NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title:	Biological Opinion on the National Science Foundation's Pier Replacement at Palmer Station, Antarctica, and the National Marine Fisheries Service Permits and Conservation Division's Issuance of a Marine Mammal Protection Act Incidental Harassment Authorization.
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1 INTRODUCTION

The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of threatened or endangered species or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat that may be affected by the action that are under NMFS' jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS' jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures.

The action agencies for this consultation are the National Science Foundation (NSF), Office of Polar Programs, and the NMFS Office of Protected Resources, Permits and Conservation Division (Permits Division). NSF proposes to construct a replacement pier at Palmer Station, Antarctica. The project is expected to start in October or November 2021 and continue through April 2022. The Permits Division proposes to issue an Incidental Harassment Authorization (IHA) authorizing non-lethal "takes" by Level A and B harassment (as defined by the Marine Mammal Protection Act [MMPA]) of marine mammals incidental to the pier replacement project, pursuant to section 101(a)(5)(D) of the MMPA 16 U.S.C. 1371(a)(5)(D).

This consultation, biological opinion (opinion) and incidental take statement, were completed in accordance with section 7(a)(2) of the statute (16 U.S.C. §1536 (a)(2)), associated implementing regulations (50 C.F.R. §§402.01-17), and agency policy and guidance. This consultation was conducted by the NMFS Office of Protected Resources, Endangered Species Act Interagency Cooperation Division (hereafter referred to as "we," "us," or "our"). We prepared this opinion and incidental take statement in accordance with section 7(b) of the ESA, agency policy and guidance, and implementing regulations at 50 C.F.R. Part 402.

This document represents our opinion on the effects of the action on the following ESA-listed species: blue whale (*Balaenoptera musculus)*, fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), Southern right whale (*Eubalaena australis*), and sperm whale (*Physeter macrocephalus*). A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

The NSF's Office of Polar Programs (Polar Programs) provides access and support for research in the Arctic and Antarctica. Polar Programs is proposing to construct a replacement pier at Palmer Station, Anvers Island, Antarctica, for the United States Antarctic Program. The construction project would be implemented by Leidos through an Antarctic Support Contract.

The NSF typically consults with NMFS for marine seismic research surveys a few times a year. Consultations for NSF construction projects are rare. The primary concern to protected resources from the marine seismic surveys is acoustic impacts. Exposure to acoustic stressors is also a concern for the proposed pier demolition and reconstruction.

1.2 Consultation History

This opinion was developed from information provided in the initiation packages from the Permits Division and from the NSF and responses to requests for clarifications and revisions from NSF. The NSF provided a Draft Initial Environmental Evaluation with a marine mammal assessment, and a noise assessment, when they submitted their request for consultation. Documents from the Permits Division included an IHA application and a notice for a proposed IHA prepared pursuant to the MMPA.

Our communications with NSF and the Permits Division regarding this consultation were through electronic mail (e-mail) and summarized as follows:

- January 8, 2020: The NSF requested a species list for the Palmer Station area. We provided them with a list on January 21, 2020.
- February 8, 2021: The NSF shared their IHA application submitted to the Permits Division with us.
- April 27, 2021: The NSF submitted an initiation package to us requesting ESA section 7 consultation.
- May 10, 2021: Notified NSF that there were some figures missing from the initiation documents. They replied with the figures the same day.
- May 13, 2021: Requested additional information from NSF. They provided responses and revisions to a noise report appendix in their Draft Initial Environmental Evaluation that day.
- May 14, 2021: Notified NSF that some questions remained unanswered.

- May 17, 2021: After reviewing the remaining responses to our requests for additional information, we notified the NSF that the initiation package was sufficient to initiate consultation as of May 17, 2021.
- August 3, 2021: The Permits Division submitted an initiation package to us requesting ESA section 7 consultation, including the IHA application, which had been revised by NSF since it was shared with us in February.
- August 9, 2021: We notified the Permits Division that the initiation package was sufficient to initiate consultation as of August 3, 2021.

2 THE ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of threatened or endangered species; or adversely modify or destroy their designated critical habitat.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 C.F.R. §402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of an ESA-listed species (50 C.F.R. §402.02).

An ESA section 7 assessment involves the following steps:

Description of the Proposed Action (Section 3): We describe the activities proposed by NSF and the proposed authorization by the Permits Division and those aspects (or stressors) of the proposed action that may have effects on the physical, chemical, and biotic environment. This section also includes measures to avoid and minimize impacts to ESA-listed species.

Action Area (Section 4): The action area is defined as " all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 C.F.R. §402.02). We describe action area with the spatial extent of those effects and associated stressors.

Endangered Species Act Resources in the Action Area (Section 5): We identify the ESA-listed species under NMFS' jurisdiction that may occur within the action area and therefore could be affected by the proposed action. There is no designated critical habitat occurring within the action area of this consultation.

Potential Stressors (Section 6): We identify the stressors that could result from the proposed action and affect ESA-listed species.

Status of Species Likely to be Adversely Affected (Section 7): We examine the status of ESA-listed species that may be adversely affected by the proposed action.

*Environmental Baseline (*Section 8): We describe the environmental baseline as the condition of ESA-listed species in the action area, without the consequences caused by the proposed action. The environmental baseline includes the past and present impacts of: all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process. The consequences to ESA-listed species from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 C.F.R. §402.02).

Effects of the Action (Section 9): Effects of the action are all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 C.F.R. §402.02). These are broken into analyses of exposure and response as described below for the species that are likely to be adversely affected by the action.

In the exposure analysis, we identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or sub-populations to which those individuals belong.

In the response analysis, we evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond to the stressors given their probable exposure.

Cumulative Effects (Section 10): Cumulative effects are the effects to ESA-listed species of future state or private activities that are reasonably certain to occur within the action area (50 C.F.R. §402.02). Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate ESA section 7 compliance.

Integrated Risk Assessment (Section 11): We begin with problem formulation that identifies and integrates the stressors of the action with the species' status and the environmental baseline and formulate risk hypotheses based on the anticipated exposure of listed species to stressors and the likely response of species to this exposure. We consider the effects of the action within the action area on populations or subpopulations when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to reduce appreciably the likelihood of survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution.

Conclusion (Section 12): The results of our jeopardy analyses are summarized in this section.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (50 C.F.R. §402.14).

In addition, we include an *Incidental Take Statement* (Section 13) that specifies the amount of incidental take when possible, or extent of incidental take when the amount cannot be estimated numerically, reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures (ESA section 7 (b)(4); 50 C.F.R. §402.14(i)).

We also provide discretionary *Conservation Recommendations* (Section 14) that may be implemented by the action agency (50 C.F.R. §402.14(j)). Finally, we identify the circumstances in which *Reinitiation of Consultation* (Section 15) is required (50 C.F.R. §402.16).

2.1 Evidence Available for the Consultation

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of *Google Scholar*, literature cited sections of peer reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

- Information submitted by NSF and the Permits Division;
- Government reports (including NMFS biological opinions and stock assessment reports);
- National Oceanic and Atmospheric Administration (NOAA) technical memoranda; and
- Peer-reviewed scientific literature.

These resources were used to identify information relevant to the potential stressors, animal density and distribution to estimate likely exposure and responses of ESA-listed species under NMFS' jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species.

3 Description of the Proposed Actions

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 C.F.R. § 402. 02).

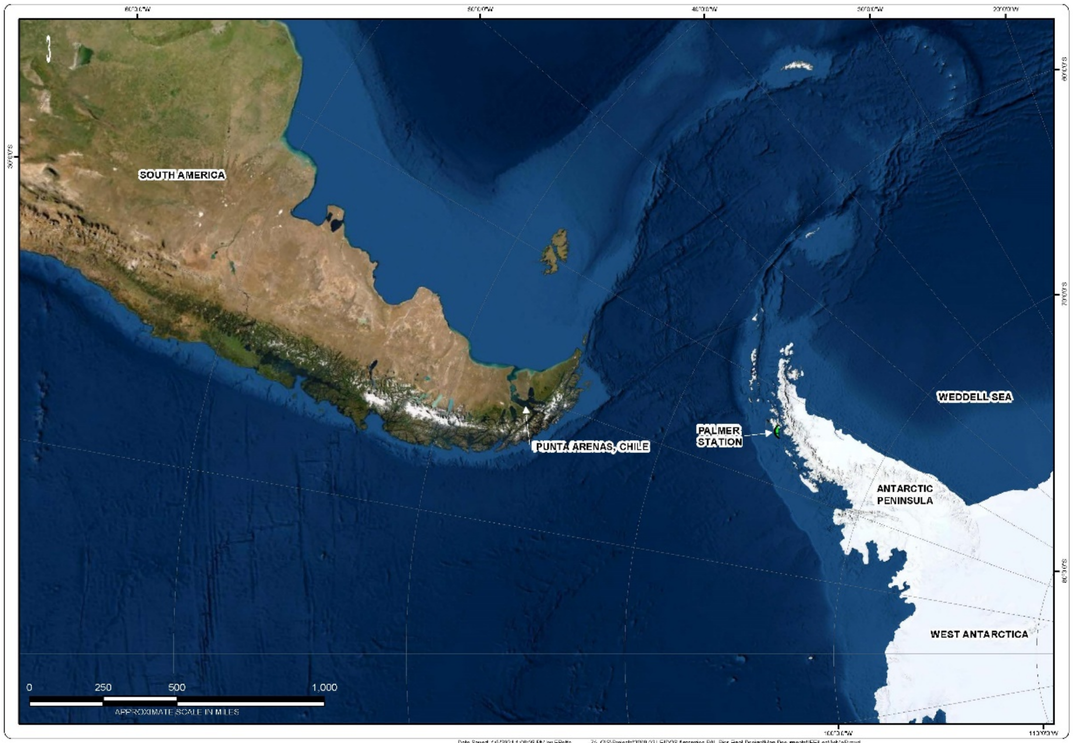
Two federal actions were evaluated during consultation. The first action is the construction project proposed by NSF Polar Programs to replace a pier at Palmer Station, Antarctica. The second action is the IHA proposed by the Permits Division, authorizing non-lethal "takes" by MMPA Level A and B harassment pursuant to section 101(a)(5)(D) of the MMPA: "Taking Marine Mammals Incidental to the Palmer Station Pier Replacement Project, Antarctica".

3.1 National Science Foundation's Proposed Activities

3.1.1 Palmer Station

Palmer Station (64˚46.45'S, 64˚03.25'W) is located on Anvers Island, Antarctica (Figure 1) and is one of three scientific research stations in Antarctica operated by the United States that are occupied year-round. There are multiple structures, a helipad, fuel tanks, and other support facilities distributed on the approximately 15-acre site (Figure 2).

All cargo deliveries and personnel transfer operations are conducted by marine vessel due to the lack of an airstrip or commercial air service to Palmer Station. Two NSF research vessels, the Nathaniel B. Palmer (NBP) and the Lawrence M. Gould (LMG), access Palmer Station. The nearest major port facility is Punta Arenas, Chile, which is approximately 1770 kilometers (km) (1100 miles) north of Palmer Station (Figure 1).



3.1.2 Pier Replacement Project - Purpose and Need

The purpose of the project is to provide a safe and reliable pier for the unloading of personnel and critical supplies necessary for NSF to effectively carry out its scientific mission. The existing pier is constructed of sheet piles arranged to form interconnected cells. Sheet piles are long structural sections of steel with interlocking edges that are driven into the ground to create a continuous wall. This circular sheet pile structure (cellular bulkhead) is backfilled with gravel, cobbles, and boulders. The 8.2 meters (m) (27 feet) (ft) diameter pier was constructed in 1967 and now, more than 50 years later, it is in need of replacement. Corrosion has resulted in deterioration and there is severe sheet pile section loss in places that have been patched numerous times.

Currently, only the *LMG* has regular use of the pier as larger vessels, such as the *NBP,* can only moor during high tide and typically only do so in emergency situations. Replacement of the existing pier is expected to allow for regular use by the *NBP* and potentially other research vessels for 50 to 75 years (estimated life span for new structure; dependent on maintenance).

This project would replace the existing pier with a new pile-supported concrete deck pier, an energy absorbing fender system, as well as on-pier power and lighting (Figure 3). The deck for the pier would be supported by steel pipe piles, which would be drilled into the shallow bedrock. These piles would be filled with gravel and topped with a pile cap. A retaining wall would be installed along the shoreline at the location where the pier comes into contact with (i.e. abuts) the shoreline (pier abutment) and would extend to the northwest and along the northeastern edge of the pier. At this time, piles for a wave attenuator are planned for installation; however, the wave attenuator itself would be installed at a future date. The wave attenuator would be constructed of foam-filled pipes secured in place by the piles and would act as a protective shield against incoming waves by reflecting or dissipating wave energy.

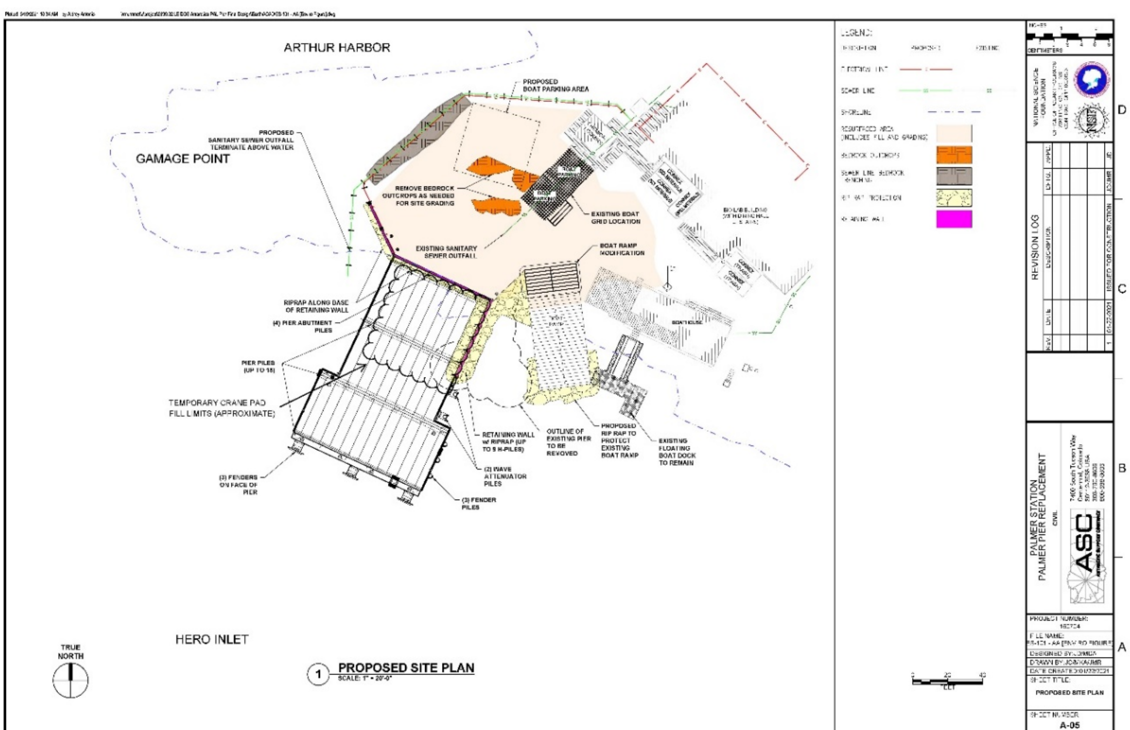


Figure 3. Proposed Site Plan for Palmer Pier Project

3.1.3 Construction Activities

Equipment and supplies would be brought to Palmer Station on the construction contractor's (Contractor) barge. Upon arrival at the site, the Contractor would moor the construction barge against the existing pier using soft lines and the existing moorage points and deploy anchors to further secure the barge. Equipment would be unloaded from the barge to the existing pier and relocated upland for access during construction activities. Construction equipment would likely include two cranes, an excavator, a dozer, a skidsteer, several forklifts, a welder, an impact hammer, a vibratory hammer, a down the hole (DTH) hammer drill, and other small tools and equipment. Components to assemble a modular work platform would also be included on the construction barge.

Construction activities include the creation of a temporary crane pad, existing pier demolition, installation of piles and new pier structures, upland site grading, and site dismantling. The proposed project is expected to take up to 89 days of in-water work and construction would be limited to one season, October or November 2021 through April 2022. Workdays would be limited to 12-hour shifts during daylight, 7 days a week.

Crane Pad

The pier replacement work would largely be performed by two cranes, one based on the barge and one based on land. The existing sheet pile pier cannot be relied upon to transfer heavy, pier-building equipment off the barge utilizing ramps. Based on the weights of the land-based crane components and the safe working radius (reach) of the barge-based crane, a temporary crane assembly pad is required in order to facilitate the land-based crane offload and assembly.

The temporary crane assembly pad would be constructed mainly of coarse aggregate material including crushed stone and gravel imported in bulk bags via a separate gravel barge. Bulk bags are also known as super sacks or flexible intermediate bulk containers and are made of woven polypropylene material (i.e. plastic) for strength and durability. It is estimated that 1,376 cubic meters (1,800 cubic yards) of material is needed to construct the pad.

The bagged aggregate would be transferred directly from the gravel barge to the existing pier and moved to a staging area. The bulk bags would then be opened as needed to create a pile of aggregate material. Once the appropriate elevation has been reached, aggregate placement would cease and crane mats would be laid out to match the existing pier elevation.

Once the land-based crane has been offloaded from the barge and assembled, it would be moved into position to assist with deconstruction of the existing pier. The temporary crane pad would be located largely within the footprint of the new pier. Much of the loose aggregate material placed for the crane pad would be left in place on the seaward side of the new pier abutment where riprap armor (rock used to protect shoreline structures) will be installed, as well as along the edge of the boat ramp where the aggregate would aid in wave protection. Rock for the riprap will be sourced from the imported aggregate material, as well as the demolition of the existing pier and other upland areas as described in the following sections. It is estimated that approximately

50% of the total crane pad fill aggregate material would be recovered and salvaged for reuse as pile fill or used elsewhere on-site during construction.

Demolition

The existing pier, consisting of steel sheet piles that are backfilled with gravel, cobbles, and boulders, would be demolished and materials reused as much as practicable to construct the new pier facility. An excavator, skidsteer, and dozer would be used to remove and repurpose fill material from the existing bulkhead pier. Salvaged gravel fill material may be used in uplands for site grading/contouring or as pile fill. Depending on the size, boulders removed from the existing pier may be placed along the bottom of the new retaining wall and/or the existing boat ramp to protect against wave scour (erosion at the base of the structure). Should larger rock formations/bedrock be encountered, they would be broken using a rock breaker attachment on the excavator. The 36 existing sheet piles would be extracted with a vibratory hammer or cut off at the mud line. Material that cannot be reused would be stockpiled in an upland location and later loaded onto the barge when construction equipment and remaining materials are prepared for removal at the end of the project. The foam-filled marine fenders located at the end of the existing pier would be removed.

Pile Installation

Pile installation for the new pier would begin once the existing pier facility is removed. Temporary template piles would be installed first to develop a support structure to ensure proper placement of the permanent piles. The template piles serve as a grid and would not be installed in the same locations as the permanent piles. The permanent piles would support the pier, pier abutment, retaining wall, three of the six fenders, and future wave attenuator (Figure 3). Only the three fenders on the eastern side of the pier will be supported by dedicated piles. The three fenders on the face of the pier would be supported by structural pier piles. The primary technique for installing temporary and permanent piles would be DTH drilling. The DTH drill/hammer acts on a shoe at the bottom of the pile and uses a pulsing/rotating mechanism to break up rock below the pile while simultaneously installing the pile through the rock formation. Rotating bit wings extend below the pile and remove the broken rock fragments as the pile advances. Because the shoreline and upland areas are comprised of rocky or exposed bedrock, the piles would be socketed in place. This involves drilling into the rock to create a socket deeper and larger than the pile diameter. Once the pile is set, the remaining void space is filled with a high-performance cement-based sealing grout. The piles would likely be hammered (impact-driven) for short periods of time to seat (set) the piles in the sockets. Once permanent piles are installed, the temporary template piles would be removed with a vibratory hammer or cut off at the seafloor. Table 1 summarizes the number and size of the piles expected for each structure, including socket depth and diameter, as well as an estimate of days needed for installation. Approximately one to two pile installations would occur over 12 daylight hours each workday.

Table 1. Summary of Piles Planned for Project.

Structure	Diameter of Pile[a]	Socket Depth (feet)	Number of Piles	Days of Installation [b]
Pier Abutment	32- or 36-in steel piles	30	4	47
Pier	36-in steel piles	20	Up to 18	
Retaining Wall	Steel H-piles inserted in pre-drilled 24-in diameter hole	10	Up to 9	16
Wave Attenuator	24-in steel piles	20	2	
Fenders[c]	24-in steel piles	20	3	
Template Piles	24-in steel piles	10	16	

a Dimensions provided in United States customary units to match design; metric units not provided.
b This is a conservative estimate. Some 24-in. piles may be driven on the same day as 36-in. piles, which would reduce the overall days for pile installation.

Rock Chipping

Rock chipping may be required to level the sea bottom at pile locations to ensure accurate pile location and alignment. Rock chipping would be attempted using the DTH hammer and appropriate bit(s) to flatten the surface for pile installation. If the DTH hammer is not able to flatten the surface at the pile location, the excavator with a rock breaking attachment would be used. If rock chipping is found to be necessary, it would occur on the same days as DTH drilling.

Pier Structures

Construction of the pier abutment and retaining wall would require bedrock excavation using the excavator/rock breaker. Trench excavation would begin about 0.9 m (3 ft) seaward of the retaining wall alignment and extend to 1.5 m (5 ft) landward for approximately 16.8 m (55 ft). The retaining wall would be constructed along the shoreline at the new pier location, landward of the pier abutment. The retaining wall would be constructed using a series of stacked horizontal pre-cast concrete planks between the retaining wall piles. Upland fill would be placed on the landward side of the retaining wall, as required, to close any gaps below the planks. Where the retaining wall extends beyond the pier abutment, riprap armor stone would be placed on the seaward side of the retaining wall at a 50% slope to aid in wave protection. The pier abutment would consist of steel pipe piles with armor stone placed between the piles at a 50% slope.

