BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XD341

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Reconstruction 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 Port of Friday Harbor, WA (Port) for authorization to take marine mammals incidental to construction activities as part of a marina reconstruction project. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to the Port to incidentally take marine mammals, by Level B Harassment only, 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 the application should be addressed to Jolie Harrison, Supervisor, Incidental Take Program, 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: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted to the Internet at www.nmfs.noaa.gov/pr/permits/incidental.htm without change. 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.

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

SUPPLEMENTARY INFORMATION:

Availability

An electronic copy of the Port's application and supporting documents, as well as a list of the references cited in this document, may be obtained by visiting the Internet at: www.nmfs.noaa.gov/pr/permits/incidental.htm. In case of problems accessing these documents, please call the contact listed above (see FOR FURTHER INFORMATION CONTACT).

National Environmental Policy Act (NEPA)

We are preparing an Environmental Assessment (EA) in accordance with NEPA and the regulations published by the Council on Environmental Quality and will consider comments submitted in response to this notice as part of that process. The EA will be posted at the foregoing website once it is finalized.

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.

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 one year, pursuant to requirements and conditions contained within an IHA. The establishment of these prescriptions 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 [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]."

Summary of Request

On August 12, 2013, we received a request from the Port for authorization to take marine mammals incidental to pile driving and removal associated with the reconstruction of a marina at Friday Harbor, WA. The Port submitted revised versions of the request on February 28, 2014, June 4, 2014, and June 11, 2014, after which we deemed the application adequate and complete. The Port proposes to conduct in-water work that may incidentally harass marine mammals (i.e., pile driving and removal) during a portion of the in-water work window established to protect fish species. This IHA would be valid from September 1, 2014, through February 15, 2015. Please note that any general reference to pile driving in this document is intended to refer to both pile driving and removal.

The use of vibratory pile driving is expected to produce underwater sound at levels that have the potential to result in behavioral harassment of marine mammals. Species with the expected potential to be present during all or a portion of the in-water work window include the Steller sea lion (Eumetopias jubatus monteriensis), California sea lion (Zalophus californianus), harbor seal (Phoca vitulina richardii), Dall's porpoise (Phocoenoides dalli dalli), and harbor porpoise (Phocoena phocoena vomerina). These species may occur year-round in the vicinity of Friday Harbor, with the exception of the Steller and California sea lions, which are generally absent during summer. The Steller sea lion is present from fall to late spring (approximately October to May), while the California sea lion is generally absent only from approximately mid-June to August.

Description of the Specified Activity

Overview

The Port has determined that reconstruction of the marina is necessary due to the increasing age of the existing structures. Repair and replacement work is necessary in order to maintain the existing purpose of the marina, which provides access, permanent and short-term moorage and berthing opportunities, and marina support facilities to commercial and recreational boaters. A vibratory hammer would be used to extract existing timber piles. Broken and damaged pilings unable to be removed with the vibratory hammer may need to be removed with a clamshell bucket. All new piles would be driven with a vibratory hammer, to the extent possible. If vibratory driving is not effective for any given pile (i.e., due to substrate conditions), piles may be installed via confined drilling. No impact pile driving is proposed for this project. The Port does not plan to operate multiple pile driving rigs concurrently.

Dates and Duration

The allowable season for in-water work, including pile driving, in the vicinity of Friday Harbor is July 16 through February 15, a window established by the Washington Department of Fish and Wildlife in coordination with NMFS and the U.S. Fish and Wildlife Service to protect salmonid fish. The proposed action would occur only during a portion of that window, from September 1, 2014, through February 15, 2015. The Port expects to require three days for pile removal and a maximum of 29 days for pile installation, for a total of 32 days during this period.

Pile driving and removal may occur on any day during the specified period, only during daylight hours.

Specific Geographic Region

The Port of Friday Harbor Marina is located at Friday Harbor, WA, on the eastern shore of San Juan Island (see Figure 1-1 of the Port's application). Friday Harbor is approximately 111 km north of Seattle, WA and 52 km southeast of Victoria, BC. The Town of Friday Harbor is located directly adjacent to the marina. Please refer to the U.S. Navy's Marine Resource Assessment for the Pacific Northwest, which documents and describes the marine resources that occur in Navy operating areas of the Pacific Northwest, including Puget Sound (DoN, 2006), for additional information regarding physical and oceanographic characteristics of the region. The document is publicly available at www.navfac.navy.mil/products_and_services/ev/products_and_services/marine_resources/marine_resource_assessments.html (accessed June 16, 2014).

Detailed Description of Activities

The Friday Harbor Marina is an existing public marina providing water access to the adjacent Town of Friday Harbor. The marina includes approximately 500 vessel slips, of which up to 150 are available to visiting boaters. The marina, protected by a U.S. Army Corps of Engineers (USACE)-maintained floating breakwater to the north, provides both permanent and temporary vessel moorage for commercial and recreational vessels, a U.S. Customs office, fuel dock, and other amenities. The Washington State Department of Transportation (WSDOT) maintains the Friday Harbor Ferry Terminal just east of the marina.

The marina was built in the 1960s-70s and, due to increasing age of the existing structures, reconstruction work is necessary to maintain the existing purpose of the marina. The project will entail repair and replacement of portions of the existing floats, piles, and walkways. Specifically, the Port plans to replace existing dilapidated finger and main walkway floats, treated timber walers (i.e., structural beams typically mounted to floating docks), and a steel footbridge, and to repair certain existing treated timber piles and bracing and install some new floats. In addition, the Port plans to remove 95 creosote timber piles (diameters range from 12-20 inches) and replace these with 52 steel pipe piles (twenty at 16-in diameter and 32 at 24-in diameter). Only the latter portion of the specified activity (removal and installation of piles) carries the potential for incidental take of marine mammals, and is considered further in this document.

The Port plans to remove existing treated timber piles using vibratory extraction. This involves use of a vibratory hammer, which is suspended from a crane by a cable, attached to a derrick, and positioned on the top of a pile. The pile is then unseated from the sediments by engaging the hammer, creating a vibration that loosens the sediments binding the pile, and then slowly lifting up on the hammer with the aid of the crane. Once unseated, the crane will continue to raise the hammer and pull the pile from the sediment. Vibratory removal is anticipated to require approximately 10 to 15 minutes per pile. In the event that broken or damaged pilings occur and are not able to be completely removed via the vibratory hammer, a clamshell bucket may be used to direct pull the pile remnant. Removal via clamshell bucket is not expected to result in the potential for incidental take of marine mammals.

The Port plans to install new piles using a vibratory driver as well, to the extent possible. Vibratory installation of piles using the vibratory hammer operates in the same manner as vibratory extraction, except that the weight of the hammer presses the piling into the substrate as the vibration results in liquefaction of the sediment. In the event that difficult substrate conditions are encountered, piles would be installed through drilling techniques. Unlike naked drilling, this would be confined drilling within a steel casing. The steel pipe pile would be installed as far as possible using the vibratory driver. If a pile reaches refusal prior to reaching the required embedment depth, an augur would be placed within the steel pipe to augur material from within and below the pile until the desired embedment depth is reached. Because any drilling would take place within the steel casing, this technique is not expected to result in the harassment of marine mammals. Pile installation is expected to require approximately 20 to 60 minutes per pile, with two to four piles installed per day. Pile driving is therefore expected to require between 13-26 days depending on the actual production rate. No impact pile driving will occur as part of this project.

Description of Marine Mammals in the Area of the Specified Activity

There are 11 marine mammal species known to occur in the San Juan Islands region of Washington inland waters, including seven cetaceans and four pinnipeds. The harbor seal is a year-round resident in Washington waters, while the Steller sea lion and California sea lion are seasonally present. Dall's porpoises and harbor porpoises may also occur with year-round regularity in the San Juan Islands. Remaining species that could occur in the project area include the killer whale (Orcinus orca; both transient and resident ecotypes), humpback whale (Megaptera novaeangliae), gray whale (Eschrichtius robustus), and minke whale (Balaenoptera acutorostrata scammoni); the northern elephant seal (Mirounga angustirostris), and the Pacific white-sided dolphin (Lagenorhynchus obliquidens). While these latter six species could occur in the project area, we do not believe that such occurrence is sufficiently likely to present a reasonable likelihood of take incidental to the specified activity. For more detail, please see the

"Proposed Monitoring and Reporting" and "Estimated Take by Incidental Harassment" sections, later in this document.

We have reviewed the Port's detailed species descriptions, including life history information, for accuracy and completeness and refer the reader to Section 3 of the Port's application instead of reprinting the information here. Please also refer to NMFS' website (www.nmfs.noaa.gov/pr/species/mammals) for generalized species accounts and to the Navy's Marine Resource Assessment for the Pacific Northwest, which documents and describes the marine resources that occur in Navy operating areas of the Pacific Northwest, including the San Juan Islands (DoN, 2006). The document is publicly available at www.navfac.navy.mil/products_and_services/ev/products_and_services/marine_resources/marine_resource_assessments.html (accessed June 16, 2014).

