequences from behavioral harassment. Repeated exposures of individuals to levels of sound that may cause Level B harassment are unlikely to result in hearing impairment or to significantly disrupt foraging behavior. 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 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 – which is not believed to provide any habitat of special significance – while the activity is occurring.

In summary, this negligible impact analysis is founded on the following factors: (1) the possibility of injury, serious injury, or mortality may reasonably be considered discountable; (2) the anticipated incidences of Level B harassment consist of, at worst, temporary modifications in behavior; (3) the absence of any significant habitat within the project area, including rookeries, significant haul-outs, or known areas or features of special significance for foraging or reproduction; (4) the presumed efficacy of the proposed mitigation measures in reducing the effects of the specified activity to the level of least practicable impact. In addition, neither of these stocks are listed under the ESA or considered depleted under the MMPA. 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 activity will have only short-term effects on individuals. The specified activity is not expected to impact rates of recruitment or survival and will therefore not result in population-level impacts.

Preliminary Determinations

The number of marine mammals actually incidentally harassed by the project will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity. However, we find that the number of potential takings proposed for authorization (by level B harassment only), which we consider to be a conservative, maximum estimate, is small relative to the relevant regional stock or population numbers, and that the effect of the activity will be mitigated to the level of least practicable impact through implementation of the mitigation and monitoring measures described previously. Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, we preliminarily find that the total taking from the activity will have a negligible impact on 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 this action. Therefore, we have preliminarily 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.

Endangered Species Act (ESA)

There are no ESA-listed marine mammals expected to occur in the action area. Therefore, the Navy has not requested authorization of the incidental take of ESA-listed species and no such authorization is proposed for issuance; therefore, no consultation under the ESA is required.

National Environmental Policy Act (NEPA)

The Navy has prepared a Draft Environmental Assessment (EA; Pier 6 Pile Replacement Naval Base Kitsap) in accordance with NEPA and the regulations published by the Council on Environmental Quality. We have posted it on the NMFS website (see SUPPLEMENTARY INFORMATION) concurrently with the publication of this proposed IHA. NMFS will independently evaluate the EA and determine whether or not to adopt it. We may prepare a separate NEPA analysis and incorporate relevant portions of the Navy's EA by reference. Information in the Navy's application, EA, and this notice collectively provide the environmental information related to proposed issuance of the IHA for public review and comment. We will review all comments submitted in response to this notice as we complete the NEPA process, including a decision of whether to sign a Finding of No Significant Impact (FONSI), prior to a final decision on the IHA request.

Proposed Authorization

As a result of these preliminary determinations, we propose to authorize the take of marine mammals incidental to the Navy's pier maintenance project, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: September 10, 2013.

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Helen M. Golde,

Deputy Director,

Office of Protected Resources,

National Marine Fisheries Service.

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