Concrete caps would be installed on top of the piles and welded in place. Precast concrete deck panels would be set and grouted in place on top of the caps, followed by railing installation. The grout is the same high-performance cement-based sealing grout to be used for pile installation. A total of three prefabricated fenders would be installed on the pier from the pier deck.

Sacrificial anodes are included in the design in order to protect the major submerged steel components from corrosion. A sacrificial anode is made of a different metal alloy than the structure it is protecting and preferentially corrodes to protect the structure from corrosion. These aluminum alloy anodes would be installed below the waterline by divers. Installation would involve welding using hand-held equipment.

The existing sewer outfall is within the footprint of the proposed pier. A new outfall would be constructed and most of the existing pile-supported sewer line would be relocated. Because the existing sewer line outfall is in the same area as the crane assembly pad and ultimately the new pier, the first priority would be to create a temporary bypass for the existing sewer line until the new permanent alignment is constructed. The system would be in operation at all times while the new line is being constructed. Portions of the new sewer line would require that a trench be excavated through the bedrock to provide clearance for the pile-supported line and maintain gravity flow through the system. This trench excavation may be done with an excavator using a breaker attachment or drilling holes and using a high expansion grout agent such as Dexpan® to create a non-explosive, controlled expansion to fracture the rock. After fracturing, the demolished rock and debris, including grout, would be collected, and reusable material would remain at the Station, and any remainder would be removed on the barge at the end of the project. Although excavation (trenching) is required in certain areas of the alignment, the sewer line will be placed aboveground on pipe supports and not buried. Mechanical means would be used as much as possible for rock breaking and excavation. The method of drilling holes and using expanding grout would be used if the equipment cannot successfully break/remove the rock. The existing sewer lines near the dock would be demolished once the relocation is complete and operational.

The project would provide a new power pedestal with modifications to the existing power feeder from the Biological Lab (BioLab) as well as power for the fuel system heat trace and pier lighting. The power and lighting system would include a power center, power stations for refrigerated containers, and an outlet for welding/hand tool use. Exterior pier lighting would consist of light poles, floodlights, small area lights, catwalk lights, navigation/marker lights and low-level pedestals. No communications or surveillance are included.

Upland Site Grading

Portions of the upland areas would be graded to improve access and use of the pier facility and provide boat parking. A vertical adjustment of the upper portion of the existing concrete boat launch ramp would be required and two bedrock outcrops may need to be removed for site grading. Construction methods previously discussed for bedrock excavation would be used. In general, strategic placement of the excess fill is anticipated and rocks greater than 0.5 m in diameter would be salvaged and placed for toe and shore protection for the boat launch ramp and retaining wall. Any remaining fill could be used in the graded area north of the pier or used to fill in holes and even out surfaces along existing roads and pads within the Station. Any unused fill would be loaded onto the barge and removed at the end of the project.

Site Dismantling

Upon completion of the project, the Contractor will remove all material and equipment brought to the Station. Construction site dismantling would begin with the final inspection followed by transfer of all remaining equipment, material, and waste onto a barge and preparing to disembark. Site dismantling is expected to occur no later than June of 2022 and take between 10 to 14 days.

3.1.4 Project Timeline

The construction window is limited due to sea ice. As such, a majority of the construction is anticipated to occur between November 2021 and April 2022. Project completion would occur once final as-built drawings have been approved and is scheduled for August 28, 2022.

Table 2. Expected Date and Duration of Construction Activities.

Activity	Begin [a]	End [a]
Site Development	12/24/2021	2/28/2022
Crane pad construction	1/1/2022	4/14/2022
Transfer crane to shore and assemble	1/3/2022	4/18/2022
Demolition	1/6/2022	4/7/2022
Construction	1/25/2022	4/7/2022
Bedrock excavation (as needed)	--	--
Retaining wall/abutment	2/2/2022	2/27/2022
Pier pile installation	2/28/2022	4/27/2022
Fender systems	4/28/2022	4/29/2022
Install wave attenuator piles	4/14/2022	4/17/2022
Miscellaneous pier work	4/18/2022	4/28/2022
Upland site grading	4/7/2022	4/10/2022
Cathodic protection [b]	4/22/2022	6/21/2022
Site Dismantling	Approximately 10 -14 days from date construction is completed	
Final inspection and project acceptance		
Load and prepare barge for departure		
Depart Palmer Station		
Final closeout (Onsite work complete)	7/8/2022	8/18/2022
Project completion	9/25/2022	

a Time frames are based on 95% construction schedule and may be modified based on field conditions and/or logistics.
b Leidos/ASC to install anodes, not construction contractor.

3.2 National Marine Fisheries Service's Proposed Activities

On December 29, 2020, the Permits Division received a request from the NSF for an IHA to take marine mammals incidental to conducting pier demolition and reconstruction at Palmer Station, Anvers Island, Antarctica. After some revisions, the Permits Division deemed NSF's application for an IHA to be adequate and complete on July 15, 2021. The request is for take of a small number of 17 species of marine mammals mostly by MMPA Level B harassment and some Level A harassment. Neither NSF, nor the Permits Division expects serious injury or mortality to result from the proposed activities; therefore, an IHA is appropriate.

The IHA will authorize the incidental harassment of the following endangered species: blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera* *borealis*), Southern right whale (*Eubalaena australis*), and sperm whale (*Physeter macrocephalus*). The proposed IHA specifies requirements that the NSF must comply with as part of its authorization (see Appendix A). The IHA will be effective for a period of one year from November 1, 2021 through October 31, 2022. Project operations are not expected to occur beyond that time. The Permits Division proposes to issue the IHA prior to the start of the proposed construction project.

On August 18, 2021, the Permits Division published a notice of proposed IHA and request for comments in the *Federal Register* (86 FR 46199). The public comment period closed on September 17, 2021. The text in Appendix A was taken directly from the proposed IHA provided to us in the consultation initiation package.

3.2.1 Renewal of IHA

On a case-by-case basis, NMFS may issue a one-time, one-year renewal of the IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical, or nearly identical, activities (or a subset of those activities) are planned or (2) the specified activities will not be completed by the time the IHA expires and a renewal would allow for completion of the activities, provided all of the following conditions are met:

(a) A request for renewal is received no later than 60 days prior to the needed renewed IHA effective date.

(b) The request for renewal must include the following:

(i) An explanation that the activities to be conducted under the requested renewed IHA are identical to the activities analyzed for the current IHA, are a subset of the activities, or include changes so minor (e.g., reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(ii) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

(c) Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings made in support of the IHA remain valid.

3.2.2 Revisions to Proposed Incidental Harassment Authorization

The Permits Division has made revisions to the proposed incidental harassment authorization since the notice was published in the *Federal Register* on August 18, 2021 (86 FR 46199). The revisions are based on public comments received. The revisions to the proposed IHA include modification of the shutdown zone distance to 1000 m for all marine mammal hearing categories. This revised mitigation measure has been incorporated into the analysis of this opinion. The final IHA may have other changes but they are not expected to be relevant to ESA-listed species and therefore, should not affect this opinion.

3.3 Mitigation and Monitoring

Under the ESA, the NSF is obligated and to reduce the likelihood of adverse effects to ESA-listed marine species or adverse effects on their designated critical habitats. Mitigation is a measure that avoids or reduces the severity of the effects of the action. Monitoring observes and checks the progress of the mitigation over time, ensuring that any measures implemented to reduce or avoid adverse effects on ESA-listed species are successful.

Under the MMPA, the Permits Division will also require NSF to implement mitigation and monitoring measures, to have their action result in the least practicable adverse impact on marine mammal species or MMPA stocks.

The following mitigation and monitoring measures listed below are proposed by NSF for the project and described in subsequent sections:

- Workday time restriction
- Soft start
- Shutdown zone
- Visual monitoring by protected species observers
- Shutdown procedures
- Pre-clearance procedures
- Vessel strike avoidance
- Reporting

Additional details for the mitigation and monitoring measures required by the Permits Division can be found in *Federal Register* notice of proposed IHA and request for comments (86 FR 46199) and in Appendix A of this opinion.

3.3.1 Workday time restriction

In-water construction activities would be confined to a 12-hour workday only during daylight hours to limit exposure of animals to activities and to facilitate monitoring.

3.3.2 Soft Start

To minimize disturbance and harm to marine mammals from pile driving noise, NSF will implement a "soft-start" procedure to allow animals to leave the area prior to full sound exposure. Specifically, NSF would use the soft-start technique at the beginning of impact pile driving each day, or if impact driving has ceased for more than 30 minutes. Soft start requires the Contractor to provide an initial set of three strikes at reduced energy, followed by a 30-second waiting period, then two subsequent reduced-energy strike sets.

3.3.3 Shutdown Zone

Shutdown zones are regularly used as an effective mitigation measure to minimize potential harm to protected species. Shutdown zones are areas where the occurrence of a protected species triggers a shutdown of acoustic sources, such as pile driving equipment. The Permits Division will require NSF to implement a shutdown zone of 1000 m around the construction site to reduce exposure of marine mammals to under water sound levels expected to have adverse effects on the species.

3.3.4 Visual Monitoring by Protected Species Observers

Monitoring requires the use of trained protected species observers (PSOs) to scan visually for the presence of marine mammals. The adjacent waters will be visually scanned to establish and maintain the 1000 m zone around the sound source that are clear of marine mammals, thereby reducing the potential for injury and minimizing the potential for more severe behavioral reactions for animals occurring close to the project site. The PSOs must be independent (i.e., not construction personnel) and must have no tasks other than to conduct observations, record observational data, and communicate with and instruct relevant construction crew with regard to the presence of marine mammals and mitigation requirements.

One NMFS-approved, formally trained PSO with prior experience monitoring for an incidental take authorization would serve as team leader, supported by three PSOs trained on-site or through available online training programs compliant with NMFS standards. There will be two PSOs on duty during construction limited to monitoring no more than four hours per shift with sufficient breaks and no more than 12 hours per day to minimize fatigue.

The primary monitoring location proposed by NSF would be on the roof platform of the Garage Warehouse Recreation (GWR) building (approximately 20 meters above sea level) to provide visual coverage of the shutdown zone. The primary PSO can monitor the area generally south-southeast while the second PSO can monitor the area generally west-southwest that may be ensonified (filled with sound). NSF expects that with reticle binoculars the distance potentially visible by a 1.8-m tall PSO from this point would be about 4,360 m. The Permits Division requests that mounted 'big eye' binoculars be provided to PSOs to better cover the shutdown zone. Should environmental conditions deteriorate such that marine mammals within the shutdown zone will not be visible (e.g., fog, heavy rain), pile driving and removal must be delayed until the PSO is confident marine mammals within the shutdown zone could be detected.

Protected species observers will establish and monitor the 1000 m shutdown zone based upon the radial distance from the edges of the construction site. Marine mammal monitoring will be conducted during all pile removal or driving activities. PSOs will scan the waters using binoculars and by naked eye, in conjunction with a hand-held GPS or rangefinder device to verify the distance to each sighting. PSOs would record observations and behavioral responses of any marine mammals observed during pile operations.

Briefings are expected to occur between construction supervisors and crews and the PSO team and relevant NSF staff prior to the start of all pile driving and construction activities, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures to be sure they are clearly understood.

3.3.5 Shutdown Procedures

A shutdown requires the immediate de-activation of pile driving and removal equipment. Any protected species observer on duty will have the authority to delay the start of construction activities or to call for a shutdown if a marine mammal is detected within the 1000 m zone. The operator must also establish and maintain clear lines of communication directly between PSOs on duty and the crew controlling the pile driving and removal equipment to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch.

If pile driving is delayed or halted due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily exited and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal for pinnipeds and 30 minutes have passed for cetaceans.[1]

3.3.6 Pre-Clearance Procedures

The intent of pre-clearance observation is to ensure no protected species are observed within the shutdown zone prior to the beginning of construction noise. Monitoring must take place from 30 minutes prior to initiation of pile driving activity through 30 minutes post-completion of pile driving activity. Pre-start clearance monitoring must be conducted during periods of visibility sufficient for the lead PSO to determine the shutdown zone is clear of marine mammals. Pile driving may commence following 30 minutes of observation after the determination that the zone is clear.

3.3.7 Vessel Strike Avoidance

Vessel strike avoidance measures are intended to minimize the potential for collisions with marine mammals. The support vessel speed would be limited to 5-10 knots for maneuvering close to shore. If a whale is sighted in the project area, the support vessel will maintain a distance

[1] Pinnipeds and cetaceans are protected under the MMPA. In the action area (Section 4), there are no ESA-listed pinnipeds, but there are some ESA-listed cetaceans, as noted in Section 5.

of 92 m (300 feet) or greater between the whale and the vessel. If the distance between the support vessel and a whale is ever less than 92 m, the vessel will reduce speed and shift the engine to neutral until the whale leaves the area.

3.3.8 Reporting

A draft marine mammal monitoring report will be submitted to NMFS within 90 days after the completion of pile driving and removal activities, or 60 days prior to a requested date of issuance of any future IHAs for projects at the same location, whichever comes first. The report will include an overall description of work completed, a narrative regarding marine mammal sightings, and associated PSO data sheets. More details regarding the specific contents required for the report can be found in the proposed IHA in Appendix A.

Reporting Injured or Dead Marine Mammals

In the event that personnel involved in the construction activities discover an injured or dead marine mammal, the IHA-holder must immediately cease the activities and report the incident to the Office of Protected Resources (OPR; PR.ITP.MonitoringReports@noaa.gov), NMFS as soon as feasible. If the death or injury was clearly caused by the construction activity, NSF must immediately cease the activities until NMFS is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the IHA. NSF must not resume their activities until notified by NMFS. Details regarding the specific contents required for reporting can be found in the proposed IHA in Appendix A.

3.4 Project Noise

NSF provided NMFS an assessment of expected noise from the proposed pier replacement project that identified project sources of underwater noise and determined ensonified (filled with sound) areas based on guidance provided by the Permits Division for acoustic exposure thresholds.

3.4.1 Sound Sources

The greatest source of underwater noise from the pier replacement project would be from pile installation and the main installation method would be by DTH. Two DTH systems would be available on site and could be used simultaneously. One vibratory hammer would be used to remove existing piles, and one impact hammer could be used to proof piles. As a precautionary measure, it is assumed that two activities could be occurring at one time (i.e., simultaneously).

The estimated sound source levels proposed by NSF and used by the Permits Division for exposure assessment can be found in Table 1 of Appendix B. Sound levels from pile installation came from the (Caltrans 2015) or are based on empirical data collected from other sites with similar conditions (e.g., rock substrate where DTH driving would be used to install piles). NSF referenced two studies to arrive at sound levels (SL) for 24-in DTH pile installation – noise studies from Kodiak ferry terminal (Denes et al. 2016) and Skagway cruise ship terminal (Reyff

2020; Reyff and Heyvaert 2019). NSF proposed using the DTH pile installation sound source levels for 24-in piles, which are more conservative than those recommended by NMFS, and NMFS deemed this approach acceptable.

Rock chipping methods would generate sound similar to that of a hoe ram that is commonly used to demolish concrete structures. If rock chipping is necessary, it is expected occur on the same days as DTH pile installation. NSF determined the sound source levels for rock chipping based on underwater sounds measured for concrete demolition from two sets of data available from the demolition of the Tappan Zee Bridge (New York) pier structures (Reyff 2018).

3.4.2 Acoustic Thresholds

Acoustic thresholds are applied by NMFS to help determine at what point marine mammals exposed to sound sources may be subject to injury or considered harassed under the MMPA. The development of these thresholds are described in the *Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2018), which is available online at https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.

NMFS utilizes an acoustic threshold of 160 dB re: 1 μPa root mean square (rms) for impulsive sound sources and 120 dB re: 1 μPa rms for non-impulsive sound sources to estimate the number of takes by MMPA Level B harassment. Impulsive sounds (e.g., impact pile driving and rock chipping) consist of a high peak pressure with rapid rise time and rapid decay, whereas non-implusive sounds (e.g., vibratory pile driving) lack a rapid peak and decay (NIOSH 1998). DTH is considered a hybrid source, as the rotary drill action produces non-impulsive, continuous sounds, while the hammer function produces impulsive sounds (Denes et al. 2019; Denes et al. 2016; Reyff and Heyvaert 2019).

NMFS considers exposure that will generate a response equal to or above the acoustic threshold for the onset of permanent threshold shift (PTS) in hearing as criteria for auditory injury, and thus MMPA Level A harassment. Unlike the threshold for MMPA Level B harassment (behavioral), thresholds for auditory injury differ by marine mammal hearing group. Furthermore, these acoustic thresholds are a dual metric for impulsive sounds. The peak sound pressure level (0-to-peak SPL) is one threshold and it does not include the duration of exposure. The other metric, the cumulative sound exposure level (SEL_{cum}) criteria, incorporates auditory weighting functions based upon a species group's hearing sensitivity, and thus susceptibility to auditory injury, over the exposed frequency range and duration of exposure. The metric that results in the largest distance from the sound source (i.e., produces the largest field of exposure) is used in estimating total range to potential exposure and effect, because it is the more precautionary criteria.

The ESA-listed cetaceans in this opinion (see Section 5) are in the low-frequency (LF) hearing group, except for sperm whales which are in the mid-frequency hearing group (MF). See Table 3 for the acoustic thresholds applicable for the Palmer pier project noise assessment.

Table 3. Underwater Acoustic Thresholds for Low-Frequency and Mid-Frequency Cetaceans from Impulsive and Non-impulsive Sound Sources.

Marine Mammal Hearing Group and Generalized Hearing Range	Non-Impulsive Sources (e.g., Vibratory Pile Driving)		Impulsive Sources (e.g., Impact Pile Driving)		
	Level A (dB SELcum[1])	Level B (dB RMS)	Level A Dual Criteria		Level B (dB RMS)
			(dB Peak SPL)	(dB SELcum[1])	
Low-frequency cetaceans (LF) 7 Hertz to 35 kiloHertz	199	120	219	183	160
Mid-frequency cetaceans (MF) 150 Hertz to 160 kiloHertz	198		230	185	

All decibel (dB) levels are referenced to one microPascal (1μPa).
[1] NMFS recommends an accumulation period of 24 hours.

3.4.3 Ensonified Area

In order to evaluate potential exposure of the ESA-listed cetaceans to sound, an estimate of the area that will be ensonified with underwater noise from the construction and demolition activity sources that is at or above the acoustic thresholds is needed.

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 * Log10 (R1/R2), where

TL = transmission loss in dB

B = transmission loss coefficient; for practical spreading equals 15

R1 = the distance of the modeled SPL from the driven pile, and

R2 = the distance from the driven pile of the initial measurement

The recommended TL coefficient for most nearshore environments is the practical spreading value of 15. This value results in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions, which is the most appropriate assumption for NSF's proposed activity in the absence of specific modelling. The MMPA Level B harassment isopleths that result from applying the TL to the sound sources for non-simultaneous pier project activities are in Table 2 of Appendix B.

Calculating ensonified areas can be technically challenging, especially for MMPA Level A harassment due to the duration component and the use of weighting functions in the SEL_{cum} thresholds. NMFS developed a user spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to facilitate the estimation of exposure that could result in take (see Section 9.3.1. for discussion of take). The Companion User Spreadsheet (Version 2.0) to the NMFS Technical Guidance (NMFS 2018) was used to predict zones based on the acoustic thresholds. The NMFS User Spreadsheet predicts the distance from stationary sources at which a marine mammal could incur PTS if it remained there the whole duration of the activity.

Information used to determine the Level B harassment isopleths are included as inputs to the User Spreadsheets, such as the source levels (adjusted from 10 meters) for each anticipated activity and the TL. Inputs used in the User Spreadsheets can be found in Appendix C, and the resulting PTS (Level A harassment, ESA harm) for non-simultaneous pile installation activities are in Table 2 of Appendix B.

When the sound fields from two or more concurrent pile installation activities overlap, the decibel addition of continuous noise sources can result in larger zones than from a single source. Decibel addition is not a consideration when sound fields do not overlap. The increased sound levels potentially associated with two concurrent sources with overlapping sound fields are shown in Table 3 of Appendix B (WSDOT 2018). Decibel addition is only applicable to continuous sources. The Permits Division advised NSF to use 166 dB as the sound source level for continuous sounds from DTH pile installation regardless of the size of the pile. Under decibel addition, simultaneous DTH pile installation activities would use a SL of 169 (166 + 3) to derive the isopleth for the Level B harassment zone.

The NSF project noise assessment assumed two installation activities could occur simultaneously using DTH drilling and the resultant threshold isopleth distances are shown in Table 4 of Appendix B. An abutment pile requires additional depth (30 ft instead of 20 ft) to support lateral loads and to provide side friction against ice uplift that could occur at the shoreline. Simultaneous installation of two 36-in piles, one 30-ft and one 20-ft socket depths, referred to as Scenario 1A in the NSF project noise assessment, results in the greatest distance to NMFS thresholds and is used to estimate potential marine mammal exposures. The maximum Level A harassment distance would be 3,484 m for LF cetaceans, and 124 m for MF cetaceans. The Level B harassment distance for simultaneous DTH installation would be 18,478 m. The distances to the respective isopleths would be less if land or very shallow water interferes with the sound propagation. The area estimated to be ensonified above NMFS criteria thresholds is calculated based on the distance from the Palmer Station pier. The maximum areas, corresponding to Scenario 1A, for Level A harassment (PTS) would be 3.38 km^2 for LF cetaceans, and 0.03 km^2 for MF cetaceans; see Figure 4. The Level B harassment area for simultaneous DTH installation would be 54.99 km^2; see Figure 5.