Table 1 lists the 12 marine mammal stocks that could occur in the vicinity of Friday Harbor during the project timeframe and summarizes key information regarding stock status and abundance. Taxonomically, we follow Committee on Taxonomy (2014). Please see NMFS' Stock Assessment Reports (SAR), available at www.nmfs.noaa.gov/pr/sars, for more detailed accounts of these stocks' status and abundance. All stocks are addressed in the Pacific SARs (e.g., Carretta et al., 2013a), with the exception of the Steller sea lion and transient killer whale, which are treated in the Alaska SARs (e.g., Allen and Angliss, 2013a).

In the species accounts provided here, we offer a brief introduction to the species and relevant stock as well as available information regarding population trends and threats, and describe any information regarding local occurrence. We first briefly describe the occurrence of those species not expected to be affected by the Port's activity before providing additional information for those species for which incidental take is expected.

Species	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR[3]	Annual M/SI[4]	Relative occurrence in San Juan Islands; season of occurrence
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						
Gray whale	Eastern North Pacific	-; N	19,126 (0.071; 18,017; 2007)	558	127[13]	Seasonal to rare; more likely winter to spring
Family Balaenopteridae (rorquals)						
Humpback whale	California/Oregon/ Washington (CA/OR/WA)[6]	E/D; Y	1,918 (0.03; 1,855; 2011)	22[11]	≥5.5	Seasonal to rare with highest likelihood spring to fall
Minke whale	CA/OR/WA	-; N	478 (1.36; 202; 2008)	2	0	Seasonal; more likely spring to fall
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae						
Pacific white-sided dolphin	CA/OR/WA	-; N	26,930 (0.28; 21,406; 2008)	171	17.8	Rare but more likely summer and fall
Killer whale[5]	West coast transient[6,7]	-; N	243 (n/a; 2006)	2.4	0	Likely to rare
	Eastern North Pacific southern resident[6]	E/D; Y	85 (n/a; 2012)	0.14	0	Likely to rare
Family Phocoenidae (porpoises)						
Harbor porpoise	Washington inland waters[8]	-; N	10,682 (0.38; 7,841; 2003)	63	≥2.2	Likely to rare
Dall's porpoise	CA/OR/WA	-; N	42,000 (0.33; 32,106; 2008)	257	≥0.4	Likely to rare
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
California sea lion	U.S.	-; N	296,750 (n/a; 153,337; 2008)	9,200	≥431	Seasonal/common; not generally present in Jul
Steller sea lion	Eastern U.S.[6]	-; N[9]	63,160-78,198 (n/a; 57,966; 2008-11)[10]	1,552[12]	65.1	Seasonal; not generally present Jun-Sep
Family Phocidae (earless seals)						
Harbor seal	Washington inland waters[8]	-; N	14,612 (0.15; 12,844; 1999)	771	13.4	Common; Year-round resident
Northern elephant seal	California breeding	-; N	124,000 (n/a; 74,913; 2005)	4,382	≥10.4	Likely to rare

Table 1. Marine mammals potentially present in the vicinity of Friday Harbor

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR (see footnote 3) or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

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

[3]Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP).

[4]These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, subsistence hunting, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value. All values presented here are from the draft 2013 SARs (www.nmfs.noaa.gov/pr/sars/draft.htm).

[5]Transient and resident killer whales are considered unnamed subspecies.

[6]Abundance estimates (and resulting PBR values) for these stocks are new values presented in the draft 2013 SARs. This information was made available for public comment and is currently under review and therefore may be revised prior to finalizing the 2013 SARs. However, we consider this information to be the best available for use in this document.

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

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

[9]The eastern distinct population segment of the Steller sea lion, previously listed under the ESA as threatened, was delisted on December 4, 2013 (78 FR 66140; November 4, 2013). Because this stock is not below its OSP size and the level of direct human-caused mortality does not exceed PBR, this delisting action implies that the stock is no longer designated as depleted or as a strategic stock under the MMPA.

[10]Best abundance is calculated as the product of pup counts and a factor based on the birth rate, sex and age structure, and growth rate of the population. A range is presented because the extrapolation factor varies depending on the vital rate parameter resulting in the growth rate (i.e., high fecundity or low juvenile mortality).

[11]This stock is known to spend a portion of time outside the U.S. EEZ. Therefore, only a portion of the PBR presented here is allocated for U.S. waters. U.S. PBR allocation is half the total for humpback whales (11).

[12]PBR is calculated for the U.S. portion of the stock only (excluding animals in British Columbia) and assumes that the stock is not within its OSP. If we assume that the stock is within its OSP, PBR for the U.S. portion increases to 2,069.

[13]Includes annual Russian harvest of 123 whales.

Humpback whales were common in Washington inland waters prior to commercial whaling, but few sightings had been reported since that time until approximately the past decade (Scheffer and Slipp, 1948; www.orcanetwork.org). Opportunistic sightings have increased, and humpback whales now appear to occur in small numbers in the Strait of Juan de Fuca and San

Juan Islands but also occasionally in Puget Sound (Falcone et al., 2005), and are typically observed in spring and summer (April-July). This species is still considered to have rare occurrence in inland waters (more likely in warmer months), and is not expected to be present in all areas or to remain in any given location for extended periods of time.

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, and six to ten of these are individual whales that return most years to feeding sites 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).

Minke whales of the California, Oregon, and Washington stock appear to establish home ranges (e.g., Washington inland waters, central California; Dorsey et al., 1990), as opposed to more migratory minke whales in northern waters. Minke whales are reported in inland waters year-round, although the majority of the records are from March through November (Calambokidis and Baird, 1994), and are sighted primarily in the San Juan Islands and Strait of Juan de Fuca (www.orcanetwork.org). A majority of feeding observations in the San Juan Islands were over submarine slopes of moderate incline at depths of 20-100 m (Hoelzel et al., 1989).

Although a single species of killer whale is currently recognized, three recognizable forms (or ecotypes) are known in the North Pacific and killer whale taxonomy is unresolved. These three ecotypes, distinguished on the basis of social and foraging behavior (among other traits), include resident, transient, and offshore animals. Both resident and transient whales may occur in Washington inland waters, and seasonal movements tend to be correlated with prey availability.

Transient killer whales in the Pacific Northwest spend most of their time along the outer coast of British Columbia and Washington, but visit inland waters in search of harbor seals, sea lions, and other prey. Transients, which feed on marine mammals, may occur in inland waters in any month (www.orcanetwork.org), but several studies have shown peaks in occurrences. Stacey et al. (1990) found bimodal peaks in spring and fall for transients on the northeastern coast of British Columbia, while Baird and Dill (1995) found some transient groups frequenting the vicinity of harbor seal haul-out sites around southern Vancouver Island during August and September. However, not all transient groups were seasonal in these studies, and their movements appear to be unpredictable. The number of west coast transients in Washington inland waters at any one time is probably fewer than twenty individuals (Wiles, 2004), although occurrence in inland waters has increased in correlation with increasing abundance of some prey species (e.g., seals, sea lions, and porpoises) (Houghton et al., in prep). In the activity area, small groups of one to five individuals are sighted intermittently throughout the year.

Southern resident killer whales, which eat fish, are most frequently seen during the spring and summer months in the San Juan Islands region, with intermittent sightings in Puget Sound. During fall and early winter, this pattern reverses, with whales seen more frequently in Puget

Sound. During later winter months, residents spend more time in outer waters of the coast. The Friday Harbor Whale Museum keeps a database of verified marine mammal sightings (whale days) by location quadrants. Between 1990 and 2008, in the September to February window proposed for this project, an average of 3.2 killer whale sightings were annually reported for the project area. From 2009-2012, during the same timeframe, three reports of southern residents were recorded for Friday Harbor.

Pacific white-sided dolphins are known to enter the inshore passes of British Columbia and Washington, and have been encountered in the Strait of Juan de Fuca and the Strait of Georgia (Stacey and Baird, 1991; Norman et al., 2004). Small groups have also been seen in Haro Strait off San Juan Island. Pacific white-sided dolphins are considered as occasional visitors to the inland waters region and occurrence is considered rare.

Northern elephant seal breeding sites are located on beaches and islands in California and Mexico. After their winter breeding season and annual molt cycles, individuals typically disperse northward along the Oregon and Washington coasts and may be present typically on only a seasonal basis. However, a few individuals are now found in Washington inland waters year-round. Haul-out areas for elephant seals are not as predictable as for the other species of pinnipeds with more regular occurrence. A few individuals use beaches at Protection Island (46 km south of Friday Harbor) and Smith/Minor Islands (27 km south) (Jeffries et al., 2000). Typically these sites host only small numbers of animals.

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 (Loughlin et al., 1984). Based on distribution, population response, and 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 (DPS) 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 project area.

According to NMFS' recent status review (NMFS, 2013), the best available information indicates that the overall abundance of eastern DPS Steller sea lions has increased for a sustained period of at least three decades while pup production has also increased significantly, especially since the mid-1990s. Johnson and Gelatt (2012; in NMFS, 2013) provided an analysis of growth trends of the entire eastern DPS from 1979-2010, indicating that the stock increased during this period at an annual rate of 4.2 percent (90% CI 3.7-4.6). Most of the overall increase occurred in the northern portion of the range (southeast Alaska and British Columbia), but pup counts in Oregon and California also increased significantly (e.g., Merrick et al., 1992; Sease et al., 2001; Olesiuk and Trites, 2003; Fritz et al. 2008; Olesiuk, 2008; NMFS, 2008, 2013). In Washington, Pitcher et al. (2007) reported that Steller sea lions, presumably immature animals and non-breeding adults, regularly used four haul-outs, including two "major" haul-outs (>50 animals). The same study reported that the numbers of sea lions counted between 1989 and 2002 on Washington haul-outs increased significantly (average annual rate of 9.2 percent) (Pitcher et al., 2007). Although the stock size has increased, its status relative to OSP size is unknown. However, the consistent long-term estimated annual rate of increase may indicate that the stock is reaching OSP size (Allen and Angliss, 2013a).

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 an approximate total from all fisheries of 17 eastern Steller sea lions (Allen and Angliss, 2013a). In addition, opportunistic observations and stranding data indicate that an additional 32 animals are killed or seriously injured each year through interaction with commercial and recreational troll fisheries and by entanglement (Allen and Angliss, 2013b). The annual average take for subsistence harvest in Alaska was 11.9 individuals in 2004-08 (Allen and Angliss, 2013a). Data on community subsistence harvests is no longer being collected, and this average is retained as an estimate for current and future subsistence harvest. Sea lion deaths are also known to occur because of illegal shooting, vessel strikes, or capture in research gear and other traps, totaling 4.2 animals per year from 2007-11 (Allen and Angliss, 2013b). 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, 2013a) 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 2011, the minimum count for Steller sea lions in Washington was 1,749 (Allen and Angliss, 2013b), up from 516 in 2001 (Pitcher et al., 2007). 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). Haul-outs in the San Juan Islands include Green Point on Speiden Island (13 km northwest of Friday Harbor), North Peapod Rock (23 km northeast of Friday Harbor), Bird Rocks (19 km southeast of Friday Harbor), and Whale Rock (11 km south of Friday Harbor) (Jeffries et al., 2000).

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 (e.g., O'Corry-Crowe et al., 2003; Temte, 1986; Calambokidis et al., 1985; Kelly, 1981; Brown, 1988; Lamont, 1996; Burg, 1996). Harbor seals are generally non-migratory, and analysis of genetic information suggests that genetic differences increase with geographic distance (Westlake and O'Corry-Crowe, 2002). 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., 2013a). 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.

Recent genetic evidence suggests that harbor seals of Washington inland waters may have sufficient population structure to warrant division into multiple distinct stocks (Huber et al., 2010, 2012). Based on studies of pupping phenology, mitochondrial DNA, and microsatellite variation, Carretta et al. (2013b) suggest division of the Washington inland waters stock into three new populations, and present these as prospective stocks: (1) southern Puget Sound (south of the Tacoma Narrows Bridge); (2) Washington northern inland waters (including Puget Sound north of the Tacoma Narrows Bridge, the San Juan Islands, and the Strait of Juan de Fuca); and (3) Hood Canal. Until this stock structure is accepted, we consider a single Washington inland waters stock.

The best available abundance estimate was derived from aerial surveys of harbor seals in Washington 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 pooled correction factor (across three coastal and three inland sites) of 1.53 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 (see Table 1).

Harbor seal counts in Washington State increased at an annual rate of six percent from 1983-96, increasing to ten percent for the period 1991-96 (Jeffries et al., 1997). The population is thought to be stable, and the Washington inland waters stock is considered to be within its OSP size (Jeffries et al., 2003).

Data from 2007-11 indicate that a minimum of four harbor seals are killed annually in Washington inland waters commercial fisheries, while mean annual mortality for recreational fisheries is one seal (Carretta et al., 2013b). 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 8.4 harbor seals per year are estimated to be killed as a result of various non-fisheries human interactions (Carretta et al., 2013b). Tribal subsistence takes of this stock may occur, but no data on recent takes are available.

The nearest known haul-out sites to Friday Harbor are the intertidal rocks northeast of Point George on Shaw Island (approximately 4-5 km northeast of Friday Harbor; see Figure 1-3 of the Port's application). The level of use during the project timeframe is unknown, but would be expected to be less as air temperatures become colder than water temperatures in the fall and winter.

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, and (3-5) southern, central, and 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., 2013a). 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).

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., 2013a). The maximum population growth rate was 9.2 percent when pup counts from the El Niño years were removed. 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., 2013a).

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 (seventeen per year, 2008-10) or incidentally captured during scientific research (three per year, 2005-09) (Carretta et al., 2013a). Sea lion mortality has also been linked to the algal-produced neurotoxin domoic acid (Scholin et al., 2000). Future mortality may be expected to occur, due to the sporadic occurrence of such harmful algal blooms. There is currently an Unusual Mortality Event (UME) declaration in effect for California sea lions. 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. Findings to date indicate that a likely contributor to the large number of stranded, malnourished pups was a change in the availability of sea lion prey for nursing mothers, especially sardines. The causes and mechanisms of this UME remain under investigation (www.nmfs.noaa.gov/pr/health/mmume/californiasealions2013.htm; accessed May 8, 2014).

An estimated 3,000 to 5,000 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 (Jeffries et al., 2000) and return south the following spring (Mate, 1975; Bonnell et al., 1983). Peak numbers of up to 1,000 California sea lions occur in Puget Sound during this time period (Jeffries et al., 2000). The nearest documented California sea lion haul-out sites to Friday Harbor are intertidal rocks and reef areas around Trial Island and Race Rocks near Victoria, B.C. (approximately 24 km west of Friday Harbor). Small numbers of sea lions may occasionally haul-out on navigation buoys in the San Juan Islands (Jeffries et al., 2000).

Harbor Porpoise

Harbor porpoises are found primarily in inshore and relatively shallow coastal waters (< 100 m) from Point Barrow (Alaska) to Point Conception (California). Various genetic analyses and investigation of pollutant loads indicate a low mixing rate for harbor porpoises along the west coast of North America and likely fine-scale geographic structure along an almost continuous distribution from California to Alaska (e.g., Calambokidis and Barlow, 1991; Osmek et al., 1994; Chivers et al., 2002, 2007). However, stock boundaries are difficult to draw because any rigid line is generally arbitrary from a biological perspective. On the basis of genetic data and density discontinuities identified from aerial surveys, eight stocks have been identified in the eastern North Pacific, including northern Oregon/Washington coastal and inland Washington stocks (Carretta et al., 2013a). The Washington inland waters stock includes individuals found east of Cape Flattery and is the only stock that may occur in the project area.

Although long-term harbor porpoise sightings in southern Puget Sound declined from the 1940s through the 1990s, sightings and strandings have increased in Puget Sound in recent years and harbor porpoise are now considered to regularly occur year-round in these waters (Carretta et al., 2013a). Reasons for the apparent decline, as well as the apparent rebound, are unknown. Recent observations may represent a return to historical conditions, when harbor porpoises were considered one of the most common cetaceans in Puget Sound (Scheffer and Slipp, 1948). The status of harbor porpoises in Washington inland waters relative to OSP is not known (Carretta et al., 2013a).

Data from 2005-09 indicate that a minimum of 2.2 Washington inland waters harbor porpoises are killed annually in U.S. commercial fisheries (Carretta et al., 2013a). Animals captured in waters east of Cape Flattery are assumed to belong to this stock. This estimate is considered a minimum because the Washington Puget Sound Region salmon set/drift gillnet fishery has not been observed since 1994, and because of a lack of knowledge about the extent to which harbor porpoise from U.S. waters frequent the waters of British Columbia and are, therefore, subject to fishery-related mortality. However, harbor porpoise takes in the salmon drift gillnet fishery are unlikely to have increased since the fishery was last observed, when few interactions were recorded, due to reductions in the number of participating vessels and available fishing time. Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids (Carretta et al., 2013a). In addition, an estimated 0.4 animals per year are killed by non-fishery human causes (e.g., ship strike, entanglement). In 2006, a UME was declared for harbor porpoises throughout Oregon and Washington, and a total of 114 strandings were reported in 2006-07. The cause of the UME has not been determined and several factors, including contaminants, genetics, and environmental conditions, are still being investigated (Carretta et al., 2013a).

Harbor porpoises occur year-round and breed in the waters around the San Juan Archipelago and north into Canadian waters (Calambokidis and Baird, 1994). Little information exists on harbor porpoise occurrence in the project area, although it is suspected that in some areas harbor porpoises migrate seasonally.