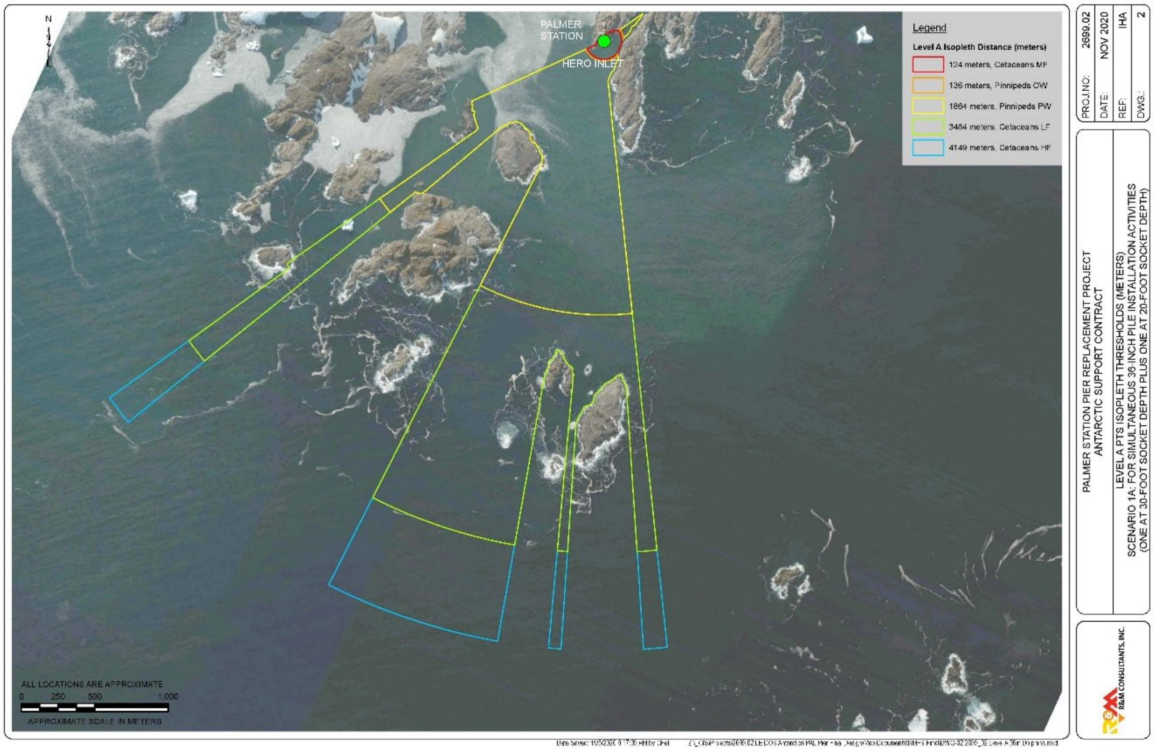
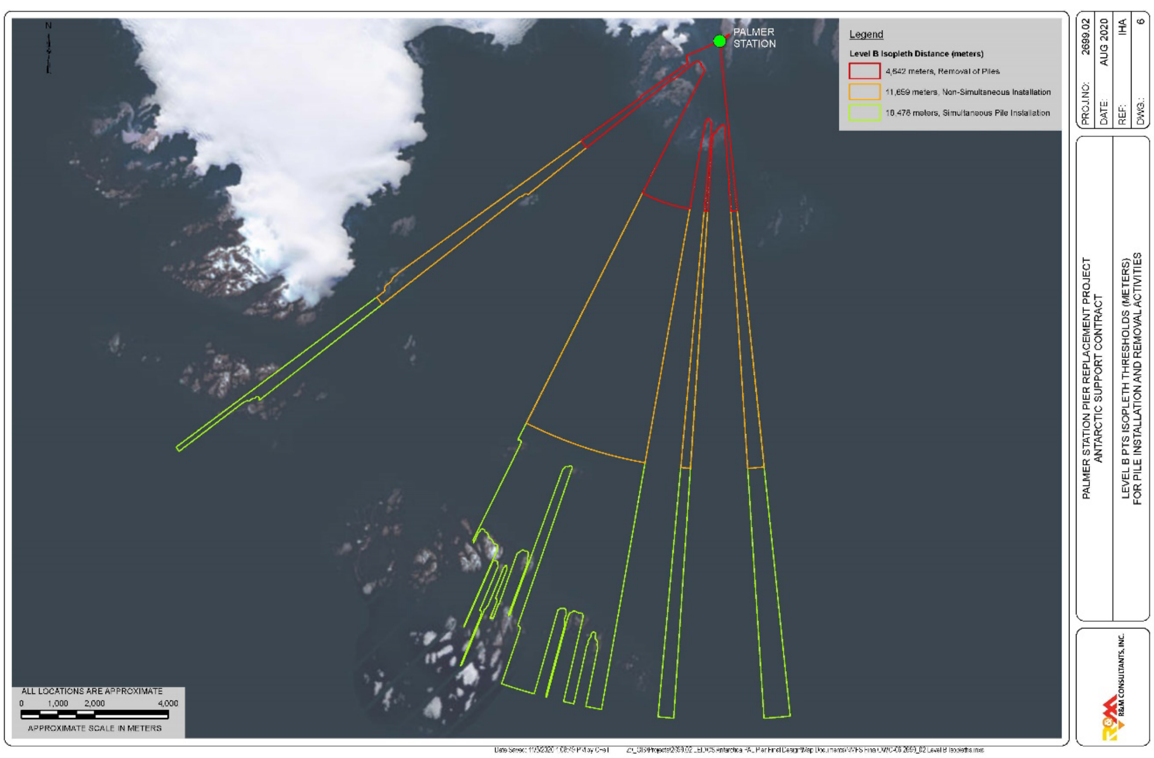


Figure 4. Largest Level A Harassment zones from simultaneous DTH Pile Installation; Scenario 1A from NSF Palmer Pier Project Noise Assessment.



4 ACTION AREA

Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 C.F.R. §402.02).

The proposed pier replacement project will occur at Palmer Station (64°46' S, 64°03' W), a U.S. scientific research station on Anvers Island in the Antarctic Peninsula. Palmer Station is situated on Gamage Point at Hero Inlet, which is approximately 135 m wide at the Station, on the southwestern coast of Anvers Island (Figure 6). The ice-free shoreline and upland area is rocky. Above the station, ice cliffs rise into the Marr Ice Piedmont that covers Anvers Island. Heading out of Hero Inlet there are several small rocky islets that are clustered off the southwestern coast of Anvers Island (Figure 7).

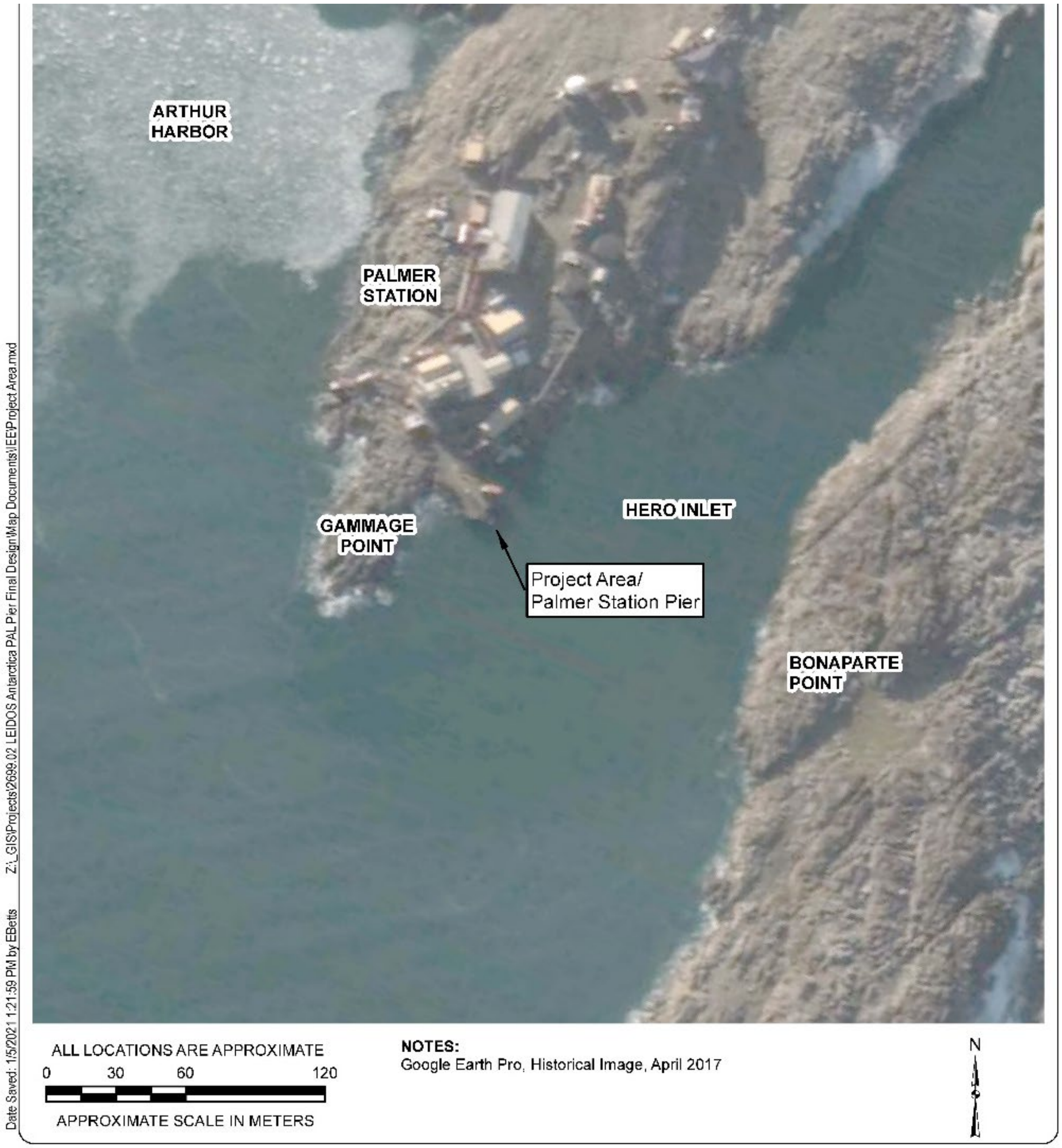


Figure 6. Palmer Station Pier Project Area on Hero Inlet.

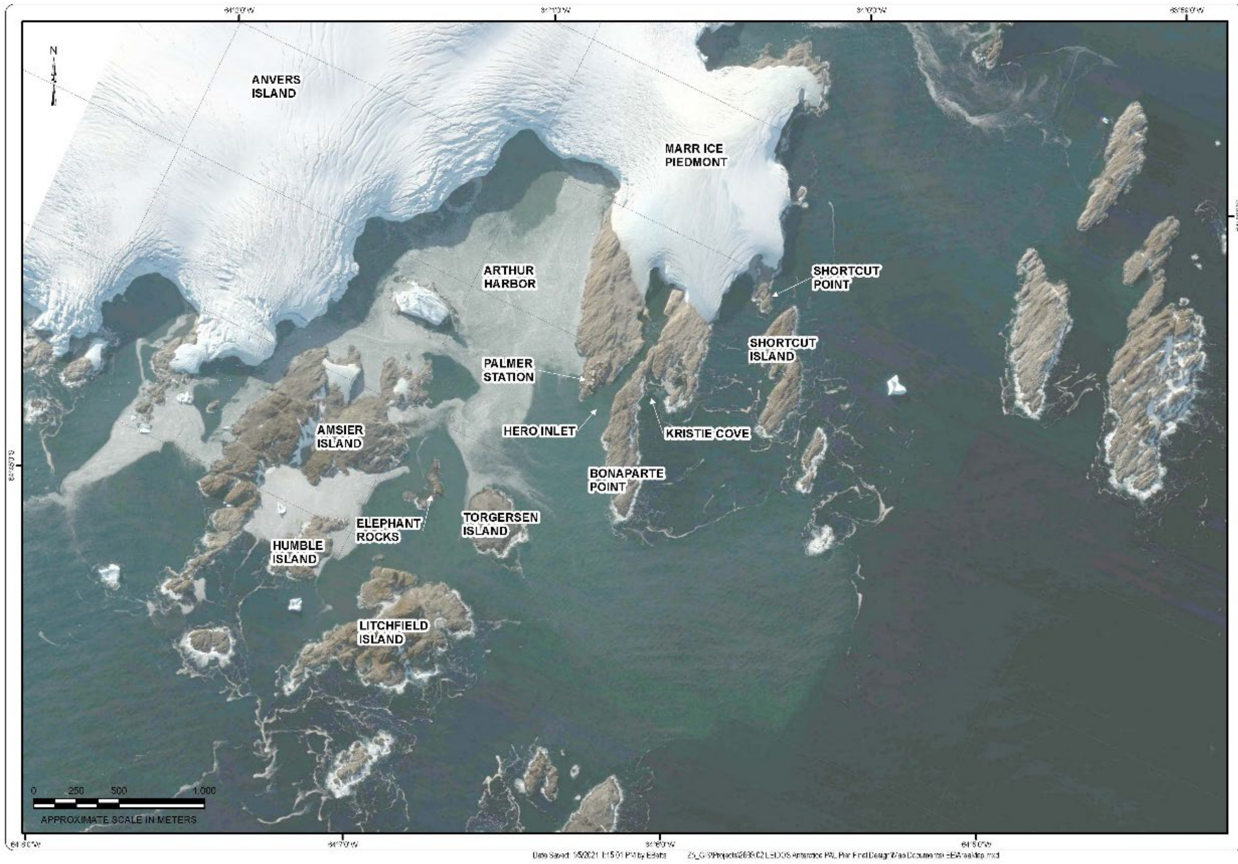


Figure 7. Anvers Island Southwestern Coastal Region near Palmer Station.

5 Endangered Species Act Resources in the Action Area

The ESA-listed species under NMFS jurisdiction in Table 4 may occur near the action area and therefore may be affected by the proposed action. Five ESA-listed species may occur in the remote Antarctic locale, all of which are endangered cetaceans, and none of which have designated critical habitat.

Table 4. ESA-listed species that may occur in the action area.

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
Blue Whale (*Balaenoptera musculus)*	E – 35 FR 18319	-- --	07/1998 11/2020
Fin Whale (*Balaenoptera physalus)*	E – 35 FR 18319	-- --	07/2010 75 FR 47538
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011 76 FR 43985

Species	ESA Status	Critical Habitat	Recovery Plan
Southern Right Whale (*Eubalaena australis*)	E – 35 FR 18319	-- --	-- --
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	12/2010 75 FR 81584

E=Endangered

6 Potential Stressors

Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus or event that may induce an adverse response in an ESA-listed species. During consultation, we deconstructed the proposed action to identify stressors that could reasonably result from the proposed activities. These are potential fuel spills, vessel strike during site operations, and noise produced by construction/demolition activities. The potential for these stressors to have adverse consequences to ESA-listed species are evaluated in the effects of the action section (Section 9).

7 Status of Species Likely to be Adversely Affected

The five species of endangered cetaceans listed in Table 4 are likely to be adversely affected by the proposed activities. The evaluation of the adverse effects in this opinion begins by summarizing the biology and ecology of those species and what is known about their life histories. This section examines the status of those species, which is determined by the level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This helps to inform the description of the species' current "reproduction, numbers, or distribution" that is part of the jeopardy determination as described in 50 C.F.R. §402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations published in the *Federal Register*, status reviews, recovery plans, and on the NMFS Web site: https://www.fisheries.noaa.gov/species-directory/threatened-endangered.

7.1 Blue Whale

The blue whale is a widely distributed baleen whale found in all major oceans (Figure 8).

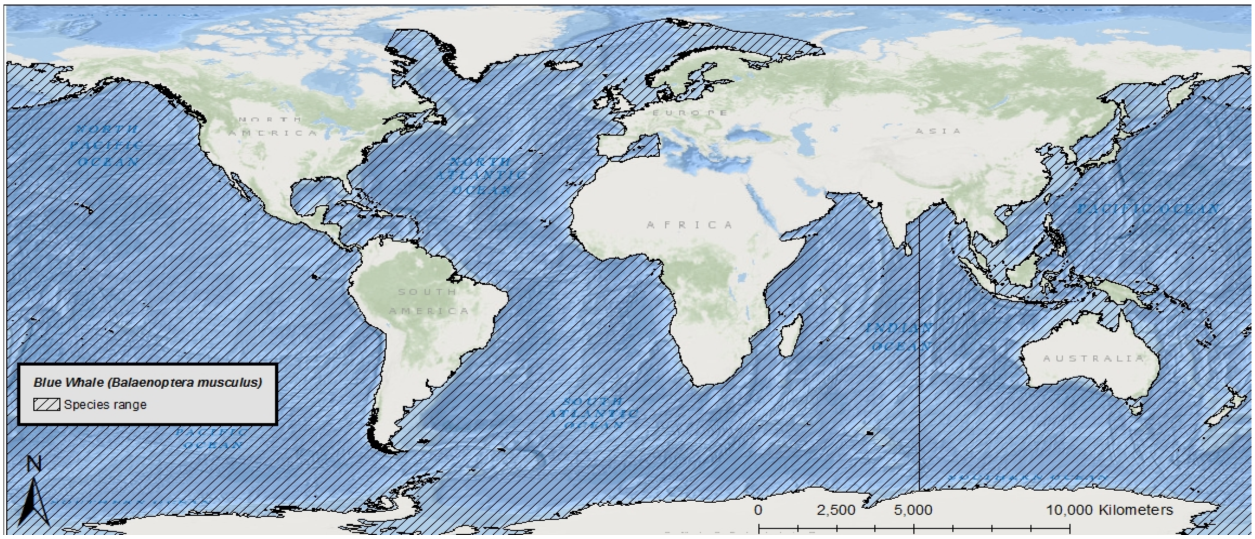


Figure 8. Map identifying the range of the endangered blue whale.

Blue whales are the largest animal on earth and distinguishable from other whales by a long-body and comparatively slender shape, a broad, flat "rostrum" when viewed from above, proportionally smaller dorsal fin, and are a mottled gray color that appears light blue when seen through the water. Most experts recognize at least three subspecies of blue whale, *B. m. musculus*, which occurs in the Northern Hemisphere, *B. m. intermedia*, which occurs in the Southern Ocean, and *B. m. brevicauda*, a pygmy species found in the Indian Ocean and South Pacific. The blue whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 1998), recent stock assessment reports (Carretta et al. 2018; Hayes et al. 2018; Muto et al. 2018), and status review (COSEWIC 2002) were used to summarize the life history, population dynamics and status of the species as follows.

7.1.1 Life History

The average life span of blue whales is 80 to 90 years. They have a gestation period of ten to 12 months, and calves nurse for six to seven months. Blue whales reach sexual maturity between five and 15 years of age with an average calving interval of two to three years. They winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. Blue whales forage almost exclusively on krill and can eat approximately 3,600 kilograms (7,936.6 pounds) daily. Feeding aggregations are often found at the continental shelf edge, where upwelling produces concentrations of krill at depths of 90 to 120 meters (295.3 to 393.7 feet).

7.1.2 Population Dynamics

The global, pre-exploitation estimate for blue whales is approximately 181,200 (IWC 2007). Current estimates indicate approximately 5,000 to 12,000 blue whales globally (IWC 2007). An overall population growth rate for the species is not available at this time.

Little genetic data exist on blue whales globally. Data from Australia indicates that populations in this region experienced a recent genetic bottleneck, likely the result of commercial whaling, although genetic diversity levels appear to be similar to other, non-threatened mammal species (Attard et al. 2010). Consistent with this, data from Antarctica also demonstrate this bottleneck but high haplotype diversity, which may be a consequence of the recent timing of the bottleneck and blue whales' long lifespan (Sremba et al. 2012). Data on genetic diversity of blue whales in the Northern Hemisphere are currently unavailable. However, genetic diversity information for similar cetacean population sizes can be applied. Stocks that have a total population size of 2,000 to 2,500 individuals or greater provide for maintenance of genetic diversity resulting in long-term persistence and protection from substantial environmental variance and catastrophes. Stocks that have a total population 500 individuals or less may be at a greater risk of extinction due to genetic risks resulting from inbreeding. Stock populations at low densities (less than 100) are more likely to suffer from the 'Allee' effect, where inbreeding and the heightened difficulty of finding mates reduces the population growth rate in proportion with reducing density.

In general, blue whale distribution is driven largely by food requirements; blue whales are more likely to occur in waters with dense concentrations of their primary food source, krill. While they can be found in coastal waters, they are thought to prefer waters further offshore. In the North Atlantic Ocean, the blue whale range extends from the subtropics to the Greenland Sea. They are most frequently sighted in waters off eastern Canada with a majority of sightings taking place in the Gulf of St. Lawrence. In the North Pacific Ocean, blue whales range from Kamchatka to southern Japan in the west and from the Gulf of Alaska and California to Costa Rica in the east. They primarily occur off the Aleutian Islands and the Bering Sea. In the northern Indian Ocean, there is a "resident" population of blue whales with sightings being reported from the Gulf of Aden, Persian Gulf, Arabian Sea, and across the Bay of Bengal to Burma and the Strait of Malacca. In the Southern Hemisphere, distributions of subspecies (*B. m. intermedia* and *B. m. brevicauda*) seem to be segregated. The subspecies *B. m. intermedia* occurs in relatively high latitudes south of the "Antarctic Convergence" (located between 48 and 61°S latitude) and close to the ice edge. The subspecies *B. m. brevicauda* is typically distributed north of the Antarctic Convergence.

7.1.3 Vocalizations and Hearing

Blue whale vocalizations tend to be long (greater than 20 seconds), low frequency (less than 100 Hertz) signals (Thomson and Richardson 1995), with a range of 12 to 400 Hertz and dominant energy in the infrasonic range of 12 to 25 Hertz (Ketten 1998; McDonald et al. 2001; McDonald et al. 1995; Mellinger and Clark 2003). Vocalizations are predominantly songs and calls.

Calls are short-duration sounds (two to five seconds) that are transient and frequency-modulated, having a higher frequency range and shorter duration than song units and often sweeping down in frequency (20 to 80 Hertz), with seasonally variable occurrence. Blue whale calls have high acoustic energy, with reports of source levels ranging from 180 to 195 decibel (dB) re: 1 microPascal (μPa) at 1 meter (Aburto et al. 1997; Berchok et al. 2006; Clark and Gagnon 2004;

Cummings and Thompson 1971; Ketten 1998; McDonald et al. 2001; Samaran et al. 2010). Calling rates of blue whales tend to vary based on feeding behavior. For example, blue whales make seasonal migrations to areas of high productivity to feed, and vocalize less at the feeding grounds then during migration (Burtenshaw et al. 2004). Stafford et al. (2005) recorded the highest calling rates when blue whale prey was closest to the surface during its vertical migration. Wiggins et al. (2005) reported the same trend of reduced vocalization during daytime foraging followed by an increase at dusk as prey moved up into the water column and dispersed. Oleson et al. (2007c) reported higher calling rates in shallow diving whales (less than 30 meters [98.4 feet]), while deeper diving whales (greater than 50 meters [164 feet]) were likely feeding and calling less.