Dall's Porpoise

Dall's porpoises are endemic to temperate waters of the North Pacific, typically in deeper waters between 30-62°N, and are found from northern Baja California to the northern Bering Sea. Stock structure for Dall's porpoises is not well known; because there are no cooperative management agreements with Mexico or Canada for fisheries which may take this species, Dall's porpoises are divided for management purposes into two discrete, noncontiguous areas: (1) waters off California, Oregon, and Washington, and (2) Alaskan waters (Carretta et al., 2013a). Only individuals from the CA/OR/WA stock may occur within the project area.

Data from 2002-08, from all fisheries for which mortality data are available, indicate that a minimum of 0.4 animals are killed per year (Carretta et al., 2013a). Species-specific information is not available for Mexican fisheries, which could be an additional source of mortality for animals beyond the stock boundaries delineated for management purposes. No other sources of human-caused mortality are known.

Dall's porpoise distribution on the U.S. west coast is highly variable between years and appears to be affected by oceanographic conditions (Forney and Barlow, 1998); animals may spend more or less time outside of U.S. waters as oceanographic conditions change. Because distribution and abundance of this stock is so variable, population trends are not available (Carretta et al., 2013a). In Washington, Dall's porpoises are most abundant in offshore waters where they are year-round residents, although interannual distribution is highly variable (Green et al., 1992). In inland waters, Dall's porpoises are most frequently observed in the Strait of Juan de Fuca and Haro Strait between San Juan Island and Vancouver Island (Nysewander et al., 2005).

Potential Effects of the Specified Activity on Marine Mammals

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals. This discussion also includes reactions that we consider to rise to the level of a take and those that we do not consider to rise to the level of a take (for example, with acoustics, we may include a discussion of studies that showed animals not reacting at all to sound or exhibiting barely measurable avoidance). This section is intended as a background of potential effects and does not consider either the specific manner in which this activity will be carried out or the mitigation that will be implemented, and how either of those will shape the anticipated impacts from this specific activity. The "Estimated Take by Incidental Harassment" section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The "Negligible Impact Analysis" section will include the analysis of how this specific activity will impact marine mammals and will consider the content of this section, the "Estimated Take by Incidental Harassment" section, the "Proposed Mitigation" section, and the "Anticipated Effects on Marine Mammal Habitat" section to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals and from that on the affected marine mammal populations or stocks. In the following discussion, we provide general background information on sound and marine mammal hearing before considering potential effects to marine mammals from sound produced by vibratory pile driving.

Description of Sound Sources

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). It 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). 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. Note that all underwater sound levels in this document are referenced to a pressure of 1 μPa and all airborne sound levels in this document are referenced to a pressure of 20 μPa.

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.

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.

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 noise 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 noise 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 noise at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times.

- Biological: Marine mammals can contribute significantly to ambient noise 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 noise 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 noise typically dominates the total ambient noise 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 (Richardson et al., 1995). 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.

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 only known available in-water background noise data in the San Juan Islands area was collected on the west side of San Juan Island (approximately 10 km west of Friday Harbor), as part of the Orcasound in-water monitoring study. Data were collected between April 2004 and November 2005, with average daytime in-water noise levels during the summer (July-Aug) and non-summer (Oct-Apr) measured at 118 and 116 dB rms, respectively (Veirs and Veirs, 2005). Known sound levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 2. Details of the source types are described in the following text.

Sound source	Frequency range (Hz)	Underwater sound level	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 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 (CISS) pile	10-1,500	195 dB rms at 10 m	Reviewed in Hastings and Popper, 2005

Table 2. Representative sound levels of anthropogenic sources

In-water construction activities associated with the project would include vibratory pile driving and removal. The sounds produced by these activities fall into the latter of two general sound types: impulse and continuous (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g., Ward, 1997 in Southall et al., 2007). Please see Southall et al., (2007) for an in-depth discussion of these concepts.

Pulsed sound sources (e.g., explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986; 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 (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push them into the sediment. 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).

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals. To appropriately assess 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 (e.g., Richardson et al., 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall et al. (2007) recommended that marine mammals be divided into functional hearing groups based on 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; Watkins, 1986; 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; now considered to include two members of the genus Lagenorhynchus on the basis of recent echolocation data and genetic data [May-Collado and

Agnarsson, 2006; Kyhn et al. 2009, 2010; Tougaard et al. 2010]): 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 (Hemilä et al., 2006; Kastelein et al., 2009; Reichmuth et al., 2013).

There are five marine mammal species (two cetacean and three pinniped [two otariid and one phocid] species) with expected potential to co-occur with Port construction activities. Please refer to Table 1. The two cetacean species that may be present are classified as high-frequency.

Acoustic Effects, Underwater

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., 2004; 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 would be expected to 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 from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton et al., 1973).

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 constitutes injury, but TTS does not (Southall et al., 2007). 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 p-p [peak]) in order to produce brief, mild TTS. Exposure to several strong pulses that each have received levels near 190 dB 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.

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). 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 a sound source can incur TTS, it is possible that some individuals 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, based on anatomical similarities. 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 rms. 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, 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 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 continuous sound, 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). Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance (Thorson and Reyff, 2006).

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 cause 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 anthropogenic, 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 only 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 the population or community 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.

Vibratory pile driving is relatively short-term, with rapid oscillations occurring for approximately sixty minutes per installed pile. 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 pile driving, and which have already been taken into account in the exposure analysis.

Acoustic Effects, Airborne

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 either hauled-out or looking with heads above water in the project area. 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 Friday Harbor would not result in permanent impacts to habitats used directly by marine mammals, such as haul-out sites, and is unlikely to have even short-term impacts to food sources such as forage fish as impact driving is not proposed for this project. There are no rookeries or major haul-out sites nearby (there are rocks used by harbor seals as haul-outs within the acoustic zone of influence, approximately 5 km from the project site) or ocean bottom structure of significant biological importance to marine mammals that may be present in the marine waters in the vicinity of the project area. Therefore, the main impact 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 minor impacts to the immediate substrate during installation and removal of piles during the project.

Potential Pile Driving Effects on Prey

Construction activities would produce 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) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (e.g., Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). Sound pulses at received levels of 160 dB 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 and lack of impact pile driving.

Pile Driving Effects on Potential Foraging Habitat

The area likely impacted by the project is relatively small compared to the available habitat in the San Juan Islands. 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.

In summary, given the short daily duration of sound associated with individual pile driving events, the relatively small areas being affected, and the absence of impact pile driving, 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. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS 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.

Measurements from similar pile driving events were coupled with practical spreading loss to estimate zones of influence (ZOI; see "Estimated Take by Incidental Harassment"). ZOIs are often used to establish a mitigation zone around each pile to prevent Level A harassment to marine mammals, and also provide estimates of the areas within which Level B harassment might occur. ZOIs may vary between different diameter piles and types of installation methods. In addition to the measures described later in this section, the Port would employ the following standard mitigation measures:

(a) Conduct briefings between construction supervisors and crews, marine mammal monitoring team, and Port 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.

(b) For in-water heavy machinery work other than pile driving (using, e.g., standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), if a marine mammal comes within 10 m, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions. This type of work could include the following activities: (1) movement of the barge to the pile location; (2) positioning of the pile on the substrate via a crane (i.e., stabbing the pile); or (3) removal of the pile from the water column/substrate via a crane (i.e., deadpull). For these activities, monitoring would take place from 15 minutes prior to initiation until the action is complete.

Monitoring and Shutdown for Pile Driving

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

Shutdown Zone – For all pile driving activities, the Port will establish a shutdown zone. Shutdown zones are intended to contain the area in which SPLs equal or exceed the 180/190 dB rms acoustic injury criteria, with the purpose being 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 of marine mammals. However, the Port's activities are not expected to produce sound at or above the 180 dB rms injury criterion (see "Estimated Take by Incidental Harassment"). The Port would, however, implement a minimum shutdown zone of 10 m radius for all marine mammals around all pile driving and removal activity. These precautionary measures are intended to further reduce the unlikely possibility of injury from direct physical interaction with construction operations.

Disturbance Zone – Disturbance zones are the areas in which SPLs equal or exceed 120 dB rms (for continuous sound) for pile driving installation and removal. 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. Given the size of the disturbance zone for vibratory pile driving, it is impossible to guarantee that all animals would be observed or to make comprehensive observations of fine-scale behavioral reactions to sound. We discuss monitoring objectives and protocols in greater depth in "Proposed Monitoring and Reporting."

In order to document observed incidents 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 and the estimated ZOIs for relevant activities (i.e., pile installation and removal). 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 and removal activities. In addition, observers shall record all incidents 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. Monitoring will take place from fifteen minutes prior to initiation through thirty 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 thirty minutes. Please see the Marine Mammal Monitoring Plan (available at www.nmfs.noaa.gov/pr/permits/incidental.htm), developed by the Port with our approval, for full details of the monitoring protocols.

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 or related field (undergraduate degree or higher 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 fifteen minutes to ensure that it is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals; animals will be allowed to remain in the shutdown zone (i.e., must leave of their own volition) and their behavior will be monitored and documented. The shutdown zone may only be declared clear, and pile driving started, when the entire shutdown zone is visible (i.e., when not obscured by dark, rain,

fog, etc.). In addition, if such conditions should arise during impact pile driving that is already underway, the activity would be halted.

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

Timing Restrictions

In the San Juan Islands, designated timing restrictions exist for pile driving activities to avoid in-water work when salmonids are likely to be present. The in-water work window is July 16-February 15, although work will not begin prior to September 1. In-water construction activities will occur 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 thirty-second waiting period. This procedure is repeated two additional times.

We have carefully evaluated the Port’s proposed mitigation measures and considered their effectiveness in past implementation to preliminarily determine whether they are likely to effect 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.

Any mitigation measure(s) we prescribe should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal).

(2) A reduction in the number (total number or number at biologically important time or location) of individual marine mammals exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(3) A reduction in the number (total number or number at biologically important time or location) of times any individual marine mammal would be exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(4) A reduction in the intensity of exposure to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing the severity of behavioral harassment only).

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying particular attention to the prey base, blockage or limitation of passage to or from biologically important areas, permanent destruction of habitat, or temporary disturbance of habitat during a biologically important time.

(6) For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the Port's proposed measures, including information from monitoring of implementation of mitigation measures very similar to those described here under previous IHAs for other similar projects in Washington inland waters, including work conducted at Friday Harbor by the Washington State Department of Transportation, 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 IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking". The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations 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.

Any monitoring requirement we prescribe should improve our understanding of one or more of the following:

- Occurrence of marine mammal species in action area (e.g., presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (e.g., source

characterization, propagation, ambient noise); (2) Affected species (e.g., life history, dive patterns); (3) Co-occurrence of marine mammal species with the action; or (4) Biological or behavioral context of exposure (e.g., age, calving or feeding areas).

- Individual responses to acute stressors, or impacts of chronic exposures (behavioral or physiological).
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of an individual; or (2) Population, species, or stock.
- Effects on marine mammal habitat and resultant impacts to marine mammals.
- Mitigation and monitoring effectiveness.

The Port submitted a marine mammal monitoring plan as part of the IHA application for this project, which can be found on the Internet at www.nmfs.noaa.gov/pr/permits/incidental.htm. Although this plan was initially developed as part of the ESA consultation process (with NMFS' West Coast Regional Office) to enable the Port to cease activities in the event that ESA-listed species occur in the project vicinity, the plan is applicable to all marine mammals that may occur in the action area. The plan may be modified or supplemented based on comments or new information received from the public during the public comment period.

Visual Marine Mammal Observations

The Port 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 Port will monitor the shutdown zone and disturbance zone before, during, and after pile driving and removal, with observers located at the best practicable vantage points. Based on our requirements, the Marine Mammal Monitoring Plan 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 vibratory driving, a minimum of four MMOs will be deployed, including two shore-based (with one of these located appropriately to focus on the shutdown zone) and two vessel-based. Please see Figure 2 of the Port's plan. During vibratory removal, a minimum of three observers shall be deployed at the best vantage points to observe the shutdown and disturbance zones.
- 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.
- 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.

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 Port.

Although we have determined that incidental take of multiple species with recorded occurrence in the action area (e.g., killer whales, humpback whales) is unlikely (see "Estimated Take by Incidental Harassment"), the Port's monitoring plan will provide additional protections against the unauthorized take of these species. While it is difficult to say with certainty that smaller cetaceans or pinnipeds would always be detected in an area as large as the typical ZOI for vibratory driving (in this case estimated at 6.7 km^2), we do believe that there is a high degree of certainty that large whales would be detected. Therefore, in the event that humpback whales, gray whales, minke whales, or killer whales occurred in the project area, the Port would be able to detect those animals and cease construction activity as necessary to avoid unauthorized take. The Port will also consult available sighting networks (e.g., Orca Network) on a daily basis while pile installation and removal is occurring for situational awareness of large whale occurrence in the general vicinity of Friday Harbor, such that MMOs know when there is the increased possibility for such species to be present.

Data Collection

We require that observers use approved data forms. Among other pieces of information, the Port 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 Port will attempt to distinguish between the number of individual animals taken and the number of incidents 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 distance from pile driving activity;
- 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.

Reporting

A draft report would be submitted within ninety calendar days of the completion of the in-water work window. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days, and will also provide descriptions of any problems encountered in deploying sound attenuating devices, any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within thirty days following resolution of comments on the draft report.

Estimated Take by Incidental Harassment

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

All anticipated takes would be by Level B harassment resulting from vibratory pile driving/removal and involving temporary changes in behavior. Injurious or lethal takes are not expected due to the expected source levels and sound source characteristics associated with the activity, and the proposed mitigation and monitoring measures are expected to further minimize the possibility of such take.

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 (e.g., 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 because 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, especially if those individuals display some degree of residency or site fidelity and the impetus to use the site (e.g., because of foraging opportunities) is stronger than the deterrence presented by the harassing activity.

The project area is not believed to be particularly important habitat for marine mammals, nor is it considered an area frequented by marine mammals. 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. Specifically, at Friday Harbor marina there is a known individual harbor seal that the Port believes is unlikely to respond to harassing stimuli in aversive manner, meaning the seal is believed likely to simply remain in the immediate vicinity of the marina and be exposed to sound (either airborne or underwater) at or above levels that we consider to incur incidental take. This is accounted for in estimating incidental take for harbor seals below.

The Port has requested authorization for the incidental taking of small numbers of Steller sea lions, California sea lions, harbor seals, Dall's porpoises, and harbor porpoises near Friday Harbor that may result from pile driving during construction activities associated with the marina reconstruction project described previously in this document. In order to estimate the potential incidents of take that may occur incidental to the specified activity, we must first estimate the extent of the sound field that may be produced by the activity and then consider in combination with information about marine mammal density or abundance in the project area. We first provide information on applicable sound thresholds for determining effects to marine mammals before describing the information used in estimating the sound fields, the available marine mammal density or abundance information, and the method of estimating potential incidences of take.

Sound Thresholds

We use generic sound exposure thresholds to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by harassment might occur. To date, no studies have been conducted that explicitly examine impacts to marine mammals from pile driving sounds or from which empirical sound thresholds have been established. These thresholds (Table 3) are used to estimate when harassment may occur (i.e., when an animal is exposed to levels equal to or exceeding the relevant criterion) in specific contexts; however, useful contextual information that may inform our assessment of effects is typically lacking and we consider these thresholds as step functions. NMFS is working to revise these acoustic guidelines; for more information on that process, please visit www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.

Criterion	Definition	Threshold
Level A harassment (underwater)	Injury (PTS – any level above that which is known to cause TTS)	180 dB (cetaceans) / 190 dB (pinnipeds) (rms)
Level B harassment (underwater)	Behavioral disruption	160 dB (impulsive source) / 120 dB (continuous source) (rms)
Level B harassment (airborne)*	Behavioral disruption	90 dB (harbor seals) / 100 dB (other pinnipeds) (unweighted)

*NMFS has not established any formal criteria for harassment resulting from exposure to airborne sound. However, these thresholds represent the best available information regarding the effects of pinniped exposure to such sound and NMFS' practice is to associate exposure at these levels with Level B harassment.

Table 3. Current acoustic exposure criteria

Distance to Sound Thresholds

Underwater Sound Propagation Formula – Pile driving generates underwater noise that can potentially result in disturbance to marine mammals in the project area. Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

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

R_1 = the distance of the modeled SPL from the driven pile, and

R_2 = the distance from the driven pile of the initial measurement.

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

Underwater Sound – 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. A large quantity of literature regarding SPLs recorded from pile driving projects is available for consideration. In order to determine reasonable SPLs and their associated effects on marine mammals that are likely to result from pile driving at Friday Harbor, studies with similar properties to the specified activity were evaluated. The Port plans to install 16- and 24-in steel pipe piles via vibratory driver and to remove 12- and 20-in timber piles, as well as several 12-in steel pipe piles, via vibratory methods. We rely on measurement conducted previously by WSDOT for similar activities in similar locations for proxy source levels. Data were collected during vibratory pile driving of 24-in diameter steel piles at the Friday Harbor Ferry Terminal (immediately adjacent to the Friday Harbor marina) facility during January 2005 (Laughlin, 2010). The average SPL was measured as 162 dB rms at 10 m from the pile. For comparison, Caltrans (2012) reports summary values of 155 dB rms and 170 dB rms (at 10 m distance from source) for 12- and 36-in steel pipe piles, respectively. They do not report a value for 24-in diameter steel pipe piles. The vibratory removal of 12-in timber piles was measured at the Port Townsend Ferry Terminal during December 2010, with an average SPL of 150 dB rms recorded at 16 m from the source (Laughlin, 2011). This is the only measurement we are aware of for vibratory pile removal and, although the 20-in diameter piles to be removed by the Port are larger, it is not expected that a slightly larger pile size would result in meaningfully greater SPLs for vibratory pile removal. Vibratory pile removal involves only very brief vibration of the pile to be removed such that liquefaction of the surrounding substrate is achieved. Pile size is not a critical factor here.