Although general characteristics of blue whale calls are shared in distinct regions (McDonald et al. 2001; Mellinger and Clark 2003; Rankin et al. 2005; Thompson et al. 1996), some variability appears to exist among different geographic areas (Rivers 1997). Sounds in the North Atlantic Ocean have been confirmed to have different characteristics (i.e., frequency, duration, and repetition) than those recorded in other parts of the world (Berchok et al. 2006; Mellinger and Clark 2003; Samaran et al. 2010). Clear differences in call structure suggestive of separate populations for the western and eastern regions of the North Pacific Ocean have also been reported (Stafford et al. 2001); however, some overlap in calls from the geographically distinct regions have been observed, indicating that the whales may have the ability to mimic calls (Stafford and Moore 2005). In Southern California, blue whales produce three known call types: Type A, B, and D. B calls are stereotypic of blue whale population found in the eastern North Pacific (McDonald et al. 2006) and are produced exclusively by males and associated with mating behavior (Oleson et al. 2007a). These calls have long durations (20 seconds) and low frequencies (10 to 100 Hertz); they are produced either as repetitive sequences (song) or as singular calls. The B call has a set of harmonic tonals, and may be paired with a pulsed Type A call. D calls are produced in highest numbers during the late spring and early summer and in diminished numbers during the fall, when A-B song dominates blue whale calling (Hildebrand et al. 2011; Hildebrand et al. 2012; Oleson et al. 2007c).

Blue whale songs consist of repetitively patterned vocalizations produced over time spans of minutes to hours or even days (Cummings and Thompson 1971; McDonald et al. 2001). The songs are divided into pulsed/tonal units, which are continuous segments of sound, and phrases, repeated in combinations of one to five units (Mellinger and Clark 2003; Payne and McVay 1971). Songs can be detected for hundreds, and even thousands of kilometers (Stafford et al. 1998), and have only been attributed to males (McDonald et al. 2001; Oleson et al. 2007a). Worldwide, songs are showing a downward shift in frequency (McDonald et al. 2009). For example, a comparison of recording from November 2003 and November 1964 and 1965 reveals a long-term shift in the frequency of blue whale calling near San Nicolas Island. In 2003, the spectral energy peak was 16 Hertz compared to approximately 22.5 Hertz in 1964 and 1965, illustrating a more than 30 percent shift in call frequency over four decades (McDonald et al. 2006). McDonald et al. (2009) observed a 31 percent downward frequency shift in blue whale calls off the coast of California, and also noted lower frequencies in seven of the world's ten known blue whale songs originating in the Atlantic, Indian, Pacific, and Southern Oceans. Many possible explanations for the shifts exist but none has emerged as the probable cause.

As with other baleen whale vocalizations, blue whale vocalization function is unknown, although numerous hypotheses exist (maintaining spacing between individuals, recognition, socialization, navigation, contextual information transmission, and location of prey resources) (Edds-Walton 1997; Oleson et al. 2007b; Payne and Webb 1971; Thompson et al. 1992). Intense bouts of long, patterned sounds are common from fall through spring in low latitudes, but these also occur less frequently while in summer high-latitude feeding areas. Short, rapid sequences of 30 to 90 Hertz calls are associated with socialization and may be displays by males based upon call seasonality and structure. The low frequency sounds produced by blue whales can, in theory, travel long distances, and it is possible that such long distance communication occurs (Edds-Walton 1997; Payne and Webb 1971). The long-range sounds may also be used for echolocation in orientation or navigation (Tyack 1999).

Direct studies of blue whale hearing have not been conducted, but it is assumed that blue whales can hear the same frequencies that they produce (low frequency) and are likely most sensitive to this frequency range (Ketten 1997; Richardson et al. 1995). Based on vocalizations and anatomy, blue whales are assumed to predominantly hear low-frequency sounds below 400 Hertz (Croll et al. 2001; Oleson et al. 2007c; Stafford and Moore 2005). In terms of functional hearing capability, blue whales belong to the low frequency group, which have a hearing range of 7 Hertz to 35 kiloHertz (NMFS 2018).

7.1.4 Status

The blue whale is endangered as a result of past commercial whaling. In the North Atlantic Ocean, at least 11,000 blue whales were harvested from the late 19th to mid-20th centuries. In the North Pacific Ocean, at least 9,500 whales were killed between 1910 and 1965. Commercial whaling no longer occurs, but blue whales are threatened by vessel strikes, entanglement in fishing gear, pollution, harassment due to whale watching, and reduced prey abundance and habitat degradation due to climate change. Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats; however, the species has not recovered to pre-exploitation levels.

7.1.5 Status in the Action Area

The Antarctic blue whale is typically found south of 55°S during austral summer. The blue whale was once abundant in the Southern Hemisphere and historically most abundant in the Southern Ocean, but are rare today because of commercial whaling that began in 1904.

Due to food availability, they are found predominately offshore. Branch et al. (2007) combined evidence from three long-term sightings series to arrive at an abundance estimate of 1,700 Antarctic blue whales. There are no estimates of blue whale density in the immediate area of the

Antarctic Peninsula, but NMFS has utilized a density of 0.00005 whales per km^2 (Navy 2012) in the Amundsen Sea, Antarctica (NMFS 2020).

7.1.6 Critical Habitat

No critical habitat has been designated for the blue whale.

7.1.7 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover blue whale populations. These threats will be discussed in further detail in the *Environmental Baseline* section of this consultation. See the 1998 Final Recovery Plan for the blue whale for complete downlisting/delisting criteria for each of the following recovery goals:

1. Determine stock structure of blue whale populations occurring in U.S. waters and elsewhere.
2. Estimate the size and monitor trends in abundance of blue whale populations.
3. Identify and protect habitat essential to the survival and recovery of blue whale populations.
4. Reduce or eliminate human-caused injury and mortality of blue whales.
5. Minimize detrimental effects of directed vessel interactions with blue whales.
6. Maximize efforts to acquire scientific information from dead, stranded, and entangled blue whales.
7. Coordinate state, Federal, and international efforts to implement recovery actions for blue whales.
8. Establish criteria for deciding whether to delist or downlist blue whales.

7.2 Fin Whale

The fin whale is a large, widely distributed baleen whale found in all major oceans and comprised of three subspecies: *B. p. physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere (Figure 9).

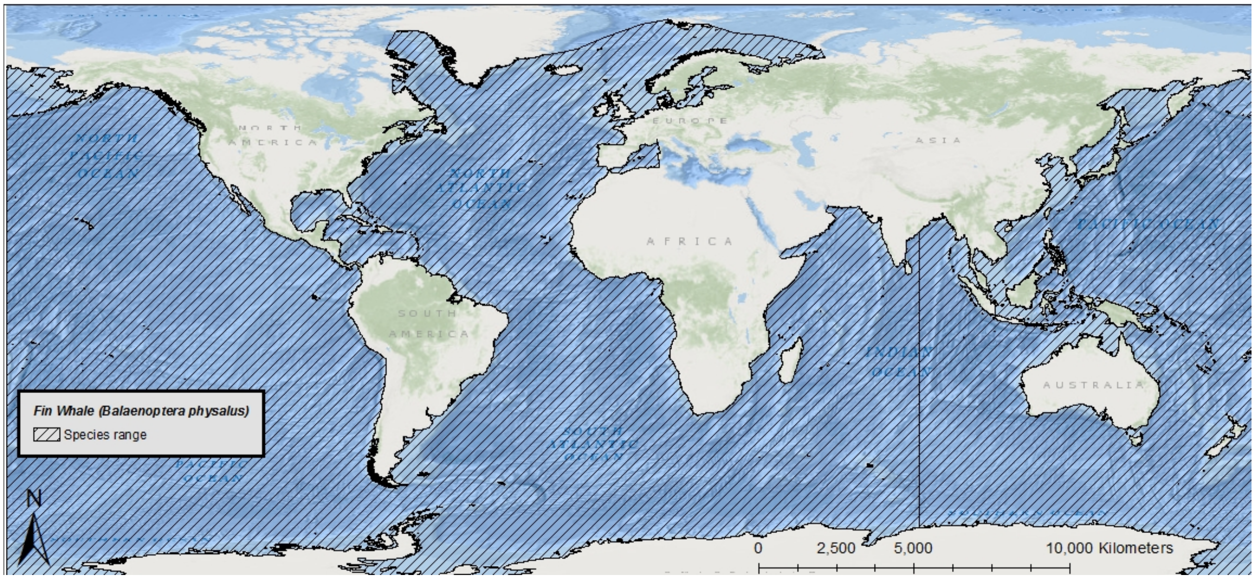


Figure 9. Map identifying the range of the endangered fin whale.

Fin whales are distinguishable from other whales by a sleek, streamlined body, with a V-shaped head, a tall falcate dorsal fin, and a distinctive color pattern of a black or dark brownish-gray body and sides with a white ventral surface. The lower jaw is gray or black on the left side and creamy white on the right side. The fin whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2010b), recent stock assessment reports (Carretta et al. 2018; Hayes et al. 2018; Muto et al. 2018) and status review (NMFS 2011a) were used to summarize the life history, population dynamics and status of the species as follows.

7.2.1 Life History

Fin whales can live, on average, 80 to 90 years. They have a gestation period of less than one year, and calves nurse for six to seven months. Sexual maturity is reached between six and ten years of age with an average calving interval of two to three years. They mostly inhabit deep, offshore waters of all major oceans. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed, although some fin whales appear to be residential to certain areas. Fin whales eat pelagic crustaceans, mainly euphausiids, especially krill in the southern hemisphere, and schooling fish such as capelin, herring, and sand lice.

7.2.2 Population Dynamics

The pre-exploitation estimate for the fin whale population in the North Pacific Ocean was 42,000 to 45,000 (Ohsumi and Wada 1974). In the North Atlantic Ocean, at least 55,000 fin whales were killed between 1910 and 1989. Approximately 704,000 fin whales were killed in the Southern Hemisphere from 1904 through 1975. An overall population growth is not available at this time.

Archer et al. (2013) recently examined the genetic structure and diversity of fin whales globally. Full sequencing of the mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere, resulted in 136 haplotypes, none of which were shared among ocean basins suggesting differentiation at least at this geographic scale. However, North Atlantic fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific Ocean, which may indicate a revision of the subspecies delineations is warranted. Generally speaking, haplotype diversity was found to be high both within ocean basins, and across. Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some populations having small abundance estimates, the species may persist long-term and be somewhat protected from substantial environmental variance and catastrophes.

There are over 100,000 fin whales worldwide, occurring primarily in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere where they appear to be reproductively isolated. The availability of prey, sand lance in particular, is thought to have had a strong influence on the distribution and movements of fin whales.

7.2.3 Vocalizations and Hearing

Fin whales produce a variety of low frequency sounds in the 10 to 200 Hertz range (Edds 1988; Thompson et al. 1992; Watkins 1981; Watkins et al. 1987). Typical vocalizations are long, patterned pulses of short duration (0.5 to two seconds) in the 18 to 35 Hertz range, but only males are known to produce these (Clark et al. 2002; Patterson and Hamilton 1964). The most typically recorded call is a 20 Hertz pulse lasting about one second, and reaching source levels of 189 ± 4 dB re: 1 µPa at 1 meter (Charif et al. 2002; Clark et al. 2002; Edds 1988; Garcia et al. 2018; Richardson et al. 1995; Sirovic et al. 2007; Watkins 1981; Watkins et al. 1987). These pulses frequently occur in long sequenced patterns, are down swept (e.g., 23 to 18 Hertz), and can be repeated over the course of many hours (Watkins et al. 1987). In temperate waters, intense bouts of these patterned sounds are very common from fall through spring, but also occur to a lesser extent during the summer in high latitude feeding areas (Clark and Charif 1998). Richardson et al. 1995 reported this call occurring in short series during spring, summer, and fall, and in repeated stereotyped patterns in winter. The seasonality and stereotype nature of these vocal sequences suggest that they are male reproductive displays (Watkins 1981; Watkins et al. 1987); a notion further supported by data linking these vocalizations to male fin whales only (Croll et al. 2002). In Southern California, the 20 Hertz pulses are the dominant fin whale call type associated both with call-counter-call between multiple animals and with singing (U.S. Navy 2010; U.S. Navy 2012). An additional fin whale sound, the 40 Hertz call described by Watkins (1981), was also frequently recorded, although these calls are not as common as the 20 Hertz fin whale pulses. Seasonality of the 40 Hertz calls differed from the 20 Hertz calls, since 40 Hertz calls were more prominent in the spring, as observed at other sites across the northeast Pacific Ocean (Sirovic et al. 2012). Source levels of Eastern Pacific Ocean fin whale 20 Hertz calls has been reported as 189 ± 5.8 dB re: 1 µPa at 1 meter (Weirathmueller et al. 2013). Some researchers have also recorded moans of 14 to 118 Hertz, with a dominant frequency of 20 Hertz, tonal and upsweep vocalizations of 34 to 150 Hertz, and songs of 17 to 25 Hertz (Cummings and Thompson 1994; Edds 1988; Garcia et al. 2018; Watkins 1981). In general, source levels for fin whale vocalizations are 140 to 200 dB re: 1 µPa at 1 meter (see also Clark and Gagnon 2004; as compiled by Erbe 2002). The source depth of calling fin whales has been reported to be about 50 meters (164 feet) (Watkins et al. 1987). Although acoustic recordings of fin whales from many diverse regions show close adherence to the typical 20-Hertz bandwidth and sequencing when performing these vocalizations, there have been slight differences in the pulse patterns, indicative of some geographic variation (Thompson et al. 1992; Watkins et al. 1987).

Although their function is still in doubt, low frequency fin whale vocalizations travel over long distances and may aid in long distance communication (Edds-Walton 1997; Payne and Webb 1971). During the breeding season, fin whales produce pulses in a regular repeating pattern, which have been proposed to be mating displays similar to those of humpback whales (Croll et al. 2002). These vocal bouts last for a day or longer (Tyack 1999). Also, it has been suggested that some fin whale sounds may function for long range echolocation of large-scale geographic targets such as seamounts, which might be used for orientation and navigation (Tyack 1999).

Direct studies of fin whale hearing have not been conducted, but it is assumed that fin whales can hear the same frequencies that they produce (low) and are likely most sensitive to this frequency range (Ketten 1997; Richardson et al. 1995). This suggests fin whales, like other baleen whales, are more likely to have their best hearing capacities at low frequencies, including frequencies lower than those of normal human hearing, rather than mid- to high-frequencies (Ketten 1997). In a study using computer tomography scans of a calf fin whale skull, Cranford and Krysl (2015) found sensitivity to a broad range of frequencies between 10 Hertz and 12 kiloHertz and a maximum sensitivity to sounds in the 1 to 2 kiloHertz range. In terms of functional hearing capability, fin whales belong to the low-frequency group, which have a hearing range of 7 Hertz to 35 kiloHertz (NMFS 2018).

7.2.4 Status

The fin whale is endangered because of past commercial whaling. Prior to commercial whaling, hundreds of thousands of fin whales existed. Fin whales may be killed under "aboriginal subsistence whaling" in Greenland, under Japan's commercial whaling program, and Iceland's formal objection to the International Whaling Commission's ban on commercial whaling. Additional threats include vessel strikes, reduced prey availability due to overfishing or climate change, and sound. The species' overall large population size may provide some resilience to current threats, but trends are largely unknown.

7.2.5 Status in the Action Area

There is a lack of fin whale sightings in the Weddell and Bellinghausen Seas, in the most extreme latitudes fin whales are generally absent near the ice edge (Aguilar and García-Vernet 2018). Overall, fin whale densities in the southern hemisphere tend to be higher outside the continental slope than inside it. Wursig et al. (2018) cited an abundance estimate of 38,200 individuals south of 30.7°S, including the Antarctic, while NOAA (2015) estimated an abundance of 1,725 fin whales south of 60°S. Reilly et al. (2004) estimated the abundance around the northern Antarctic Peninsula and Scotia Sea to be 1,492 whales. Assuming a strip width of 1 km, Santora et al. (2009) recorded 0.08391 fin whales per linear km^2 within a survey area that included locations at the northern tip of the Antarctic Peninsula (near Elephant and Joinville islands and in the Bransfield Strait) and the Scotia Sea. NMFS has utilized an estimated density of 0.0072 fin whales per km^2 (Navy 2012) in the Amundsen Sea, Antarctica (NMFS 2020).

7.2.6 Critical Habitat

No critical habitat has been designated for the fin whale.

7.2.7 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover fin whale populations. These threats will be discussed in further detail in the *Environmental Baseline* section of this consultation. See the 2010 Final Recovery Plan for the fin whale for complete downlisting/delisting criteria for both of the following recovery goals:

1. Achieve sufficient and viable population in all ocean basins.
2. Ensure significant threats are addressed.

7.3 Sei Whale

The sei whale is a widely distributed baleen whale found in all major oceans (Figure 10).

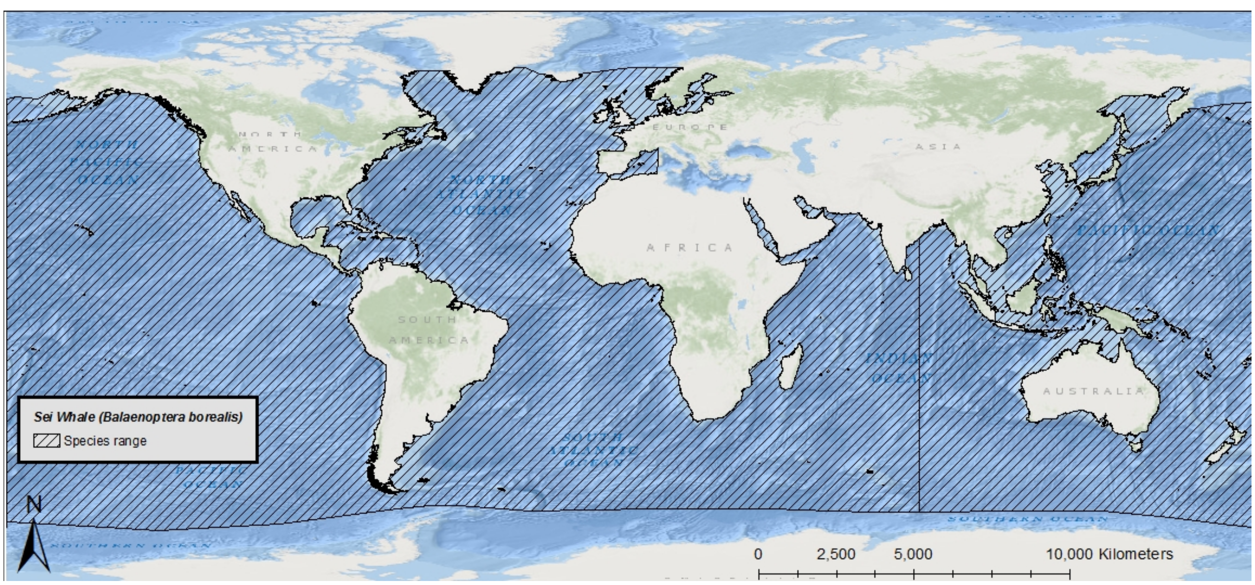


Figure 10. Map identifying the range of the endangered sei whale.

Sei whales are distinguishable from other whales by a long, sleek body that is dark bluish-gray to black in color and pale underneath, and a single ridge located on their rostrum. The sei whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2011b), recent stock assessment reports (Carretta et al. 2018; Hayes et al. 2018; Muto et al. 2018), and status review (NMFS 2012) were used to summarize the life history, population dynamics, and status of the species as follows.

7.3.1 Life History

Sei whales can live, on average, between 50 and 70 years. They have a gestation period of ten to 12 months, and calves nurse for six to nine months. Sexual maturity is reached between six and 12 years of age with an average calving interval of two to three years. Sei whales mostly inhabit continental shelf and slope waters far from the coastline. They winter at low latitudes, where they calve and nurse, and summer at high latitudes mainly between the subtropical and Antarctic convergences (between 40ºS and 50ºS), where they feed on a range of prey types, including: plankton (copepods and krill), small schooling fishes, and cephalopods.

7.3.2 Population Dynamics

Two sub-species of sei whale are recognized, *B. b. borealis* in the Northern Hemisphere and *B. b. schlegellii* in the Southern Hemisphere. There are no estimates of pre-exploitation abundance for the North Atlantic Ocean. Models indicate that total abundance declined from 42,000 to 8,600 individuals between 1963 and 1974 in the North Pacific Ocean. More recently, the North Pacific Ocean population was estimated to be 29,632 (95 percent confidence intervals 18,576 to 47,267) between 2010 and 2012 (IWC 2016; Thomas et al. 2016). In the Southern Hemisphere, pre-exploitation abundance is estimated at 65,000 whales, with recent abundance estimated at 9,800 to 12,000 whales. Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales.

Sei whales are distributed worldwide, occurring in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere. Based on genetic analyses, there appears to be some differentiation between sei whale populations in different ocean basins. An early study of allozyme variation at 45 loci found some genetic differences between Southern Ocean and the North Pacific sei whales (Wada and Numachi 1991). However, more recent analyses of mtDNA control region variation show no significant differentiation between Southern Ocean and the North Pacific sei whales, though both appear to be genetically distinct from sei whales in the North Atlantic (Baker and Clapham 2004; Huijser et al. 2018). Within ocean basins, there appears to be intermediate to high genetic diversity and little genetic differentiation despite there being different managed stocks (Danielsdottir et al. 1991; Huijser et al. 2018; Kanda et al. 2011; Kanda et al. 2006; Kanda et al. 2015; Kanda et al. 2013).