All calculated distances to and the total area encompassed by the 120-dB marine mammal sound threshold for the two activities are provided in Table 4. The Port used source values of 177 dB rms for vibratory driving and 168 dB rms for vibratory removal. Because these values are below the 180/190 dB rms injury criteria, there are no zones within which injury would be expected to occur as a result of exposure to underwater sound. Please see also Figure 1-3 of the Port's application for a spatial representation of these zones in relation to local topography, which constrains the actual sound field from reaching the estimated radial distance to threshold for vibratory driving, and in certain directions for vibratory removal. The maximum line of sight distance that may be reached from the Friday Harbor marina before encountering land is approximately 4 km.

Threshold	Distance[1]	Area
Vibratory driving, disturbance (120 dB)	6.3 km	6.7 km^2
Vibratory removal, disturbance (120 dB)	1.6 km	1.8 km^2

Table 4. Calculated distance(s) to and area encompassed by underwater marine mammal sound thresholds during pile installation

[1]Radial distances presented for reference only. Maximum line of sight distance from Friday Harbor before encountering land is approximately 4 km. Please refer to Figure 1-3 in the Port's application.

Airborne Sound – Pile driving can generate airborne sound that could potentially result in disturbance to marine mammals (specifically, pinnipeds) that are hauled out or at the water's surface with heads above the water (see Table 3). The Port has estimated that airborne noise produced by vibratory pile driving might attenuate to 90 dB rms (unweighted) within approximately 30 m. However, because there are no regular haul-outs within such a small area around the site of proposed pile driving activity, we believe that incidents of incidental take resulting solely from airborne sound are unlikely. It is possible that a pinniped could occur within that zone, either in water or hauled out on some structure, and thereby be exposed to levels of airborne sound that we associate with harassment, but any such happenstance occurrence would likely be accounted for in our estimation of incidental take from underwater sound. The one exception is the known individual harbor seal that tends to remain at the marina. There is the potential for this individual animal to remain hauled out during construction activity, and therefore be exposed solely to airborne sound. We have accounted specifically for this individual, but do not propose to authorize any take of marine mammals due solely to airborne sound, while recognizing that pinnipeds occurring within this estimated 30-m radius zone could experience harassment as a result of either airborne or underwater sound. See the following discussion on harbor seals for more detail.

In summary, we recognize that pinnipeds within the estimated airborne harassment zone, whether in the water or hauled out, could be exposed to airborne sound that may result in behavioral harassment. However, any animal exposed to airborne sound above the behavioral harassment threshold is likely to also be exposed to underwater sound above relevant thresholds (which are in all cases larger zones than those associated with airborne sound). Thus, the behavioral harassment of these animals is already accounted for in these estimates of potential take. Multiple incidents of exposure to sound above NMFS' thresholds for behavioral harassment are not believed to result in increased behavioral disturbance, in either nature or intensity of disturbance reaction. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here.

Marine Mammal Densities

The Navy has developed, with input from regional marine mammal experts, estimates of marine mammal densities in Washington inland waters for the Navy Marine Species Density Database (NMSDD). A technical report (Hanser et al., 2014) describes methodologies and available information used to derive these densities, which are generally considered the best available information for Washington inland waters, except where specific local abundance information is available. Here, we have determined that for all species with potential occurrence at Friday Harbor, the Navy NMSDD information represents the best available information for the take estimation described here. We briefly describe the information used, but see Hanser et al. (2014) for more detail. That document is publicly available on the Internet at http://nwtteis.com/DocumentsandReferences/NWTTDocuments/SupportingTechnicalDocuments

.aspx (accessed June 20, 2014). These density estimates are primarily derived from available literature, except as described below.

Description of Take Calculation

The take calculations presented here rely on the best data currently available for marine mammal populations in the San Juan Islands. The formula is founded on the following assumptions:

- An individual can only be taken once during a 24-hour period;
- There were will be 26 total days of vibratory pile driving with a ZOI of 6.7 km^2 and three total days of vibratory pile removal with a ZOI of 1.8 km^2; and,
- 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 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 estimated using the relevant distances in Table 4, taking into consideration the possible affected area due to topographical constraints of the action area (i.e., radial distances to thresholds are not always reached). There are a number of reasons why estimates of potential incidents of take may be conservative, assuming that available density or abundance estimates and estimated ZOI areas are accurate. We assume, in the absence of information supporting a more refined conclusion, that the output of the calculation represents the number of individuals that may be taken by the specified activity. In fact, in the context of stationary activities such as pile driving and in areas where resident animals may be present, this number more realistically represents the number of incidents of take that may accrue to a smaller number of individuals. While pile driving can occur any day throughout the in-water work window, 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 potential effectiveness of mitigation measures in reducing the number of takes is typically not quantified in the take estimation process. For these reasons, these take estimates may be conservative. See Table 5 for total estimated incidents of take. Note that we also provide information below for those species with recorded occurrence in the vicinity, but for which we do not propose to authorize take (e.g., minke whale), in order to show the basis for our determination.

California Sea Lion – Jeffries et al. (2003) split the inland waters geographic area into seven regions, including the San Juan Islands. The Navy used this regional stratification as the basis for deriving density estimates for pinnipeds occurring in inland waters. For California sea lions, the Navy merged two regions (San Juan Islands and Strait of Juan de Fuca) and determined the number of animals known to use haul-outs in the combined stratum. The total number of expected California sea lions was then divided by the area of the stratum give a total, non-seasonal density. California sea lions are not generally present in July (outside the work period for this proposed action).

Steller Sea Lion – Similarly, a combined San Juan Islands/Strait of Juan de Fuca stratum was defined for Steller sea lions. The number of animals known to use haul-outs in the stratum was then determined and divided by the area to derive a non-seasonal density. However, Steller sea lions are not generally present from June-September (only September is within the work period for this proposed action).

Harbor Seal – The Navy's methodology for harbor seals follows that described in Jeffries et al. (2003). The authors conducted aerial surveys of harbor seals in 1999 for the Washington Department of Fish and Wildlife, dividing the survey areas into seven strata (including five in inland waters and two in coastal waters). To account for animals in the water and not observed during survey counts, a correction factor of 1.53 was applied (Huber et al., 2001) to derive a total population for each stratum (including the San Juan Islands). The correction factor (1.53) was based on the proportion of time seals spend on land versus in the water over the course of a day, and was derived by dividing one by the percentage of time harbor seals spent on land. These data came from tags (VHF transmitters) applied to harbor seals at six areas (Grays Harbor, Tillamook Bay, Umpqua River, Gertrude Island, Protection/Smith Islands, and Boundary Bay, BC) within two different harbor seal stocks (the coastal stock and the Washington inland waters stock) over four survey years. Although the sampling areas included both coastal and inland waters, with pooled correction factors of 1.50 and 1.57, respectively, Huber et al. (2001) found no significant difference in the proportion of seals ashore among the six sites and no interannual variation at one site studied across years. Therefore, we retain the total pooled correction factor of 1.53 here in determining a non-seasonal density estimate for the San Juan Islands stratum.

However, to determine an instantaneous in-water density estimate, a secondary correction may be applied to account for harbor seals that are hauled out at any given moment. The tagging research in 1991 and 1992 conducted by Huber et al. (2001) was repeated for two sites by Jeffries et al. (2003), using the same methods for the 1999 and 2000 survey years. These surveys indicated that approximately 35 percent of harbor seals are in the water versus hauled out on a daily basis (Huber et al., 2001; Jeffries et al., 2003). A corrected density can then be derived from the number of harbor seals that are present in the water at any one time. In this instance, we have chosen (in consultation with the Port) to retain the larger, uncorrected density as a precautionary measure.

Harbor Porpoise – NMFS conducted aerial line-transect surveys in 2002 and 2003 for the purpose of estimating harbor porpoise abundance off the coasts of Oregon, Washington, and southern British Columbia, as well as portions of the inland waters. Survey effort was limited to sea state conditions of Beaufort 0-2 and cloud cover less than 25 percent. In the inland waters, the surveys covered Washington and British Columbian waters in the Strait of Juan de Fuca, San Juan Islands, Gulf Islands, and Strait of Georgia. To estimate the total average number of animals sighted in each region, the number of sightings of each species was multiplied by the average group size. For harbor porpoise, estimates of mean group size were available on a region-specific basis for each year. Based on the average density estimates, weighted averages were derived to provide separate density estimates for the eastern portion of the Strait of Juan de Fuca and San Juan Islands region.