7.3.3 Vocalizations and Hearing

Data on sei whale vocal behavior is limited, but includes records off the Antarctic Peninsula of broadband sounds in the 100 to 600 Hertz range with 1.5 second duration and tonal and upsweep calls in the 200 to 600 Hertz range of one to three second durations (McDonald et al. 2005). Vocalizations from the North Atlantic Ocean consisted of paired sequences (0.5 to 0.8 seconds, separated by 0.4 to 1.0 seconds) of 10 to 20 short (4 milliseconds) frequency modulated sweeps between 1.5 to 3.5 kiloHertz (Thomson and Richardson 1995). (Tremblay et al. 2019) recorded 50 to 30-Hertz triplet and singlet downsweeps and 82 to 34-Hertz downsweeps from sei whales in the western North Atlantic, suggesting that sei whales may produce songs. Source levels of 189 ±5.8 dB re: 1 µPa at 1 meter have been established for sei whales in the northeastern Pacific Ocean (Weirathmueller et al. 2013).

Direct studies of sei whale hearing have not been conducted, but it is assumed that they can hear the same frequencies that they produce (low) and are likely most sensitive to this frequency range (Ketten 1997; Richardson et al. 1995). This suggests sei whales, like other baleen whales, are more likely to have their best hearing capacities at low frequencies, including frequencies lower than those of normal human hearing, rather than mid- to high-frequencies (Ketten 1997). In terms of functional hearing capability, sei whales belong to the low-frequency group, which have a hearing range of 7 Hertz to 35 kiloHertz (NMFS 2018).

7.3.4 Status

The sei whale is endangered because of past commercial whaling. Now, some individuals are taken each year by Japan. Current threats include vessel strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and anthropogenic sound. Given the species' overall abundance, they may be somewhat resilient to current threats. However, trends are largely unknown.

7.3.5 Status in the Action Area

Sei whales tend to be oceanic and not commonly found in shelf seas. In the southern hemisphere, they are rarely found as far south as blue, fin, and minke whales, with summer concentrations mainly between the subtropical and Antarctic convergences (between 40ºS and 50ºS). NMFS has previously estimated 626 sei whales south of 60°S, and an offshore density of 0.00025 whales per km^2 (Navy 2012) in the Amundsen Sea, Antarctica (NMFS 2020).

7.3.6 Critical Habitat

No critical habitat has been designated for the sei whale.

7.3.7 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover sei whale populations. These threats will be discussed in further detail in the *Environmental Baseline* section of this consultation. See the 2011 Final Recovery Plan for the sei whale for complete downlisting/delisting criteria for both of the following recovery goals:

1. Achieve sufficient and viable populations in all ocean basins.
2. Ensure significant threats are addressed.

7.4 Southern Right Whale

Southern right whales are a large baleen whale species distributed in the Southern Hemisphere generally from 20 to 60°S (Figure 11), occurring more frequently between 22 to 55°S. Southern right whales have been sighted as far south as 65°S.

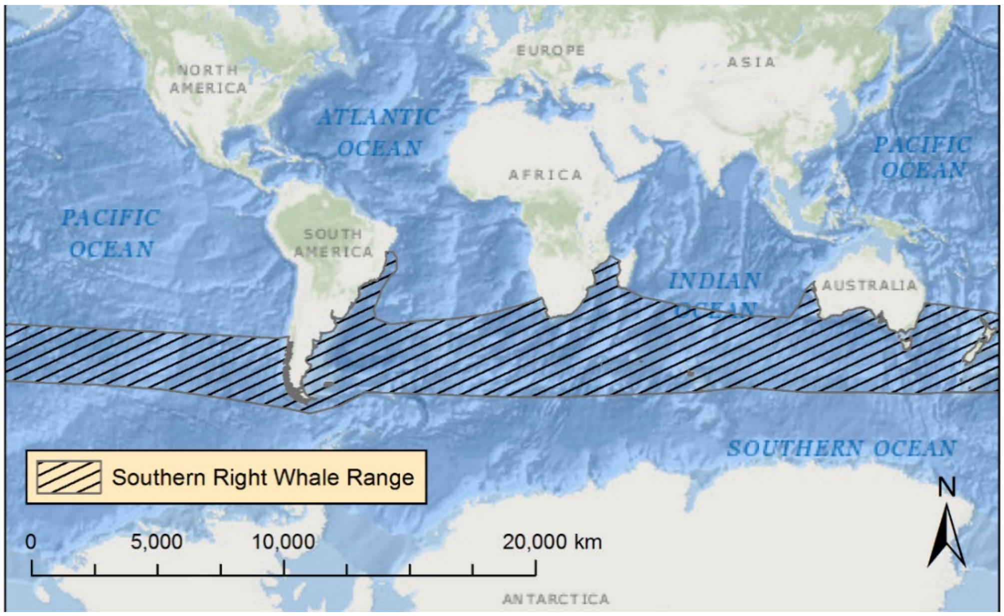


Figure 11. Map identifying the range of the endangered Southern right whale.

Southern right whales have a stocky, black body lacking a dorsal fin and a large head covered in callosities. They range in length between 13 to 17 m (43 to 56 ft), and weigh up to 54,431 kilograms (120,000 pounds). The Southern right whale was originally listed as endangered under the Endangered Species Preservation Act on December 2, 1970.

We used information in the 2015 Status Review (NMFS 2015a) to summarize the life history, population dynamics, and status of this species, as follows.

7.4.1 Life History

The lifespan of Southern right whales is currently unknown but likely similar to North Pacific and North Atlantic right whales that are believed to live around 50 years. Females usually give birth to their first calf between eight and ten years old and gestation takes approximately one year. Offspring wean at approximately one year of age, and females reproduce every three to four years. Southern right whales feed during austral summer in high latitude feeding grounds in the Southern Ocean, where they use their baleen to "skim" copepods and krill from the water. Mating likely occurs in winter in the low latitude breeding and calving grounds.

7.4.2 Population Dynamics

In 2010, there were an estimated 15,000 Southern right whales worldwide; this is over twice the species estimate of 7,000 in 1997. The population structure for southern right whales is uncertain, but some separation to the population level exists. Breeding populations can be delineated based on geographic region: South Africa, Argentina, Brazil, Peru and Chile, Australia, and New Zealand. Population estimates for all of the breeding populations are not available. There are about 3,500 southern right whales in the Australia breeding population, about 4,000 in Argentina, 4,100 in South Africa, and 2,169 in New Zealand. Other smaller southern right whale populations occur off Tristan da Cunha, South Georgia, Namibia, Mozambique and Uruguay, but not much is known about the population abundance of these groups.

The Australia, South Africa and Argentina breeding stocks of southern right whales are increasing at an estimated seven percent annually (Best 1990; Payne et al. 1990). Brazil breeding population is increasing, while the status of the Peru and Chile breeding population is unknown (NMFS 2015a). The New Zealand breeding population is showing signs of recovery; recent population modeling estimates the population growth rate at 5.6 percent (Davidson 2016). Juveniles in New Zealand show high apparent annual survival rates, between 0.87 and 0.95 percent (Carroll et al. 2016).

Mitochondrial DNA analysis of Southern right whales indicates at least 37 unique haplotypes and greater genetic diversity in the South Atlantic Ocean than in the Indo-Pacific (Patenaude et al. 2007). Females exhibit high site fidelity to calving grounds, restricting gene flow and establishing geographic breeding populations. Recent genetic testing reveals the possibility that individuals from different ocean basins are mixing on the Antarctic feeding grounds (Kanda et al. 2014).

Southern right whales are found in the Southern Hemisphere from temperate to polar waters. Southern right whales migrate between winter breeding areas in coastal waters of the South Atlantic, Pacific, and Indian Oceans from May to December and offshore summer (January to April) foraging locations in the Subtropical and Antarctic Convergence zones (Figure 11). In winter their habitat includes shallow, protected, and nearshore waters for calving and nursing off Australia, New Zealand, South America, Southern Africa, and various mid-oceanic islands. In summer, southern right whales feed in productive coastal and open ocean waters where they forage primarily on krill and copepods.

7.4.3 Vocalization and Hearing

Data on Southern right whale vocalizations indicates that they exhibit similar acoustic behavior to other right whales (Clark 1982; Matthews et al. 2001). Right whales vocalize to communicate over long distances and for social interaction, including communication apparently informing others of prey path presence (Biedron et al. 2005; Tyson and Nowacek 2005). Vocalization patterns amongst all right whale species are generally similar, with six major call types: scream, gunshot, blow, up call, warble, and down call (McDonald and Moore 2002; Parks and Tyack 2005). A large majority of vocalizations occur in the 300 to 600 Hertz range with up and down sweeping modulations (Vanderlaan et al. 2003). Vocalizations below 200 Hertz and above 900 Hertz were rare and calls tend to be clustered, with periods of silence between clusters (Vanderlaan et al. 2003). Gunshot bouts last 1.5 hours on average and up to seven hours (Parks et al. 2012a). Blows are associated with ventilation and are generally inaudible underwater (Parks and Clark 2007). Up calls are 100 to 400 Hertz (Gillespie and Leaper 2001). Gunshots appear to be largely or exclusively male vocalization (Parks et al. 2005b).

Smaller groups vocalize more than larger groups and vocalization is more frequent at night (Matthews et al. 2001). Moans are usually produced within 10 meters (33 feet) of the surface (Matthews et al. 2001). Up calls were detected year-round in Massachusetts Bay except July and August and peaking in April (Mussoline et al. 2012). Individuals remaining in the Gulf of Maine through winter continue to call, showing a strong diel pattern of up call and gunshot vocalizations from November through January possibly associated with mating (Bort et al. 2011; Morano et al. 2012; Mussoline et al. 2012). Estimated source levels of gunshots in non-surface active groups are 201 decibels re: 1 μPa peak-to-peak (Hotchkin et al. 2011). While in surface active groups, females produce scream calls and males produce up calls and gunshot calls as threats to other males; calves (at least female calves) produce warble sounds similar to their mothers' screams (Parks et al. 2003; Parks and Tyack 2005). Source levels for these calls in surface active groups range from 137 to 162 decibels re: 1 μPa-meter (root mean square), except for gunshots, which are 174 to 192 decibels re: 1 μPa-meter (root mean square) (Parks and Tyack 2005). Up calls may also be used to reunite mothers with calves (Parks and Clark 2007). Atlantic right whales shift calling frequencies, particularly of up calls, as well as increase call amplitude over both long and short term periods due to exposure to vessel noise (Parks and Clark 2007; Parks et al. 2005a; Parks et al. 2007a; Parks et al. 2011; Parks et al. 2010; Parks et al. 2012b; Parks et al. 2006), particularly the peak frequency (Parks et al. 2009). North Atlantic right whales respond to anthropogenic sound designed to alert whales to vessel presence by surfacing (Nowacek et al. 2003; Nowacek et al. 2004).

There is no direct data on the hearing range of Southern right whales. However, based on anatomical modeling, the hearing range for North Atlantic right whales is predicted to be from 10 Hertz to 22 kiloHertz with functional ranges probably between 15 Hertz to 18 kiloHertz (Parks et al. 2007b).

7.4.4 Status

Southern right whales underwent severe decline due to whaling during the 18th and 19th centuries (NMFS 2015a). In general, Southern right whale populations appear to be increasing at a robust rate. Nonetheless, the current population estimate (15,000) is still much less than the estimated 60,000 pre-whaling estimate (NHT 2005). Southern right whales are currently subject to many of the same anthropogenic threats other large whales face. In the Southern Hemisphere, southern right whales are by far the most vessel struck cetacean, with at least 56 reported instances; nearly four-fold higher than the second most struck large whale (Van Waerebeek et al. 2007). Additional threats include declines in water quality, pollutant exposure and near shore habitat degradation from development. Reproductive success is influenced by krill availability on the feeding grounds; therefore, climatic shifts that change krill abundance may hinder the recovery of Southern right whales (Seyboth et al. 2016). Because populations appear to be increasing in size, the species appears to be somewhat resilient to current threats, but it has not recovered to pre-exploitation abundance.

7.4.5 Status in the Action Area

Opportunistic sightings of Southern right whales from Peru, Chile and Antarctic waters, 172 sightings from 1964-2011 (IWC 2013), are concentrated during the winter and autumn off Peru and north and central Chile. Records during the winter and spring are concentrated in southern Chile and the western Antarctic Peninsula. Reilly et al. (2004) reported an estimated abundance of 1755 Southern right whales from a survey that included portions of the Antarctic Peninsula and the Scotian Sea. Williams et al. (2006) estimated the density of southern right whales in near the tip of the Antarctic Peninsula and in the Scotia Sea to be 0.0004 animals/km^2.

7.4.6 Critical Habitat

No critical habitat has been designated for the Southern right whale. NMFS cannot designate critical habitat in foreign waters.

7.4.7 Recovery Goals

NMFS has not prepared a Recovery Plan for the Southern right whale. In general, ESA-listed species that occur entirely outside U.S. jurisdiction are not likely to benefit from recovery plans (55 FR 24296; June 15, 1990).

7.5 Sperm Whale

The sperm whale is widely distributed and found in all major oceans (Figure 12).

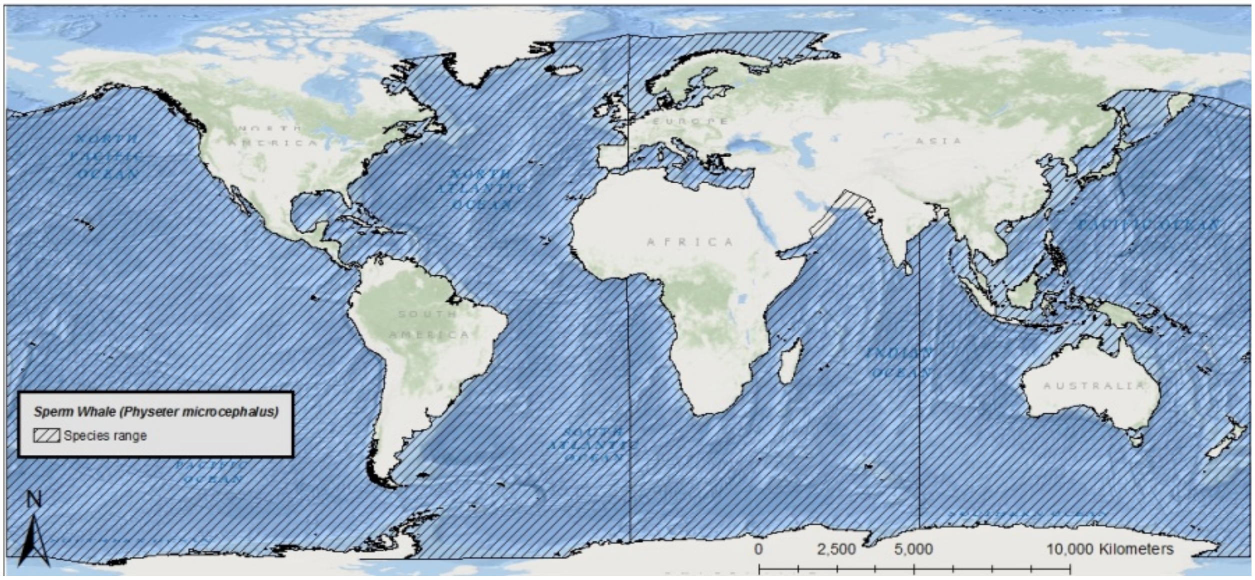


Figure 12. Map identifying the range of the endangered sperm whale.

The sperm whale is the largest toothed whale and distinguishable from other whales by its extremely large head, which takes up 25 to 35 percent of its total body length, and a single blowhole asymmetrically situated on the left side of the head near the tip. The sperm whale was originally listed as endangered on December 2, 1970.

Information available from the recovery plan (NMFS 2010a), recent stock assessment reports (Carretta et al. 2018; Hayes et al. 2018; Muto et al. 2018), and status review (NMFS 2015b) were used to summarize the life history, population dynamics and status of the species as follows.

7.5.1 Life History

The average lifespan of sperm whales is estimated to be at least 50 years (Whitehead 2009). They have a gestation period of one to one and a half years, and calves nurse for approximately two years, though they may begin to forage for themselves within the first year of life (Tønnesen et al. 2018). Sexual maturity is reached between seven and 13 years of age for females with an average calving interval of four to six years. Male sperm whales reach full sexual maturity in their 20s. Sperm whales mostly inhabit areas with a water depth of 600 meters (1,968 feet) or more, and are uncommon in waters less than 300 meters (984 feet) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish (including teleosts and elasmobranchs).

7.5.2 Population Dynamics

The sperm whale is the most abundant of the large whale species, with total abundance estimates between 200,000 and 1,500,000. The most recent estimate indicated a global population of between 300,000 and 450,000 individuals (Whitehead 2009). The higher estimates may be approaching population sizes prior to commercial whaling, the reason for ESA listing. There is insufficient data to evaluate a population growth rates of sperm whales at this time.

Ocean-wide genetic studies indicate sperm whales have low genetic diversity, suggesting a recent bottleneck, but strong differentiation between matrilineally related groups (Lyrholm and Gyllensten 1998). Consistent with this, two studies of sperm whales in the Pacific Ocean indicate low genetic diversity (Mesnick et al. 2011; Rendell et al. 2012). Furthermore, sperm whales from the Gulf of Mexico, the western North Atlantic Ocean, the North Sea, and the Mediterranean Sea all have been shown to have low levels of genetic diversity (Engelhaupt et al. 2009). As none of the stocks for which data are available have high levels of genetic diversity, the species may be at some risk to inbreeding and 'Allee' effects, although the extent to which is currently unknown.

Sperm whales have a global distribution and can be found in relatively deep waters in all ocean basins. While both males and females can be found in latitudes less than 40 degrees, only adult males venture into the higher latitudes near the poles.

7.5.3 Vocalizations and Hearing

Sound production and reception by sperm whales are better understood than in most cetaceans. Recordings of sperm whale vocalizations reveal that they produce a variety of sounds, such as clicks, gunshots, chirps, creaks, short trumpets, pips, squeals, and clangs (Goold 1999). Sperm whales typically produce short duration repetitive broadband clicks with frequencies below 100 Hertz to greater than 30 kiloHertz (Watkins 1977) and dominant frequencies between 1 to 6 kiloHertz and 10 to 16 kiloHertz. Another class of sound, "squeals," are produced with frequencies of 100 Hertz to 20 kiloHertz (e.g., Weir et al. 2007). The source levels of clicks can reach 236 dB re: 1 μPa at 1 meter, although lower source level energy has been suggested at around 171 dB re: 1 μPa at 1 meter (Goold and Jones 1995; Mohl et al. 2003; Weilgart and Whitehead 1993; Weilgart and Whitehead 1997). Most of the energy in sperm whale clicks is concentrated at around 2 to 4 kiloHertz and 10 to 16 kiloHertz (Goold and Jones 1995; Weilgart and Whitehead 1993). The clicks of neonate sperm whales are very different from typical clicks of adults in that they are of low directionality, long duration, and low frequency (between 300 Hertz and 1.7 kiloHertz) with estimated source levels between 140 to 162 dB re: 1 μPa at 1 meter (Madsen et al. 2003). The highly asymmetric head anatomy of sperm whales is likely an adaptation to produce the unique clicks recorded from these animals (Norris and Harvey 1972).

Long, repeated clicks are associated with feeding and echolocation (Goold and Jones 1995; Miller et al. 2004; Weilgart and Whitehead 1993; Weilgart and Whitehead 1997; Whitehead and Weilgart 1991). Creaks (rapid sets of clicks) are heard most frequently when sperm whales are foraging and engaged in the deepest portion of their dives, with inter-click intervals and source levels being altered during these behaviors (Laplanche et al. 2005; Miller et al. 2004). Clicks are also used during social behavior and intragroup interactions (Weilgart and Whitehead 1993). When sperm whales are socializing, they tend to repeat series of group-distinctive clicks (codas), which follow a precise rhythm and may last for hours (Watkins and Schevill 1977). Codas are shared between individuals in a social unit and are considered to be primarily for intragroup communication (Rendell and Whitehead 2004; Weilgart and Whitehead 1997). Research in the South Pacific Ocean suggests that in breeding areas the majority of codas are produced by mature females (Marcoux et al. 2006). Coda repertoires have also been found to vary geographically and are categorized as dialects (Pavan et al. 2000; Weilgart and Whitehead 1997). For example, significant differences in coda repertoire have been observed between sperm whales in the Caribbean Sea and those in the Pacific Ocean (Weilgart and Whitehead 1997). Three coda types used by male sperm whales have recently been described from data collected over multiple years: these codas are associated with dive cycles, socializing, and alarm (Frantzis and Alexiadou 2008).

Our understanding of sperm whale hearing stems largely from the sounds they produce. The only direct measurement of hearing was from a young stranded individual from which AEP tests were recorded (Carder and Ridgway 1990). From this whale, responses support a hearing range of 2.5 to 60 kiloHertz and highest sensitivity to frequencies between 5 to 20 kiloHertz. Other hearing information consists of indirect data. For example, the anatomy of the sperm whale's inner and middle ear indicates an ability to best hear high-frequency to ultrasonic hearing (Ketten 1992). The sperm whale may also possess better low-frequency hearing than other odontocetes, although not as low as many baleen whales (Ketten 1992). Reactions to anthropogenic sounds can provide indirect evidence of hearing capability, and several studies have made note of changes seen in sperm whale behavior in conjunction with these sounds. For example, sperm whales have been observed to frequently stop echolocating in the presence of underwater pulses made by echosounders and submarine sonar (Watkins et al. 1985; Watkins and Schevill 1975). In the Caribbean Sea, Watkins et al. (1985) observed that sperm whales exposed to 3.25 to 8.4 kiloHertz pulses (presumed to be from submarine sonar) interrupted their activities and left the area. Similar reactions were observed from artificial sound generated by banging on a boat hull (Watkins et al. 1985). André et al. (1997) reported that foraging whales exposed to a 10 kiloHertz pulsed signal did not ultimately exhibit any general avoidance reactions: when resting at the surface in a compact group, sperm whales initially reacted strongly, and then ignored the signal completely (André et al. 1997). Aaron et al. (2007) observed that the acoustic signal from the cavitation of a fishing vessel's propeller (110 dB re: 1 μPa^2-second between 250 Hertz and one kiloHertz) interrupted sperm whale acoustic activity and resulted in the animals converging on the vessel. Sperm whales have also been observed to stop vocalizing for brief periods when codas are being produced by other individuals, perhaps because they can hear better when not vocalizing themselves (Goold and Jones 1995). Because they spend large amounts of time at depth and use low frequency sound, sperm whales are likely to be susceptible to low frequency sound in the ocean (Croll et al. 1999). Nonetheless, sperm whales are considered to be part of the mid-frequency marine mammal hearing group, with a hearing range between 150 Hertz and 160 kiloHertz (NMFS 2018).

7.5.4 Status

The sperm whale is endangered because of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer allowed; however, illegal hunting may occur. Continued threats to sperm whale populations include vessel strikes, entanglement in fishing gear, competition for resources due to overfishing, loss of prey and habitat due to climate change, and sound. The species' large population size shows that it is somewhat resilient to current threats.

7.5.5 Status in the Action Area

Sperm whales encountered in Antarctic waters would expected to be male, as females do not venture into high latitudes. They are most likely to be sighted in productive waters, such as those along the edges of continental shelves. An abundance of 12,069 has been estimated for sperm whales south of 60°S (NMFS 2015b). Based on data reported by Santora et al. (2009) the density of sperm whales in the vicinity of the Antarctic Peninsula is 0.0006 whales per km^2 and is estimated to be 0.01699 per km^2 for the Amundsen and South Bellingshausen seas (Ainley et al. 2007).

7.5.6 Critical Habitat

No critical habitat has been designated for the sperm whale.

7.5.7 Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover sperm whale populations. These threats will be discussed in further detail in the *Environmental Baseline* section of this consultation. See the 2010 Final Recovery Plan for the sperm whale for complete downlisting/delisting criteria for both of the following recovery goals:

1. Achieve sufficient and viable populations in all ocean basins.
2. Ensure significant threats are addressed.

8 ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the ESA-listed species or its designated critical habitat in the action area, without the consequences to the ESA-listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to ESA-listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 C.F.R. §402.02).

The subsections of this Environmental Baseline section discuss natural phenomena and human activities that contribute to the status of the ESA-listed marine mammals in the action area. Whaling occurred extensively in the past, but the effects of those past reductions in numbers can persist in current populations. The following discussion summarizes impacts that include: climate change, whaling, vessel interactions and tourism, fisheries interactions, pollution, and scientific research activities. Activities by the petroleum industry and the military can be significant sources of potential stress to ESA-listed marine species in general, but the Antarctic Treaty and its Protocol on Environmental Protection designate Antarctica as a natural reserve, devoted to "peace and science," prohibiting such activities.

8.1 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Climate change effects include, changes in air and water temperatures, changes in precipitation and drought patterns, increased frequency and magnitude of severe weather events, and sea level rise; all of which are likely to impact ESA resources. Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (Doney et al. 2012). NOAA's climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://climate.gov).

Globally, there are more frequent heatwaves in most land regions and an increase in the frequency and duration of marine heatwaves (IPCC 2018). All ocean basins have experienced significant warming since 1998, with the greatest warming in the southern oceans, the tropical/subtropical Pacific Ocean, and the tropical/subtropical Atlantic Ocean (Cheng et al. 2017).

Sea ice coverage and duration has been rapidly decreasing in the polar regions. Palmer Station sea ice records indicate that the seasonal duration of sea ice has decreased by an average of 92 days, or approximately three months, for the time period from 1979-2012 (Ducklow et al. 2013).

Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure (Evans and Bjørge 2013; IPCC 2014; Kintisch 2006; Learmonth et al. 2006; MacLeod et al. 2005; McMahon and Hays 2006; Robinson et al. 2005). Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012).

Climate-related changes in important prey species' populations are likely to affect predator populations. For example, blue whales, as predators that specialize in eating krill, are likely to change their distribution in response to changes in the distribution of krill (Clapham et al. 1999; Payne et al. 1986; Payne et al. 1990). Pecl and Jackson (2008) predicted climate change will likely result in squid that hatch out smaller and earlier, undergo faster growth over shorter life spans, and mature younger at a smaller size. This could have negative consequences for species such as sperm whales, whose diets can be dominated by cephalopods. For ESA-listed species that undergo long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperatures regimes, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott 2009).

As carbon dioxide concentrations increase in the atmosphere, more carbon dioxide is absorbed by the oceans, causing lower pH and reduced availability of calcium carbonate. Because of the increase in carbon dioxide in the atmosphere since the Industrial Revolution, ocean acidity has increased by 26 percent since the beginning of the industrial era and is predicted to increase considerably between now and 2100 throughout the world's oceans (IPCC 2014). Ocean acidification negatively affects organisms such as crustaceans, crabs, mollusks, and other calcium carbonate-dependent organisms such as pteropods (free-swimming pelagic sea snails and sea slugs). Broad impacts to zooplankton populations can result in a potential cascading reduction of prey at various levels of the food web, thereby reducing the availability of the larger prey items of marine mammals.

8.2 Whaling

Prior to current prohibitions on whaling, most large whale species were significantly depleted to the extent that it was necessary to list them as endangered under the Endangered Species Preservation Act of 1966. In 1982, the IWC issued a moratorium on commercial whaling beginning in 1986. There is currently no legal commercial whaling by IWC Member Nations party to the moratorium; however, whales are still killed commercially by countries that field objections to the moratorium (i.e., Iceland and Norway) and by Japan, which has withdrawn from the IWC.[2] Three types of whaling have taken place in recent years: (1) aboriginal subsistence whaling to support the needs of indigenous people; (2) special permit whaling; and (3) commercial whaling conducted either under objection or reservation to the moratorium. The reported catch of and catch limits on large whale species from aboriginal subsistence whaling, special permit whaling, and commercial whaling can be found on the IWC's website at: https://iwc.int/whaling.

Prior to withdrawal from the IWC in 2019, Japan conducted a whaling program utilizing scientific permits in the Southern Ocean waters around Antarctica that targeted minke whales. That program has ceased since the withdrawal, and now Japan conducts commercial whaling in their territorial waters and Exclusive Economic Zone.[3] There is currently no commercial whaling known to occur in the waters of the Southern Ocean by any nation.

Four IWC member countries conduct aboriginal subsistence hunts today: Denmark (Greenland), Russia (Chukotka), St Vincent and the Grenadines (Bequia) and the United States (Alaska). There are no subsistence whale hunts known to occur near Antarctica.

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[2] https://iwc.int/statement-on-government-of-japan-withdrawal-from-t (Accessed 8/28/20)

[3] https://www.bbc.com/news/world-asia-48592682 (Accessed 3/29/21)

8.3 Vessel Strike

Vessel strikes are a serious and widespread threat to ESA-listed marine mammals, especially for large whales (Pirotta et al. 2019). All sizes and types of vessels can hit whales, but most lethal and severe injuries are caused by vessels 80 meters (262.5 feet) or longer (Laist et al. 2001). Studies show that the probability of fatal injuries for whales from vessel strikes increases as vessels operate at speeds above 26 kilometers per hour (14 knots) (Laist et al. 2001). This dangerous interaction is increasing as whale populations recover and expand, and commercial shipping lanes cross important breeding and feeding habitats (Swingle et al. 1993; Wiley et al. 1995). Global commercial shipping traffic primarily occurs in the northern hemisphere (Rodrigue 2020) and the proposed action area is remote from any sizable human population in the southern hemisphere, so there are no commercial shipping routes nearby.

8.4 Tourism

Tourism to Antarctica has become increasingly popular and the vast majority of visitors go by cruise ship. The International Association of Antarctica Tour Operators (IAATO) reported that 74,401 visitors traveled to Antarctica during the 2019/20 season that coincides with austral summer.[4] Most cruises depart from one of the gateway ports in southern South America, such as Ushuaia (Argentina) and Punta Arenas (Chile), and head to the northwestern portion of the Antarctic Peninsula that is known to be scenic and have abundant wildlife. Whale watching is a popular part of the tourism cruise activities.

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, whale watching is not without potential negative impacts (reviewed in Parsons 2012). Whale watching has the potential to harass whales by altering feeding, breeding, and social behavior, or even injure them if the vessel gets too close or strikes the animal. Preferred habitats may be abandoned if disturbance levels are too high. Animals may also become more vulnerable to vessel strikes if they habituate to vessel traffic (Swingle et al. 1993; Wiley et al. 1995).

Several studies have examined the short-term effects of whale watching vessels on marine mammals (Au and Green 2000; Corkeron 1995; Erbe 2002; Felix 2001; Magalhaes et al. 2002; Richter et al. 2003; Scheidat et al. 2004; Simmonds 2005; Watkins 1986; Williams et al. 2002). A whale’s behavioral responses to whale watching vessels depended on the distance of the vessel from the whale, vessel speed, vessel direction, vessel sound, and the number of vessels. In some circumstances, whales do not appear to respond to vessels, but in other circumstances, whales change their vocalizations, surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions. Disturbance by whale

[4] https://iaato.org/ (Accessed 3/30/21)

watch vessels has also been noted to cause newborn calves to separate briefly from their mother's sides, which leads to greater energy expenditures by the calves (NMFS 2006c).

Although numerous short-term behavioral responses to whale watching vessels were documented, little information is available on whether long-term negative effects result from whale watching (NMFS 2006c). Christiansen et al. (2014) estimated the cumulative time minke whales spent with whale watching boats in Iceland to assess the biological significance of whale watching disturbances and found that, through some whales were repeatedly exposed to whale watching boats throughout the feeding season, the estimated cumulative time they spent with boats was very low. Christiansen et al. (2014) suggested that the whale watching industry, in its current state, is likely not having any long-term negative effects on energy expenditure as inferred from observed respiration rates.

It is difficult to quantify the impact or estimate the risk posed to marine mammals in the action area from vessel approaches associated with whale watching activities. The IAATO has established guidelines for tour operators to follow while whale watching that are similar to those used in the U.S., such as reducing vessel speed, maintaining a minimum distance of 100 m, not chasing or pursuing, etc.[5]

8.5 Fisheries Interactions

In excess of 97 percent of cetacean entanglement is caused by derelict fishing gear (Baulch and Perry 2014b) and is a frequently documented source of human-caused mortality for cetaceans (see Dietrich et al. 2007). Marine mammals are also known to ingest fishing gear, which can lead to fitness consequences and mortality. Necropsies of stranded whales have found that ingestion of net pieces, ropes, and other fishing debris has resulted in gastric impaction and ultimately death (Jacobsen et al. 2010b).

In addition to these direct impacts, cetaceans may also be subject to indirect impacts from fisheries. Marine mammals probably consume at least as much fish as is harvested by humans (Kenney et al. 1985). Many cetacean species (particularly fin and humpback whales) are known to feed on species of fish that are harvested by humans (Carretta et al. 2016). Thus, competition with humans for prey is a potential concern. Reductions in prey populations, whether natural or human-caused, may affect the survival and recovery of ESA-listed marine mammal populations. Even species that do not directly compete with human fisheries could be indirectly affected by fishing activities through changes in ecosystem dynamics.

The Commission on the Conservation of Antarctic Marine Living Resources, which began after the signing of the Convention on the Conservation of Antarctic Marine Living Resources in 1980, is charged with determining the rules for fishing in the Southern Ocean. Active fisheries in

[5] https://iaato.org/wp-content/uploads/2020/04/IAATO_Cetacean_Guidelines.EN_072250.pdf (Accessed 3/30/21)

the Convention Area (Figure 13) currently target Patagonian toothfish (*Dissostichus eleginoides*), Antarctic toothfish (*Dissostichus mawsoni*), and Antarctic krill (*Euphausia superba*).[6]

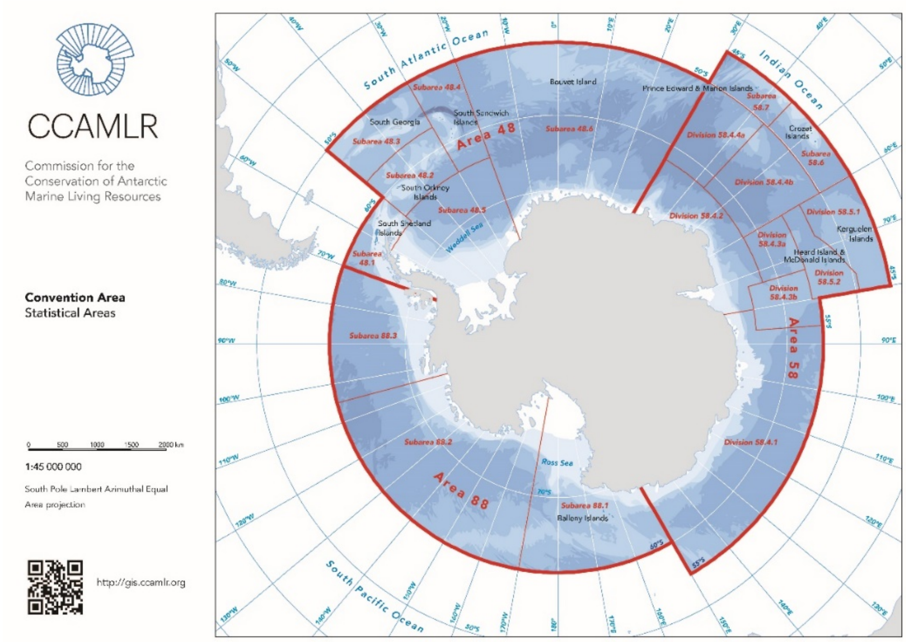

Figure 13. Statistical areas of the Convention on the Conservation of Antarctic Marine Living Resources.

Krill is a keystone species in the Antarctic ecosystem, supporting a range of predatory fish, birds, and mammals. Krill is an important prey item for large baleen whales, most notably for blue whales. Most of the krill caught in the commercial fisheries is used for aquaculture feed but has become increasingly utilized for krill oil in human health supplements (Xie et al. 2019). The Commission on the Conservation of Antarctic Marine Living Resources prioritizes the sustainable management of the krill fishery by setting conservative catch limits.

The toothfish fishery uses longlines in the sub-Antarctic and into the Antarctic region of the Southern Ocean. These operations are subject to depredation interactions (e.g., consuming caught fish from the hooks) by toothed whales, primarily from sperm whales and killer whales (*Orcinus orca*). The relatively high interaction rate for sperm whales, 31.6% of all hauled longlines studied by Tixier et al. (2019), is a conservation threat due to risk of injury or mortality from fishing gear and operators. Toothfish gets a high value marketed as Chilean seabass and has been subject to illegal (unreported and unregulated) fishing which raises concerns about lack of compliance with conservation and environmental regulations.[7]

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[6] https://www.ccamlr.org/en/fisheries/fisheries Accessed 4/7/21
[7] https://www.bbc.com/future/article/20190213-the-dramatic-hunt-for-the-fish-pirates-exploiting-our-seas Accessed 7/27/21.

Studies of toothed whales interacting with longline fisheries have focused on the economic effects of lost catch and the reporting of harm to the whales is scarce. A review of available information across multiple longline fisheries found bycatch rates across multiple species of toothed whales to be highly variable, between 0.002 and 0.231 individuals killed per set of gear deployed (Hamer et al. 2012).

8.6 Pollution

Despite the remote location of the Antarctic Peninsula, pollution does affect the region. One recent study estimated a mean concentration of 1,794 plastic items per square km (0.4 square mi) in the marine environment surrounding the Antarctic Peninsula (Lacerda et al. 2019). The same study also found paint fragments in the marine environment in quantities that were approximately 30 times greater than that of plastics (Lacerda et al. 2019).

Oil spills have occurred in the region, although they are rare. In 1989, the ship *Bahia Paraiso* sank in Arthur Harbor, roughly 2 km (1.2 mi) from Palmer Station, spilling approximately 600,000 liters (158,503 gallons) of arctic diesel fuel (Kennicutt et al. 1992; Harris et al. 2015). This spill affected the nearshore marine environment for several years following the accident (Harris et al. 2015).

8.7 Scientific Research Activities

There have been marine seismic research surveys conducted around Antarctica in the recent past. The closest scientific research activities that we are aware of in the region of the action area, will be conducted by the NMFS Southwest Fisheries Science Center's Antarctic Ecosystem Research Division, starting in 2021 into 2026. As a part of the Antarctic Living Marine Resources Program, autonomous underwater vehicles (i.e., long-range hybrid gliders) will measure the hydrography and productivity, such as acoustic estimates of krill biomass, along the west shelf of the Antarctic Peninsula region and in the Bransfield Strait. There are no effects expected to ESA-listed resources in the action area during this research project.

8.7.1 Seismic Surveys

Seismic survey activities involving towed airgun arrays generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are the primary exploration technique to locate deposits, fault structure, and geological hazards (NRC 2003). Most of the energy from the airguns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235 to 240 dB at dominant frequencies of five to 300 Hertz (NRC 2003). These activities can produce noise that could impact ESA-listed species (NMFS 2018). Most of the sound energy is at frequencies below 500 Hertz, which is within the hearing range of baleen whales.

The NSF has funded and conducted low-energy seismic surveys in the waters around Antarctica, most recently in 2020 in the Amundsen Sea and prior to that in the Ross Sea in 2015. Those surveys were issued IHAs under the MMPA and underwent formal ESA section 7 consultation. Only the potential for harassment and no injury was expected for ESA-listed cetaceans. The potential for harassment included sound that could emanate for icebreaking activities. Authorizations specified the conditions for operations, including mitigation measures to minimize adverse effects to protected species, and monitoring.

8.8 Synthesis of Environmental Baseline Impacts

Collectively, the stressors described above have had, and will continue to have, impacts on ESA-listed cetaceans that occur in the Antarctic. Assessing the aggregate impacts on these cetaceans across the baseline of stressors considered in this opinion is difficult. Due to the Antarctic Treaty prohibiting activities, there do not seem to be a great amount of stressor sources and most seem to equate to potential harassment and not lethal effects. Bycatch of sperm whales in toothfish longline fisheries is a noted exception.

We consider the best indicator of the aggregate baseline impact on ESA-listed species to be the status and trends of those species. A review of the status and trends of each species are discussed in the *Status of Species Likely to be Adversely Affected* section of this opinion.

Among the baseline sources of impacts, climate change is expected to have effects on productivity dynamics, which can have a fundamental influence on a species' health. Climate change may also influence commercial fisheries occurrence, through expansion into areas that were once restricted due to ice cover. Tourism seems poised to keep growing and the increase in traffic could bring about consequences to wildlife in general, but particularly for large whales, including harassment and potential collisions.

9 EFFECTS OF THE ACTION

"Effects of the action" is defined as all consequences to ESA-listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 C.F.R. §402.02).

This section follows the exposure and response analysis framework described in Section 2. The effects analyses describe the potential stressors associated with the proposed action that are considered likely to adversely affect ESA-listed species, the probability of individuals of ESA-listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. For any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, or lifetime reproductive success), we then consider the risk posed to the viability of the population(s) those individuals comprise and to the ESA-listed species those populations represent. For this consultation, we are particularly concerned about behavioral and stress-related physiological disruptions and potential unintentional mortality that may result in animals that fail to feed, reproduce, or survive because these responses could have population-level consequences. The purpose of this assessment and, ultimately, of this consultation is to determine if it is reasonable to expect the proposed action to have effects on ESA-listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

9.1 Stressors Not Likely to Adversely Affect

We evaluated the potential stressors and determined those in the following subsections are not likely to have adverse consequences to ESA-listed species, and therefore are not analyzed further in this opinion. Stressors anticipated to have adverse consequences are identified in Section 9.2.

9.1.1 Fuel Spills

This project has the potential to release diesel fuel into the environment. This potential spill hazard will be minimized by following established best practices such as ensuring spill containment and response materials are in place.

Construction vehicles and equipment would adhere to the guidance detailed in the Antarctic Specially Managed Area No. 7 Management Plan, including taking steps to prevent the accidental release of fuel or chemicals and ensure that spill kits are available and secondary containment units are used. Safety measures to be utilized include proper storage of all chemical and petroleum products and regular inspections of equipment, hoses, and fuel storage containers. Waste Regulations (45 C.F.R. Part 671) would be followed, including regular inspections of storage containers.

The Contractor anticipates two major fueling events over the course of construction. Each event is expected to transfer approximately 37,854 liters (100,000 gallons) of diesel fuel. The transfer would occur by running a hose between the support vessel and the deck of the barge. Refueling is anticipated to occur over two days at a rate of 1,211 liters (320 gallons) per minute. During this time, no work would be conducted from the barge in order to observe necessary safety protocols and ensure fueling operations are conducted properly. Secondary containment would be utilized for all fuel storage and fueling activities and spill response material would be located and available for immediate deployment. Spill response material would include absorbent pads, socks, protective gear, and a rope mop skimmer. Antarctic Support Contract trained staff will be on-site to provide fuel spill response, including installing a 152.4 m (500 ft) boom as a precautionary measure prior to fuel transfer.

The established best practices makes the risk of a fuel spill very low, and the ability to ensure spill containment further reduces any chance of potential impacts to the ESA-listed cetaceans. Therefore, risk from a fuel spill is so low, it is considered discountable, and not likely to adversely affect ESA-listed species.

9.1.2 Vessel Strike

The project will have a construction barge (121.9 m by 30.4 m) that will bring supplies and equipment. There will be a tugboat (27.7 m by 9.1 m) serving as a support vessel that will remain in Hero inlet for the duration of the project. Upon arrival at the site, the construction barge will be moored against the existing pier using soft lines. Once moored, anchors will be deployed to further secure the barge. The pier replacement work will largely be performed by two cranes, one based on land and one based on the barge.

The majority of vessel strikes of large whales occur when vessels are traveling at speeds greater than approximately 18.5 kilometers per hour (10 knots), with faster travel, especially of large vessels (80 meters [262.5 feet] or greater), being more likely to cause serious injury or death (Conn and Silber 2013; Jensen and Silber 2004; Laist et al. 2001; Vanderlaan and Taggart 2007).

The project support vessel speed would be limited to 5-10 knots for maneuvering close to shore. If a whale is sighted in the project area, the support vessel will maintain a distance of 92 m (300 feet) or greater between the whale and the vessel. If the distance between the support vessel and a whale is ever less than 92 m, the vessel will reduce speed and shift the engine to neutral until the whale clears out of the area.