Dall's Porpoise – The same aerial surveys described above for harbor porpoise were used to determine density estimates for other cetacean species, including Dall's porpoise. For these other species, data from the 2002-2003 surveys were prorated relative to harbor porpoise. The number of Dall's porpoise sightings from these surveys was sufficient to derive separate density estimates for the eastern portion of the Strait of Juan de Fuca and San Juan Islands region.

Killer Whale – Both southern resident and west coast transient killer whales are known to occur in the San Juan Islands. For resident whales, photo-identification of individual whales has yielded a robust understanding of stock structure, behavior, and movement in inland waters. The Navy used average pod-specific seasonal residency patterns in concert with sightings data to produce density estimates for each of four seasons. For transient whales, monthly occurrence data were used in concert with an estimate of average group size to produce seasonal density estimates. For more detail on these density estimates, please see Hanser et al. (2014). All density estimates for Washington inland waters are presented as the results of spatial models with various values throughout the spatial range. The numbers presented here are the season- and range-specific maxima. For resident whales, density in the San Juan Islands ranges from 0.0007 (winter) to 0.02 whales/km^2 (spring through fall). For transient whales, density in the San Juan Islands varies from 0.0006 whales/km^2 in winter to 0.006 in summer and 0.003 whales/km^2 in spring/fall. For purposes of estimating the potential for incidental take, we have used the largest density values, which have led us to conclude that incidental take of killer whales is unlikely. However, it is important to note the even lower potential for occurrence in winter, when approximately half of the project would occur.

Minke whale – Although minke whales are known to establish home ranges in inland waters of Washington (Dorsey, 1983; Dorsey et al., 1990), there are no published density estimates for inland waters. The same aerial surveys described above for harbor and Dall's porpoises did not produce sufficient sightings to derive regionally-stratified estimates of abundance, so a single year-round density estimate was calculated for the Strait of Juan de Fuca and San Juan Islands region. This estimate (0.02 whales/km^2) is similar to that derived by Williams and Thomas (2007) for other inshore waters (Strait of Georgia; 0.01 whales/km^2).

Gray whale – Carretta et al. (2000) provided an overall west coast density estimate for migrating gray whales (January-April) of 0.051 whales/km^2. The Navy then further assumes that, on the basis of sightings data available from Orca Network (www.orcanetwork.org), during the winter-spring migration period approximately ten percent of migrating whales may enter the Strait of Juan de Fuca and San Juan Islands (0.0051 whales/km^2). During the summer/fall, when migratory gray whales are not present, the Navy assumes that thirty percent of the Pacific Coast Feeding Group (not discussed here but please see Carretta et al. [2013a]) may occur within the Strait of Juan de Fuca and San Juan Islands, also on the basis of information available through Orca Network (0.00014 whales/km^2). As for killer whales, we use the higher density to estimate the potential for incidental take, but note the lower likelihood of occurrence during a large portion of the work period.

Humpback whale – No published density estimates are available for humpback whales in Washington inland waters although opportunistic sightings have increased over the last decade (as reported through Orca Network). Based on line-transect abundance estimates for offshore waters of Oregon and Washington (Barlow and Forney, 2007), and consideration of opportunistic sightings recorded by the Orca Network, the Navy assumed that the abundance estimate of humpback whales occurring within the Strait of Juan de Fuca and the San Juan Islands area would be twenty percent of the offshore estimates. This assumption results in values of 0.00014 whales/km^2 (spring through fall) and 0.00002 whales/km^2 (winter). We note that although the higher estimate was used to estimate the potential for incidental take, there is a lower likelihood of occurrence during half of the work period.

Pacific white-sided dolphin – Pacific white-sided dolphins are known to enter the inshore passes of British Columbia and Washington (Norman et al., 2004; Stacey and Baird, 1991) and small groups have also been seen in Haro Strait off San Juan Island, but published density estimates are not available for these inland waters. Based on line-transect abundance estimates for offshore waters of Oregon and Washington (Barlow and Forney, 2007), and consideration of opportunistic sightings recorded by the Orca Network, the Navy assumed that the abundance estimate of Pacific white-sided dolphins occurring within the Strait of Juan de Fuca and the San Juan Islands area during summer/fall would be ten percent of that produced for offshore waters (0.00248 animals/km^2). Abundance is expected to decrease in winter/spring, and density estimates were reduced by an order of magnitude for this period (i.e., 0.00025 dolphins/km^2). We note that although the higher estimate was used to estimate the potential for incidental take, there is a lower likelihood of occurrence during half of the work period.

Northern elephant seal – The Navy used a combined Strait of Juan de Fuca and San Juan Islands regional stratum and the number of animals known to use haul-outs in that region to derive a non-seasonal density estimate for elephant seals.

As described in the introduction to this section, we evaluate the potential for incidental take to occur by first multiplying the most appropriate species- and season-specific density estimate by the relevant area of effect (ZOI). Those areas are estimated as 1.8 and 6.7 km^2 for vibratory pile removal and vibratory pile installation, respectively. The product of that calculation is then rounded to the nearest whole number to estimate an instantaneous abundance within the relevant ZOI, which is then multiplied by the number of days of the relevant activity (three and 26 for pile removal and installation, respectively) to arrive at an activity-specific estimate of potential incidents of incidental take. For all species, we have used the highest available density estimate (for either fall or winter when seasonal estimates are available) to evaluate the potential for incidental take. Table 5 summarizes the density estimates described above, the interim products of the calculation, and sums to the total proposed take authorization for each species. We have provided information for all species that may occur in the San Juan islands, but take authorization is proposed for only a subset of these (i.e., California and Steller sea lions, harbor seal, and harbor and Dall's porpoises). For the remaining species, the take estimation process indicates that incidental take is unlikely. While we recognize that these species may nevertheless occur in the project area, we believe that the Port's monitoring plan further reduces the potential for any of these species (especially the large whales, which are relatively easy to detect and whose occurrence in the region may be noted on a daily basis through consultation with sighting networks such as Orca Network). Finally, we note that there is a single, known individual harbor seal that is not expected to react to stimuli with avoidance behavior. Therefore, we expect that there is the potential for this individual animal to remain present through each day of construction and have added 29 takes (one for each anticipated day of construction) to the total estimate for harbor seals. For reasons described previously in this document, no Level A takes would be expected (nor indicated through the take estimation process) and no takes occurring solely via exposure to airborne sound (with the potential exception of the known individual described here and previously). No take authorization is proposed for those species with a zero value in the right-hand column of Table 5, and no Level A takes or takes solely via airborne sound are proposed for authorization.

Species	n (animals/km^2)[1]	n * ZOI (vibratory pile removal)	Estimated Level B takes; vibratory removal	n * ZOI (vibratory pile installation)	Estimated Level B takes; vibratory installation	Total proposed authorized takes (% of total stock)
California sea lion	0.676	1.2	3	4.5	130	133 (0.04)
Steller sea lion	0.935	1.7	6	6.2	156	162 (0.3)
Harbor seal	3.1799	5.8	18	21.2	546	593[2] (4.1)

Harbor porpoise	2.11226	3.9	12	14.1	364	376 (3.5)
Dall's porpoise	0.39	0.7	3	2.6	78	81 (0.2)
Killer whale (transient)	0.00306 (fall)	0.01	0	0.02	0	0
Killer whale (resident)	0.02024 (fall)	0.04	0	0.1	0	0
Minke whale	0.02	0.04	0	0.1	0	0
Humpback whale	0.00014 (fall)	0.0003	0	0.001	0	0
Gray whale	0.0051 (winter)	0.01	0	0.03	0	0
Pacific white-sided dolphin	0.00248 (fall)	0.005	0	0.02	0	0
Northern elephant seal	0.0063	0.01	0	0.04	0	0

Table 5. Calculations for incidental take estimation

[1]Best available species- and season-specific density estimate, with season noted in parentheses where applicable.

[2]This value includes 29 additional incidents of take to account for the known individual seal expected to remain present at Friday Harbor during construction. See explanation above.

Analyses and Preliminary Determinations

Negligible Impact Analysis

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." A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through behavioral harassment, we consider other factors, such as the likely nature of any responses (e.g., intensity, duration), the context of any responses (e.g., critical reproductive time or location, migration), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, and effects on habitat.

Pile driving activities associated with the marina reconstruction 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. Potential takes could occur if individuals of these species are present in the ensonified zone when pile driving is happening.

No injury, serious injury, or mortality is anticipated given the methods of construction. Measures designed to minimize the possibility of injury to marine mammals (e.g., exclusion zones) further reduce any possibility of injury. Specifically, vibratory hammers are the sole method of installation, and this activity does not have significant potential to cause injury to marine mammals due to the relatively low source levels produced (expected to be less than 180 dB rms) and the lack of potentially injurious source characteristics. Impact pile driving produces short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks than does vibratory driving or removal. The likelihood that marine mammal detection ability by trained observers is high under the general environmental conditions expected for Friday Harbor, in concert with the very small shutdown zones – which are defined as a precautionary measure only, as expected source levels are below the relevant injury criteria – further enables the implementation of shutdowns to avoid any potential for injury.

Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from similar past projects, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). 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. In response to vibratory driving, harbor seals (which may be somewhat habituated to human activity along the Friday Harbor waterfront) have been observed to orient towards and sometimes move towards the sound. 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 an overall stock is unlikely to result in any significant realized decrease in fitness to those 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 project area while the activity is occurring.

For pinnipeds, no rookeries are present in the project area, and there are few haul-outs other than rocks used by harbor seals at the distant edge of the Level B ZOI for pile installation and opportunistic haul-outs provided by man-made objects. The project area is not known to provide foraging habitat of any special importance. The pile driving activities analyzed here are similar to other nearby construction activities In Washington inland waters, including recent projects conducted by WSDOT at the same location (Friday Harbor and Orcas Island Ferry Terminals), which have taken place with no reported injuries or mortality to marine mammals, and no known long-term adverse consequences from behavioral harassment.

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 major rookeries and only a few isolated and opportunistic haul-out areas near or adjacent to the project site; (4) the absence of any other known areas or features of special significance for foraging or reproduction within the project area; and (6) the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable impact. In addition, none of the stocks for which take authorization is proposed are listed under the ESA or designated as depleted under the MMPA. All of the stocks for which take is authorized are thought to be increasing or to be within OSP size. In combination, we believe that these factors, as well as the available body of evidence from other similar activities, including those conducted at the same time of year and in the same location, 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. Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, we preliminarily find that the total marine mammal take from the Port's marina reconstruction activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers Analysis

The numbers of animals authorized to be taken for all species would be considered small relative to the relevant stocks or populations (ranging from less than one percent for sea lions and Dall's porpoise to 4.1 percent for harbor seals) even if each estimated taking occurred to a new individual – an extremely unlikely scenario. For pinnipeds occurring in the vicinity of the Friday Harbor waterfront, there will almost certainly be some overlap in individuals present day-to-day, and these takes are likely to occur only within some small portion of the overall regional stock, such as the number of harbor seals that regularly use nearby haul-out rocks. For migratory species, the segment of the overall stock to which take would accrue is likely much smaller. For example, of the estimated 296,500 California sea lions, only certain adult and subadult males – believed to number approximately 3,000-5,000 by Jeffries et al. (2000) – travel north during the non-breeding season. That number has almost certainly increased with the population of California sea lions – the 2000 SAR for California sea lions reported an estimated population size of 204,000-214,000 animals – but likely remains a relatively small portion of the overall population.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the mitigation and monitoring measures, we preliminarily find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks.

Impact on Availability of Affected Species for Taking for Subsistence Uses

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

Endangered Species Act (ESA)

No marine mammal species listed under the ESA are expected to be affected by these activities. Therefore, we have determined that a section 7 consultation under the ESA is not required.

National Environmental Policy Act (NEPA)

We are currently conducting an analysis, pursuant to NEPA of 1969 (42 U.S.C. 4321 et seq.), as implemented by the regulations published by the Council on Environmental Quality (CEQ; 40 CFR parts 1500-1508), to determine whether or not this proposed activity may have a significant effect on the human environment. This analysis will be completed prior to the issuance or denial of this proposed IHA.

Proposed Authorization

As a result of these preliminary determinations, we propose to issue an IHA to the Port for conducting the described construction activities at Friday Harbor, from September 1, 2014 through February 15, 2015, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. The proposed IHA language is provided next.

This section contains a draft of the IHA itself. The wording contained in this section is proposed for inclusion in the IHA (if issued).

1. This Incidental Harassment Authorization (IHA) is valid from September 1, 2014 through February 15, 2015.

2. This IHA is valid only for pile driving and removal activities associated with reconstruction of the Friday Harbor Marina. Any reference to pile driving in this document is intended to refer to both pile driving and removal.

3. General Conditions

(a) A copy of this IHA must be in the possession of the Port, its designees, and work crew personnel operating under the authority of this IHA.

(b) The species authorized for taking are the harbor seal (Phoca vitulina), California sea lion (Zalophus californianus), Steller sea lion (Eumetopias jubatus), Dall's porpoise (Phocoenoides dalli), and the harbor porpoise (Phocoena phocoena).

(c) The taking, by Level B harassment only, is limited to the species listed in condition 3(b). See Table 1 (attached) for numbers of take authorized.

(d) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in condition 3(b) of the Authorization or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA.

(e) The Port shall conduct briefings between construction supervisors and crews, marine mammal monitoring team, and Port 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.

4. Mitigation Measures

The holder of this Authorization is required to implement the following mitigation measures:

(a) During all pile driving, the Port shall implement a minimum shutdown zone of 10 m radius around the pile for marine mammals. If a marine mammal comes within this zone, such operations shall cease. No marine mammal shall be exposed to sound pressure levels equaling or exceeding 180/190 dB rms (re 1 μPa) for cetaceans and pinnipeds, respectively, in order to prevent unauthorized Level A harassment.

(b) The Port shall similarly avoid direct interaction with marine mammals during in-water heavy machinery work other than pile driving that may occur in association with the construction project. If a marine mammal comes within 10 m of such activity, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions, as appropriate.

(c) The Navy shall establish monitoring locations as described in the Marine Mammal Monitoring Plan (Monitoring Plan; attached). For pile installation activities, a minimum of one observer shall be assigned to the active pile driving rig in order to monitor the shutdown zone, while at least three additional observers shall be positioned for optimal monitoring of the surrounding waters within the Level B harassment zone. At least two of these shall be vessel-based. During pile removal, a minimum of three observers shall be deployed at the best vantage points to observe the shutdown and disturbance zones. The zone to be monitored is as depicted in Figure 2 of the attached Plan. These observers shall record all observations of marine mammals, as well as behavior and potential behavioral reactions of the animals.

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

(e) If a marine mammal approaches or enters the shutdown zone, all pile driving activities shall be halted. If pile driving is halted or delayed due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal.

(f) Monitoring shall be conducted by qualified observers, as described in the Monitoring Plan. Trained observers shall be placed from the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator.

(g) The Port shall use soft start techniques recommended by NMFS for vibratory pile driving. The soft start requires contractors to initiate sound from vibratory hammers for fifteen seconds at reduced energy followed by a thirty-second waiting period. This procedure is repeated two additional times. Soft start shall be implemented at the start of each day's vibratory pile driving and at any time following cessation of pile driving for a period of 30 minutes or longer.

(h) Pile driving shall only be conducted during daylight hours.

5. Monitoring

The holder of this Authorization is required to conduct marine mammal monitoring during pile driving activity. Marine mammal monitoring and reporting shall be conducted in accordance with the Monitoring Plan.

(a) The Port shall collect sighting data and behavioral responses to pile driving for marine mammal species observed in the region of activity during the period of activity. All observers shall be trained in marine mammal identification and behaviors, and shall have no other construction-related tasks while conducting monitoring.

(b) For all marine mammal monitoring, the information shall be recorded as described in the Monitoring Plan, to include at minimum:

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

(ii) Construction activities occurring during each observation period;

(iii) Weather parameters (e.g., percent cover, visibility);

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

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

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

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

(viii) Locations of all marine mammal observations; and

(ix) Other human activity in the area.

6. Reporting

The holder of this Authorization is required to:

(a) Submit a draft report on all marine mammal monitoring conducted under the IHA within 90 calendar days of the end of the in-water work period. A final report shall be prepared and submitted within 30 days following resolution of comments on the draft report from NMFS. This report must contain the informational elements described under 5(b), at minimum.

(b) Reporting injured or dead marine mammals:

i. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment), serious injury, or mortality, Port shall immediately cease the specified activities and report the incident to the Office of Protected Resources (301-427-8425), NMFS, and the West Coast Regional Stranding Coordinator (206-526-6550), NMFS. The report must include the following information:

A. Time and date of the incident;

B. Description of the incident;

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

D. Description of all marine mammal observations in the 24 hours preceding the incident;

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

F. Fate of the animal(s); and

G. Photographs or video footage of the animal(s).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Port to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Port may not resume their activities until notified by NMFS.

(i) In the event that Port discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), Port shall immediately report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS.

The report must include the same information identified in 6(b)(i) of this IHA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Port to determine whether additional mitigation measures or modifications to the activities are appropriate.

(ii) In the event that Port discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), Port shall report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. Port shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS.

7. This Authorization may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Request for Public Comments

We request comment on our analysis, the draft authorization, and any other aspect of this Notice of Proposed IHA for the Port's construction activities. Please include with your comments any supporting data or literature citations to help inform our final decision on the Port's request for an MMPA authorization.

Dated: July 21, 2014.

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Donna S. Wieting,

Director,

Office of Protected Resources,

National Marine Fisheries Service.

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