Considering the barge will be secured in place to serve as a crane operations platform and the tugboat will have limited and relatively slow movements for most of the project, there seems to be very limited risk of a strike to ESA-listed cetaceans. The use of safety avoidance measures further reduces the very limited risk of an impact. Risk from a vessel strike is so low, it is considered discountable, and not likely to adversely affect ESA-listed species.

9.1.3 Anode Installation Noise

The project design includes installation of anode corrosion protection for the major submerged steel components. The installation of aluminum alloy sacrificial anodes, to protect the major submerged steel components from corrosion, below the waterline involves welding by divers. This activity would occur only after pile installation is complete. Divers will likely also use a hydrogrinder during anode installation. The U.S. Navy has assessed diver exposure to the use of a hydrogrinder through underwater measurements (Wolgemuth et al. 2008). The Navy measurements were reported in 1/1-octave frequency bands from 125 to 8,000 Hertz for the helmet position that was assumed to be 0.5 to 1 m from the hydraulic grinder operation. The overall unweighted sound level was computed to be 167.5 dB at 0.5 to 1 m. Source sound levels in this report are provided for 10 m distances. Since this is a point source of sound, spherical spreading 20 Log TL coefficient results in a source sound level of 142 to 148 dB at 10 m. A value of 146 dB at 10 m was used to estimate takes associated with this tool, and the area with sound that breaches any acoustic thresholds (see Exposure Analysis section for thresholds) is so small, that only a few takes of pinnipeds by harassment were estimated. Cetaceans are not expected to be exposed to stress from the hydrogrinder noise and therefore that sound source is not likely to adversely affect ESA-listed species and not considered further in this opinion.

9.2 Stressors Likely to Adversely Affect

The primary concern for stressor exposure to ESA-listed species from the proposed action is from underwater sound that has potential to disrupt behavioral patterns or even cause injury. The greatest source of underwater noise would be from pile driving. An acoustic assessment was prepared for the project, which identified and analyzed the in-water noise impacts from three different possible methods of pile driving: vibratory hammer, impact hammer, and DTH drilling. Vibratory hammers produce vertical vibrations that are transferred through the pile to the ground, which reduces friction and allows the pile to be driven into or out of the ground. The vibratory hammer will be used to remove the template construction piles and sheet piles associated with the existing pier but not to install new structural piles. DTH drilling uses an attachment at the end of a drill to break up rock into small flakes, allowing the pile to be driven into the ground. Impact hammers work like a traditional hammer and drop a heavy weight from a height onto the top of the pile, forcing it into the ground. The impact hammer may be used at the end of the pile driving process to firmly seat the pile in the hole. Rock chipping may be utilized to prepare the sea bottom at pile locations to ensure accurate pile location and alignment. In-water rock chipping may also be utilized for bedrock excavation associated with construction of the retaining wall. Rock chipping was not analyzed separately in the acoustic assessment because the area of ensonification for pile driving is larger than for rock chipping and both activities would occur on the same day.

Mitigation measures associated with the proposed action, such as soft start and shutdown procedures, are designed to minimize effects that may result from noise during the demolition and construction activities. However, even with the mitigation measures, sound fields produced by the pile driving activities are considered a potential stressor that is likely to affect ESA-listed species within the action area. The potential stress from the acoustic disturbance created by the demolition and construction activities is analyzed in further detail in the following sections.

9.3 Exposure and Response Analysis

The *Exposure Analysis* identifies, as possible, the number, age (or life stage), and sex of the individuals that are likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent. The *Response Analysis* evaluates the available evidence to determine how individuals of those ESA-listed cetaceans are likely to respond given their probable exposure.

9.3.1 Take, Harm and Harassment

Section 3 of the ESA defines 'take' as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Take can be lethal or sublethal. Lethal take is expected to result in mortality, which could be immediate, imminent, or delayed. Sublethal take is when effects of the action are below the level expected to cause death, but are expected to cause injury, harm, or harassment. Harm, as defined by regulation (50 C.F.R.

§222.102), includes acts that actually kill or injure wildlife and acts that may cause significant habitat modification or degradation that actually kill or injure fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding, or sheltering. Thus, for sublethal take, we are concerned with harm that does not result in mortality but is still likely to injure an animal.

Under the MMPA (16 U.S.C. §1361 et seq.), take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 U.S.C. §1362(13)), and under regulation (50 C.F.R. §216.3) it is further defined as "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal."

Harassment is defined under the MMPA as any act of pursuit, torment, or annoyance which:

- Has the potential to injure a marine mammal or marine mammal stock in the wild (designated as Level A harassment); or
- 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 (designated as Level B harassment).

NMFS has not defined "harass" under the ESA by regulation. However, on October 21, 2016, NMFS issued interim guidance on the term "harass," defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." The guidance also states that our "interim ESA harass interpretation does not specifically equate to MMPA Level A or Level B harassment, but shares some similarities with both levels in the use of the terms 'injury/injure' and a focus on a disruption of behavior patterns".

The NSF and the Permits Division estimate the exposure to sounds from the demolition and construction activities that will result in take, as defined under the MMPA, for all marine mammal species, including those listed under the ESA. Consultations with ESA-listed marine mammal species that involve an IHA have historically relied on MMPA Level B harassment in estimating the number of instances of harassment of ESA-listed marine mammals and estimates of MMPA Level A harassment have been considered instances of harm and/or injury under the ESA depending on the nature of the effects. This is a conservative approach given the differences between the MMPA and ESA standards for harassment because there may be circumstances in which an act is considered harassment, and thus take, under the MMPA but does not rise to the level of take under the ESA. The MMPA Level B harassment exposure estimates do not differentiate between the types of behavioral responses, nor do they address the potential fitness or other biological consequences of the responses on the affected individuals. In our response, we consider the best available scientific evidence to determine the likely nature of these behavioral responses and their potential fitness consequences in accordance with "take" related to harm or harassment under the ESA for ESA-listed species.

9.3.2 Exposure Analysis

Our exposure analysis has two basic components: (1) information on species distribution (i.e., density or occurrence within the action area), and (2) information on the level of sound exposure (i.e., acoustic thresholds) to those species. Estimating the potential exposure of animals to acoustic stressors can be difficult when there is limited information on overall animal abundance and density in the action area, the temporal and spatial location of animals, and proximity to and duration of exposure to the sound source. We evaluate the best data and information available in order to reduce the level of uncertainty during exposure analysis.

The NSF provided a noise assessment that estimated the area that may be ensonified by underwater noise during construction and demolition activities. They also provided a marine mammal assessment in their consultation initiation package that included information on the potential for marine mammals to occur in the action area.

Whale densities

Density data for the ESA-listed cetaceans in this consultation are limited for the remote action area location of Antarctica. We reviewed available cetacean densities with NSF and the Permits Division and agreed upon which densities constituted the best available scientific information for each ESA-listed marine mammal species. Those densities are provided in the "Status in the Action Area" subsections for each species in the "Status of the Species likely to be Adversely Affected" section of this opinion. The Permits Division adopted these estimates for use in their proposed IHA and we have accepted them for our ESA exposure analysis.

Some species had more than one density estimate reported and the Permits Division advised NSF to use the higher density to calculate take estimates in order to be conservative and help avoid underestimates. Some of the density data are from areas farther offshore than the action area, that may have higher concentrations of the ESA-listed cetaceans due to shelf-frontal features in the southern ocean, and therefore actual densities near the project area could be less.

Estimated Exposure

Exposure to underwater noise is estimated by considering the density of marine mammals (per km^2) multiplied by the area (km^2) ensonified to an acoustic threshold and the number of days the noise source could occur. The NSF provided estimates of marine mammals exposed to sound that could result in take with guidance from the Permits Division.

The exposures for each activity type were added to arrive at calculated total estimated exposures for Level A and B harassment (ESA harm and harassment) by species as shown in Table 5 . A copy of the detailed take estimates provided by NSF to NMFS for the Palmer Pier Project can be found in Appendix D of this opinion. The area filled with sound that exceeds the Level A harassment threshold is contained within the area that is above the Level B harassment threshold. In order to calculate Level B harassment (ESA harassment) exposure, the Level A harassment (ESA harm) area, as defined by activity type and hearing group, is subtracted from the total area of sound above the Level B harassment threshold and the remaining area is used for Level B exposure calculations.

The calculated estimates do not consider any of the mitigation measures. There are additional columns in Table 5 that show proposed take estimates. The proposed Level B harassment takes for blue whales, sei whales, and Southern right whales have been adjusted based on average group sizes for those species to account for the fact that their occurrence is typically not as solitary individuals. Average group size is derived from observation reports that are used to develop abundance and density estimates (see species Status in the Action Area) and have been previously applied for recent consultations in Antarctic (NMFS 2020).

Table 5. Calculated Exposures and Proposed Takes by Level A and Level B Harassment.

Species	Calculated Level A Harassment Exposures	Proposed Level A Harassment Take	Calculated Level B Harassment Exposures	Proposed Level B Harassment Take
Blue Whale (LF)[a]	0.01	0	0.17	2
Fin Whale (LF)	13.74	14	281.70	282
Sei Whale (LF)[a]	0.04	0	0.84	6
Southern Right Whale (LF)[a]	0.07	0	1.34	20
Sperm Whale (MF)	0.02	0	16.73	17

[a] Level B harassment takes increased to account for group size assuming one group is encountered during the project.

The ESA-listed whales considered in this opinion travel to high latitudes to feed, especially during the summer in the southern hemisphere (October to March). Whales could potentially be exposed to noise from the proposed pier replacement activities while they are feeding, traveling, or migrating near the action area and some females could have young-of-the-year accompanying them. We assume that sex distribution, and hence exposure, should be relatively even for blue, fin, sei, and Southern right whales. Only adult male sperm whales venture into the higher latitudes near the poles and therefore female sperm whales are not expected to be near the action area.

The ESA-listed cetaceans in this opinion are more common offshore where shelf and slope waters are better for feeding and these large species of whales are generally not expected to be within very close proximity of the Hero Inlet project site, where there is relatively shallow water among several small rocky islands (Figure 14). Information provided by NSF included marine mammal sightings that were recorded during bird observation studies at Palmer Station from January, 2019, through March, 2020. Most of the observations were of pinnipeds. The only cetacean observations included one sighting of an Antarctic minke whale (*Balaenoptera bonaerensis)* and a few sightings of humpback whales (*Megaptera novaeangliae*); none of them went into the narrow inlet. There were no ESA-listed cetaceans observed.

The Level B harassment threshold for continuous/non-impulsive sounds results in an ensonified zone extending outward from the pier project site to a considerable distance of 18.47 km during simultaneous DTH pile installation. Portions of the sound that travels away from the pier will hit one of several rocky islands (Figure 5) before it reaches that distance, resulting in broken up narrow swaths of sound as opposed to a continuous field. Unless an ESA-listed cetacean swims directly up the sound path between the islands, the exposure is likely to be intermittent while passing within range.

Fin whales are the only ESA-listed whales with proposed Level A take. The estimated exposures of ESA-listed cetaceans to sound at or above the acoustic thresholds are considered precautionary. These whales are not expected to get very close and the use of the shutdown reduces potential exposure. The Level B harassment zone is much larger and exposure of the ESA-listed whales is a more likely scenario. If exposed, the exposure interval is expected to be limited because the zone is fractured by islands.

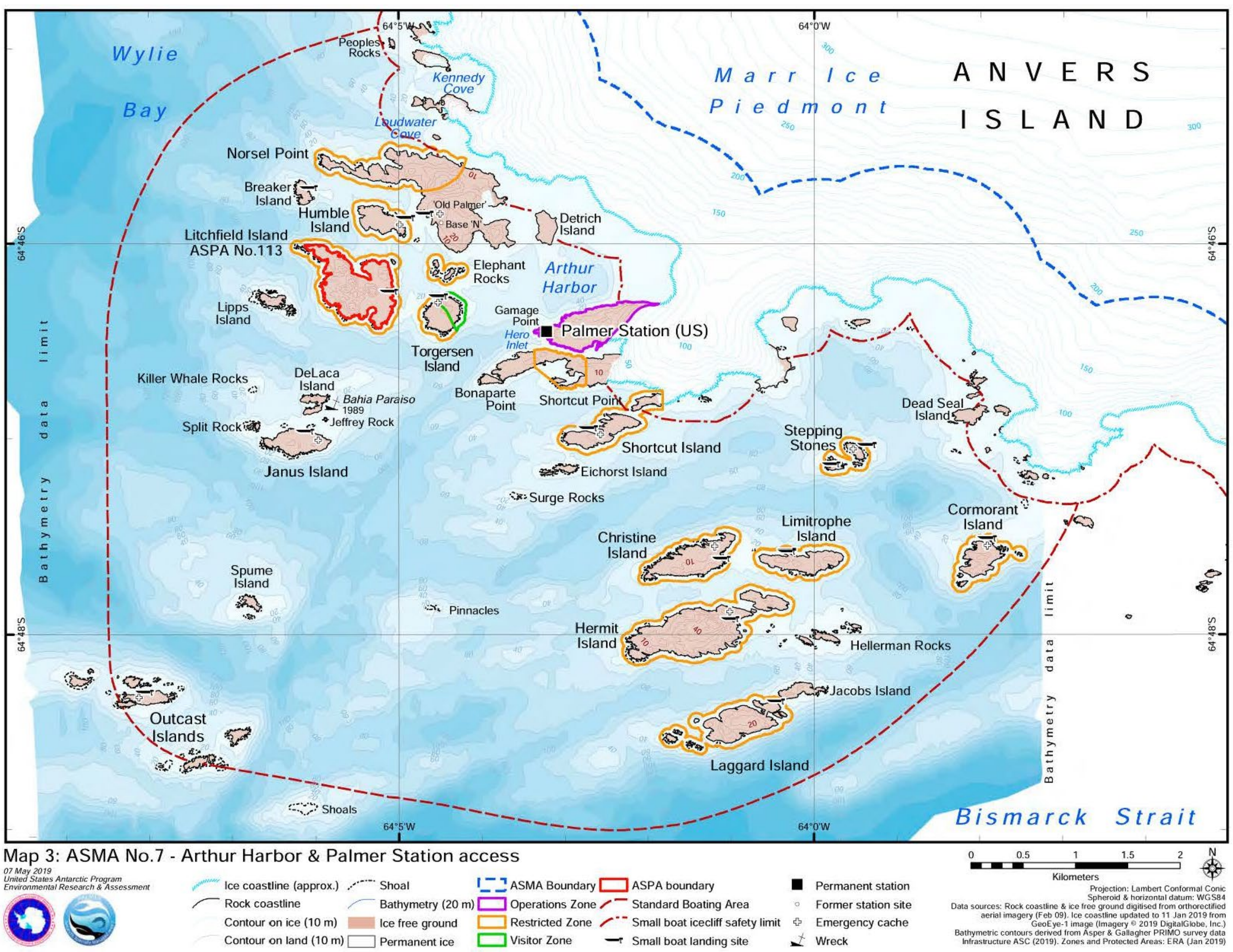

Figure 14. Map of coastal area with bathymetry near Palmer station, Antarctica.

9.3.3 Response Analysis

In the response analysis, we evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond to the stressors given their probable exposure. Exposure of marine mammals to strong underwater sound sources can result in auditory damage, such as changes to sensory hairs in the inner ear, which may temporarily or permanently impair hearing by decreasing the range of sound an animal can detect within its normal hearing ranges. Hearing threshold shifts depend upon the duration, frequency, sound pressure, and rise time of the sound. A temporary threshold shift (TTS) results in a temporary change to hearing sensitivity (Finneran 2015) and the impairment can last minutes to days, but full recovery of hearing sensitivity is expected. At higher received levels, particularly in frequency ranges where animals are more sensitive, PTS can occur, meaning lost auditory sensitivity is unrecoverable (permanent). Few data are available to precisely define each ESA-listed species hearing range, and therefore the exact sensitivity and levels necessary to induce TTS or PTS for those species, so we rely on the estimated functional hearing frequency ranges to inform thresholds, such as LF and MF hearing groups for the ESA-listed whales in this consultation.

Marine mammals exposed to underwater noise generated during construction activities have the potential be taken under the ESA as determined by established criteria (NMFS 2018). Pile driving activities could result in temporary, short-term changes in typical animal behavior, including avoidance of the affected area and temporary displacement (Richardson et al. 1995). We expect individuals to move away in an avoidance response as received sound levels increase, reducing the likelihood of exposure that is biologically meaningful. The use of 'soft starts' will provide animals an opportunity to move away before acoustic intensity increases, reducing the probability of intense exposures accumulating to injurious levels.

The threshold for PTS (MMPA Level A harassment) is based on a cumulative sound exposure level for a full 24-hour duration. Even if an ESA-listed cetacean stayed near Hero Inlet for an extended period during construction, which is not expected, the pier construction is only planned to occur over a 12-hour workday. An individual animal could only be exposed to underwater noise from the project for a maximum of 12 hours followed by a 12-hour period without the active noise source. Exposure to sound at the MMPA Level A harassment threshold is possible, but PTS seems unlikely given the limitations of exposure duration. The reduced workday followed by a recovery period within each 24-hour duration minimizes the potential for PTS. Shutdown procedures during pile driving and removal will reduce the potential for any intense exposures. The probability of ESA-listed whales being present for a sufficient duration to accumulate sound pressure levels that will lead to the onset of hearing threshold shifts seems very low.

Whales use hearing for communication as a primary way to gather information about their environment and we assume that limiting these abilities can be stressful. Any individuals exposed to sound levels sufficient to trigger onset of TTS will also experience a physiological stress response (NMFS 2006a; NRC 2003). Some individuals exposed at sound levels below those required to induce a TTS, but above the ESA harassment threshold, are likely to experience some sort of stress response, which may also be associated with an overt behavioral response.

Sounds from the construction project could overlap with vocalizations of the ESA-listed cetaceans and affect communication between individuals, or possibly affect sperm whale echolocation (Evans 1998; NMFS 2006b). Interference, or masking, occurs when a sound is a similar frequency and similar to or louder than the sound an animal is trying to hear (Clark et al. 2009; Erbe et al. 2016). Masking can interfere with an individual's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Richardson 1995). Marine mammals have shown an ability to make adjustments in the presence of elevated sound levels by increasing their source levels or altering the frequency of their calls (Au 1993; Dahlheim 1987; Foote 2004; Holt et al. 2009; Lesage 1999; Lesage 1993; Parks 2009; Parks et al. 2007a; Terhune 1999).

Although there is the potential for the ESA-listed cetaceans to traverse an area with sound at the MMPA Level B harassment threshold, it is likely to be intermittent exposure because the path of underwater sound propagation from the pier construction site will be partially blocked by islands. Intermittent exposure will effectively reduce the total duration of the exposure. Any masking that might occur during the proposed activities will likely be temporary, as we do not expect ESA listed cetaceans to be spending any significant amount of time close to the sound sources at the project site and much of the lower threshold sound field will be fractured intermittent exposures. Limited exposures to MMPA Level B harassment sounds are not expected to result in anything more than minor, transitory effects to any of the marine mammal species that may be taken during this project and not expected to have biological significance to reproduction and survival rates or population trends. The action area is not known to be an important breeding area for the ESA-listed cetaceans in this opinion. Feeding areas for these whales tend to be farther out onto the shelf in deeper waters and up into the productive Antarctic convergence zone.

We expect the greatest number of responses by ESA listed cetaceans to project sounds to be in the form of behavior changes. Individuals may briefly respond to the underwater sound by slightly changing their behavior or relocating a short distance, in which case some of the responses can equate to ESA harassment of individuals but are unlikely to result in meaningful behavioral responses at the population level. Because cases of exposure to sounds from the pier project are not expected to be of any long duration, we expect any related stress responses to be short-term.

10 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Due to the sparsely inhabited remote location and the Antarctic Treaty with its Protocol on Environmental Protection, designating Antarctica as a natural reserve devoted to "peace and science", there is a lack of other activities that occur in and around the action area. Aspects considered in the *Environmental Baseline* of this opinion, such as climate change, are likely to impact the action area. Fisheries are likely to expand further into Antarctic waters as sea ice recedes and productivity dynamics shift. Tourism is likely to continue and grow in the near future as well. The extent of these activities in the future is unknown and their impacts are speculative as this time.

11 Integrated Risk Assessment

The *Integrated Risk Assessment* section is the final step in our assessment of the risk posed to species because of implementing the proposed action. In this section, we consider the *Effects of the Action* (Section 9), the *Environmental Baseline* (Section 8), and the *Cumulative Effects* (Section 10) to formulate the agency's biological opinion as to whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution.

The following cetaceans were listed under the ESA due to severe declines resulting from years of whaling: blue, fin, sei, sperm, and Southern right whales. The prohibition of whaling curtailed the leading threat to the survival of these species. The relatively large overall global abundance of fin, sei, and sperm whales, may provide those species with some resilience to current threats, but population trends are generally not well understood. Populations of blue and Southern right whales appear to be increasing in size, which indicates these species are somewhat resilient to current threats, but they still have not approached recovery to pre-exploitation levels.

We anticipate up to two blue whales, six sei whales, 20 Southern right whales, 17 sperm whales, and 282 fin whales (see Table 5) will be exposed to pier project noise resulting in ESA harassment. Exposure to noise resulting in ESA harm during the proposed activities is anticipated for fin whales only, for up to 14 individuals. Most of the proposed take numbers are small, with the number of fin whales potentially subject to harassment being the possible exception. However, the estimated harassment number for fin whales is relatively small (<1%) compared to abundance estimates in the southern hemisphere of over 38,000 individual fin whales (see 7.2.5 Status in the Action Area).

No mortality or serious injury of marine mammals is expected from the project activities. Exposure to noise at an ESA harm level during the proposed activities could happen for fin whales, but PTS is not very likely considering the limitations on exposure, such as the 12-hr work day limit, and given the utilization of shutdown procedures as part of the mitigation measures.

Exposure of ESA-listed whales to the proposed actions will likely result in temporary harassment that is not expected to have more than short-term effects on individuals. For all the ESA-listed whale species, Hero Inlet and nearby waters represent a very small and peripheral part of their ranges. Low-level localized displacement would not be expected to reduce the long-term fitness of any individual ESA-listed whales. As such, we do not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise. No adverse effects are anticipated to annual rates of recruitment or survival of the affected ESA-listed whale species.

Considering the status of ESA-listed species, the environmental baseline and the effects of the action, we do not expect the proposed Palmer Station pier construction activities and the Permits Division's issuance of an IHA will result in a reduction in numbers or reproduction of these ESA-listed cetaceans or a change in the distribution of their populations or their geographic range. Thus, the proposed action is not likely to appreciably reduce the survival of these ESA-listed cetaceans.

Common recovery goals for these ESA-listed cetaceans include achieving sufficient and viable populations in all ocean basins and ensuring significant threats are addressed. We do not anticipate the proposed action will deter recovery objectives for these whales and is not likely to result in an appreciable reduction in the likelihood of recovery of these species in the wild. In conclusion, we believe the takes resulting from the proposed actions are not expected to appreciably reduce the likelihood of survival and recovery of ESA-listed blue, fin, sei, Southern right, and sperm whales in the wild.

12 Conclusion

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of endangered blue whales, fin whales, sei whales, Southern right whales, or sperm whales.

13 Incidental Take Statement

Definitions of take, harm and harass are provided in Section 9.3.1 of this opinion. Incidental take is take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(o)(2) of the ESA provides that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement (ITS).

ESA section 7(b)(4)(C) states that take of ESA-listed marine mammals must be authorized under MMPA section 101(a)(5) before the Secretary can issue an ITS for ESA-listed marine mammals. NMFS' implementing regulations for MMPA section 101(a)(5)(D) specify the requirements for the issuance of an IHA to conduct specified activities that will "take" marine mammals. Once NMFS has authorized the incidental take of marine mammals through an IHA (which is valid for a period of one year from the date of issuance) under the MMPA, the incidental take of ESA-listed marine mammals is exempt from the ESA take prohibitions as stated in this incidental take statement pursuant to ESA sections 7(b)(4) and 7(o)(2).

13.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 C.F.R. §402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by actions, while the extent of take specifies the impact, i.e., the amount or extent, of such incidental taking on the species and may be used if we cannot assign numerical limits of animals that could be incidentally taken during the course of an action (see 80 FR 26832).

We and the Permits Division anticipate the incidental take of ESA-listed cetaceans by harassment as a likely result of the proposed Palmer Station pier replacement project in Antarctica. Exposure to project related noise at acoustic thresholds for ESA behavioral harassment (MMPA Level B harassment) is expected to occur for ESA endangered blue whales, fin whales, sei whales, Southern right whales, and sperm whales. There is some anticipated exposure to project sound for endangered fin whales that could be at the acoustic threshold level for ESA harm (MMPA Level A harassment). We have reviewed and accepted the take estimates provided by NSF (see Table 5).

13.2 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impacts, i.e. the amount or extent, of incidental take (50 C.F.R. §402.02).

Mitigation measures were included in the proposed actions by the NSF and the Permits Division, such as soft starts and a shutdown zone (see Section 3.7 for more details), and we believe these will reduce potential ESA harm and harassment of the ESA-listed cetaceans in the action area. The following two statements proposed by the Permits Division, relating to vessel strike avoidance may cause confusion as they do not seem compatible:

1. "NSF must avoid direct physical interaction with marine mammals during construction activities, if a marine mammal comes within 10 m of such activity, operations must cease and vessels must reduce speed to the minimum level required to maintain steerage and safe working conditions."
2. "When in the Project Area, if a whale is sighted in the path of a support vessel or within 92 m (300 feet) from the vessel, NSF must reduce speed and must not engage the engines until the animals are clear of the area. If a whale is sighted farther than 92 m (300 feet) from the vessel, NSF must maintain a distance of 92 m (300 feet) or greater between the whale and the vessel and reduce speed to 10 knots or less."

We are including a measure below to help clarify that the vessel avoidance of ESA-listed whales should be a minimum distance of 92 m (300 ft) because 10 m is not a sufficient avoidance distance for this project in addition to other measures to minimize take of ESA-listed cetaceans as a result of the proposed action.

We believe the reasonable and prudent measures described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species:

- The Permits Division must ensure that the NSF implements a program to mitigate and report the potential effects of the Palmer Station pier replacement project, as well as the effectiveness of mitigation measures incorporated as part of the proposed IHA for the incidental taking of blue, fin, sei, Southern right whales and sperm whales pursuant to section 101(a)(5)(D) of the MMPA. In addition, the Permits Division must ensure that the provisions of the IHA are carried out, and to inform us if take is exceeded.
- The Permits Division must ensure that the NSF implements a program to monitor and report any potential interactions between Palmer Station pier replacement project activities and threatened or endangered marine species.
- Project support vessel speed should be limited to 5-10 knots for maneuvering in the vicinity of the project area. Any support vessel will maintain a distance of 92 m (300 feet) or greater between any ESA-listed whale and the vessel at all times. If the distance between the support vessel and an ESA-listed whale is ever less than 92 m, the vessel will reduce speed and shift the engine to neutral until the whale clears the area.

13.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the NSF and Permits Division must comply with the terms and conditions provided below. These include the take minimization, monitoring and reporting measures required by the section 7 regulations (50 C.F.R. §402.14(i)). If the NSF and the Permits Division fail to ensure compliance with these terms and conditions to implement the reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

To implement the reasonable and prudent measures, the NSF and the Permits Division shall implement the following terms and conditions:

1. A copy of the draft comprehensive report on Palmer Station pier replacement project activities and monitoring results must be provided to the ESA Interagency Cooperation Division within 90 days of the completion of the pier project, or expiration of the IHA, whichever comes sooner.
2. In addition to other reporting requirements for dead and stranded animals, any reports of injured or dead ESA-listed species must be provided to the ESA Interagency Cooperation Division within 24 hours to Cathy Tortorici, Chief, ESA Interagency Cooperation Division by e-mail at cathy.tortorici@noaa.gov.

14 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, and to help implement recovery plans or develop information (50 C.F.R. §402.02).

We make the following conservation recommendations to support information for future consultations involving actions at Palmer Station or NSF-related construction projects and the issuance of IHAs that may affect ESA-listed marine mammals:

- We recommend the NSF obtain field measurements of underwater noise produced by various pile driving construction techniques (impact, vibratory, DTH) under varied scenarios (e.g., different pile sizes and simultaneous activities) during the pier project. Data acquired can help inform potential effects analysis and mitigation for future projects.
- We recommend the NSF continue efforts to look for wildlife in the vicinity of Palmer Station, as climate change may influence species occurrence. In particular, the occurrence of marine mammals can continue to aid analysis of potential exposure to actions.
- We recommend the Permits Division develop a system for tracking and evaluating the extent of take issued and the amount that actually occurs for any given population of ESA-listed species for which take was authorized under the MMPA. Such aggregate take tracking would better enable us to evaluate the impacts of multiple actions, in a specified time period, on ESA-listed species.
- We recommend the NSF and the Permits Division work toward making the data collected as part of the required monitoring and reporting available to the public and scientific community in an easily accessible online database that can be queried to aggregate data across protected species observer reports. Access to such data, which may include sightings as well as responses to project activities, will not only help us understand the biology of ESA-listed species (e.g., their range), it will inform future consultations and incidental take authorizations/permits by providing information on the effectiveness of the conservation measures and the impact of project activities on ESA-listed species.
- We recommend the NSF submit their monitoring data (i.e., visual sightings) by Protected Species Observers to the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations online database, https://seamap.env.duke.edu/, so that it can be added to the aggregate marine mammal, seabird, sea turtle, and fish observation data from around the world.

In order for the NMFS Office of Protected Resources ESA Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, NSF and the Permits Division should notify the ESA Interagency Cooperation Division of any conservation recommendations they implement in their final action.

15 Reinitiation Notice

This concludes formal consultation for the NSF's Palmer Station pier replacement project and the related issuance of an IHA by the Permits Division pursuant to section 101(a)(5)(D) of the MMPA. Consistent with 50 C.F.R. §402.16(a), reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) The amount or extent of taking specified in the ITS is exceeded.
(2) New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
(3) The identified action is subsequently modified in a manner that causes an effect to ESA-listed species or designated critical habitat that was not considered in this opinion.
(4) A new species is listed or critical habitat designated under the ESA that may be affected by the action.

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17 Appendix A: Proposed Incidental Harassment Authorization

The text below was taken directly from the proposed IHA provided to us in the consultation initiation package from the Permits Division, in the notice of proposed IHA and request for comments, "Taking Marine Mammals Incidental to the Palmer Station Pier Replacement Project, Antarctica", published in the *Federal Register* on August 18, 2021 (86 FR 46199).

INCIDENTAL HARASSMENT AUTHORIZATION

The National Science Foundation (NSF) and their designees are hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1371(a)(5)(D)) to incidentally harass marine mammals, under the following conditions:

1. This incidental harassment authorization (IHA) is valid from October 1, 2021 through September 30, 2022.

2. This IHA authorizes take incidental to construction activities, as specified in NSF's July 15, 2021 IHA application, associated with Palmer Station Pier Replacement at Anvers Island, Antarctica. Hereafter (unless otherwise specified) the term "pile driving" is used to refer to both pile installation (including DTH pile installation) and pile removal.

3. General Conditions

   (a) A copy of this IHA must be in the possession of the Holder of the Authorization (Holder), supervisory construction personnel, lead protected species observers (PSOs), and any other relevant designees of the Holder operating under the authority of this IHA at all times that activities subject to this IHA are being conducted.

   (b) The species and/or stocks authorized for taking are listed in Table 1. Authorized take, by Level A and Level B harassment only, is limited to the species and numbers listed in Table 1.

   (c) The taking by serious injury or death of any of the species listed in Table 1 or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA. Any taking exceeding the authorized amounts listed in Table 1 is prohibited and may result in the modification, suspension, or revocation of this IHA.

(d) The Holder must ensure that construction supervisors and crews, the monitoring team, and relevant NSF staff are trained prior to the start of activities subject to this IHA, so that responsibilities, communication procedures, monitoring protocols, and operational procedures are clearly understood. New personnel joining during the project must be trained prior to commencing work.

(e) The Holder also must abide by the terms and conditions [to be (attached to the final IHA upon completion of Biological Opinion]) of the [DATE] Biological Opinion issued by NMFS pursuant to section 7 of the Endangered Species Act.

4. Mitigation Requirements

(a) The Holder must employ PSOs and establish monitoring locations as described in section 5 of this IHA. The Holder must monitor the project area to the maximum extent possible based on the required number of PSOs, required monitoring locations, and environmental conditions.

(b) Monitoring must take place from 30 minutes prior to initiation of pile driving activity (i.e., pre-start clearance monitoring) through 30 minutes post-completion of pile driving activity.

(c) If a marine mammal is observed entering or within the shutdown zones indicated in Table 2 and Table 3, pile driving activity must be delayed or halted. Pile driving must be commenced or resumed as described in condition 4(e) of this IHA.

(d) Pre-start clearance monitoring must be conducted during periods of visibility sufficient for the lead PSO to determine that the shutdown zones indicated in Table 2 and Table 3 are clear of marine mammals. Pile driving may commence following 30 minutes of observation when the determination is made that the shutdown zones are clear of marine mammals.

(e) If pile driving is delayed or halted due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily exited and been visually confirmed beyond the shutdown zones indicated in Table 2 and Table 3 or 15 minutes have passed without re-detection of the animal for pinnipeds.

(f) The Holder must use soft start techniques when impact pile driving. Soft start requires contractors to provide an initial set of three strikes at reduced energy, followed by a 30-second waiting period, then two subsequent reduced-energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of 30 minutes or longer.

(g) Pile driving activity must be halted (as described in condition 4(c) of this IHA) upon observation of either a species for which incidental take is not authorized or a species for which incidental take has been authorized but the authorized number of takes has been met, entering or within the harassment zone (as shown in Table 2 and Table 3).

(h) The Holder, construction supervisors and crews, PSOs, and relevant NSF staff must avoid direct physical interaction with marine mammals during construction activity. If a marine mammal comes within 10 meters of such activity, operations must cease to avoid direct physical interaction.

(i) When transiting to or from the construction site, marine mammal watches must be conducted by those navigating the vessel or crew.

(j) When in the Project Area, if a whale is sighted in the path of a support vessel or within 92 m (300 feet) from the vessel, the Holder must reduce speed and must not engage the engines until the animals are clear of the area.

(k) If a whale is sighted farther than 300 feet from the vessel, the Holder must maintain a distance of 92 m (300 feet) or greater between the whale and the vessel and reduce speed to 10 knots or less.

(l) Vessels must not be operated in such a way as to separate members of a group of whales from other members of the group. A group is defined as being three or more whales observed within a 500 m area and displaying behaviors of directed or coordinated activity (e.g., group feeding).

(m) If the Level A shutdown zones are not visible due to poor environmental conditions (e.g. excessive wind or fog, high Beaufort state), pile driving would cease.

5. Monitoring Requirements

(a) Marine mammal monitoring must be conducted in accordance with the conditions in this section and this IHA.

(b) Monitoring must be conducted by qualified PSOs in accordance with the following conditions:

(i) PSOs must be independent (i.e., not construction personnel) and have no other assigned tasks during monitoring periods.

(ii) The Lead PSO must be approved by NMFS and must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization.

(iii) Prior to the initiation of construction at least three PSOs, other than the Lead PSO must undergo training /refresher session that includes the following objectives:

A. Review of the mitigation, monitoring, and reporting requirements provided in this application, including any amendments specified by NMFS in the authorization;

B. Review of marine mammal sighting, identification, and distance estimation methods;

C. Review of operation of specialized equipment (reticle binoculars, GPS); and

D. Review of, and classroom practice with, data recording and data entry systems, including procedures for recording data on marine mammal sightings, monitoring operations, environmental conditions, and entry error control.

(c) Two PSOs must be on duty at all times during in-water construction.

(d) PSOs must be on duty in shifts of 4 hours duration, with sufficient breaks and a maximum of 12 hours watch time per day per PSO.

(e) Mounted big eye binoculars must be provided to PSOs to adequately cover the Level A harassment zone

(f) The Holder must establish a monitoring station on the roof of the Garage Warehouse Recreation Building. PSOs must be able to monitor the entire shutdown zone.

(g) PSOs must record all observations of marine mammals, regardless of distance from the pile being driven, as well as the additional data indicated in section 6 of this IHA.

6. Reporting

(a) The Holder must submit its draft report(s) on all monitoring conducted under this IHA within 90 calendar days of the completion of monitoring or 60 calendar days prior to the requested issuance of any subsequent IHA for construction activity at the same location, whichever comes first. A final report must be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 30 calendar days of receipt of the draft report, the report shall be considered final.

(b) All draft and final monitoring reports must be submitted to *PR.ITP.MonitoringReports@noaa.gov* and *itp.pauline@noaa.gov*.

(c) The marine mammal report must include:

(i) Dates and times (begin and end) of all marine mammal monitoring;

(ii) Construction activities occurring during each daily observation period, including:

A. The number and type of piles that were driven and the method (e.g., impact, vibratory, down-the-hole);

B. Total duration of driving time for each pile (vibratory driving) and number of strikes for each pile (impact driving); and

C. For down-the-hole drilling, duration of operation for both impulsive and non-pulse components.

(iii) PSO locations during marine mammal monitoring;

(iv) Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon, and estimated observable distance;

(v) Upon observation of a marine mammal, the following information:

A. Name of PSO who sighted the animal(s) and PSO location and activity at time of sighting;

B. Time of sighting;

C. Identification of the animal(s) (e.g., genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species;

D. Distance and location of each observed marine mammal relative to the pile being driven for each sighting;

E. Estimated number of animals (min/max/best estimate);

F. Estimated number of animals by cohort (adults, juveniles, neonates, group composition, etc.);

G. Animal's closest point of approach and estimated time spent within the harassment zone;

H. Description of any marine mammal behavioral observations (e.g., observed behaviors such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g., no response or changes in behavioral state such as ceasing feeding, changing direction, flushing, or breaching);

(vi) Number of marine mammals detected within the harassment zones, by species; and

(vii) Detailed information about implementation of any mitigation (e.g., shutdowns and delays), a description of specific actions that ensued, and resulting changes in behavior of the animal(s), if any.

(d) The Holder must submit all PSO datasheets and/or raw sighting data with the draft report, as specified in condition 6(b) of this IHA.

(e) Reporting injured or dead marine mammals:

In the event that personnel involved in the construction activities discover an injured or dead marine mammal, the Holder must report the incident to the Office of Protected Resources (OPR), NMFS (*PR.ITP.MonitoringReports@noaa.gov* and *Robert.pauline@noaa.gov*) as soon as feasible. If the death or injury was clearly caused by the specified activity, the Holder must immediately cease the activities until NMFS OPR is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of this IHA. The Holder must not resume their activities until notified by NMFS.

The report must include the following information:

(i) Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

(ii) Species identification (if known) or description of the animal(s) involved;

(iii) Condition of the animal(s) (including carcass condition if the animal is dead);

(iv) Observed behaviors of the animal(s), if alive;

(v) If available, photographs or video footage of the animal(s); and

(vi) General circumstances under which the animal was discovered.

8. This Authorization may be modified, suspended or revoked if the Holder fails to abide by the conditions prescribed herein (including, but not limited to, failure to comply with monitoring or reporting requirements), or if NMFS determines: (1) the authorized taking is likely to have or is having more than a negligible impact on the species or stocks of affected marine mammals, (2) the prescribed measures are likely not or are not effecting the least practicable adverse impact on the affected species or stocks and their habitat.

9. Renewals

On a case-by-case basis, NMFS may issue a one-time, one-year Renewal IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical, or nearly identical, activities (or a subset of those activities) are planned or (2) the specified activities will not be completed by the time the IHA expires and a Renewal would allow for completion of the activities, provided all of the following conditions are met:

(a) A request for renewal is received no later than 60 days prior to the needed Renewal IHA effective date (note a Renewal IHA expiration date cannot extend beyond one year from expiration of this IHA).

(b) The request for renewal must include the following:

(i) An explanation that the activities to be conducted under the requested Renewal IHA are identical to the activities analyzed for this IHA, are a subset of the activities, or include changes so minor (e.g., reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(ii) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

(c) Upon review of the request for Renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings made in support of this IHA remain valid.

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Catherine Marzin,
Acting Director, Office of Protected Resources
National Marine Fisheries Service

Table 1. Authorized Incidental Take.

Common name	Scientific name	Level A harassment	Level B harassment
Antarctic Minke Whale	*Balaenoptera bonaerensis*	15	312
Arnoux's Beaked Whale	*Berardius arnuxii*	0	12
Blue Whale	*B. musculus musculus*	0	2
Fin Whale	*B. physalus quoyi*	14	282
Hourglass Dolphin	*Lagenorhynchus cruciger*	0	25
Humpback Whale	*Megaptera novaeangliae australis*	6	121
Killer Whale	*Orcinus orca*	0	112
Long-finned Pilot Whale	*Globicephala melas edwardii*	0	28
Southern Bottlenose Whale	*Hyperoodon planifrons*	0	24
Sei Whale	*Balaenoptera borealis*	0	6
Southern Right Whale	*Eubalaena australis*	0	20
Sperm Whale	*Physeter macrocephalus*	0	17
Antarctic Fur Seal	*Arctocephalus gazella*	80	357
Crabeater Seal	*Lobodon carcinophaga*	120	6,129
Southern Elephant Seal	*Mirounga leonina*	0	1
Leopard Seal	*Hydrurga leptonyx*	5	5
Weddell Seal	*Leptonychotes weddellii*	10	188

Table 2. Shutdown and Harassment Zones for Non-Simultaneous Pile Installation Activities.

<table>
<tr><th rowspan="3">Pile size, type, and method</th><th colspan="5">Minimum Shutdown Zone</th><th rowspan="2">Level B Harassment Zone (m)</th></tr>
<tr><th colspan="3">Cetaceans</th><th colspan="2">Pinnipeds</th></tr>
<tr><th>LF</th><th>MF</th><th>HF</th><th>PW</th><th>OW</th><th></th></tr>
<tr><td>Dock, 36-in Dia. Pile Installation, 20’ Socket Depth - 1 pile/day (DTH)</td><td>1,900</td><td>70</td><td>2,255</td><td>1,015</td><td rowspan="10">50</td><td rowspan="6">11,659</td></tr>
<tr><td>Dock Abutment, 36-in Dia. Pile Installation, 30’ Socket Depth - 1 pile/day (DTH)</td><td>2500</td><td>90</td><td>2,955</td><td>1,330</td></tr>
<tr><td>RHIB Fender Piles, 24-in Dia. Pile Installation, 20’ Socket - 1 pile/day</td><td rowspan="4">410</td><td rowspan="4">15</td><td rowspan="4">485</td><td rowspan="4">220</td></tr>
<tr><td>24-in Dia. Template Piles, 10’ Socket Depth - 2 piles/day</td></tr>
<tr><td>24-in Dia Wave Attenuator Piles, 20’ Socket Depth - 1 pile/day</td></tr>
<tr><td>Retaining Wall HP Pile inserted in Drilled 24-in Dia Sockets, 20’ Socket Depth - 1 pile/day</td></tr>
<tr><td>Removal of 24-in Dia. Template Piles - 16 piles</td><td>55</td><td rowspan="2">10</td><td>75</td><td>35</td><td>10,000</td></tr>
<tr><td>Removal of Sheet Piles</td><td>25</td><td>35</td><td>15</td><td>4,642</td></tr>
<tr><td>Rock Chipping/Floor Preparation</td><td>405</td><td>50</td><td>720</td><td>205</td><td>123</td></tr>
<tr><td>Anode Installation</td><td>10</td><td>10</td><td>10</td><td>10</td><td>200</td></tr>
</table>

Table 3. Shutdown and Harassment Zones (meters) for Simultaneous Pile Installation Activities.

<table>
<tr><th rowspan="3">Daily Activity Scenario</th><th colspan="5">Minimum Shutdown Zone</th><th rowspan="3">Level B Harassment Zone (m)</th></tr>
<tr><th colspan="3">Cetaceans</th><th colspan="2">Pinnipeds</th></tr>
<tr><th>LF</th><th>MF</th><th>HF</th><th>PW</th><th>OW</th></tr>
<tr><td>Dock, 36-in Dia. Pile Installation, 20’ Socket Depth - 2 pile/day</td><td rowspan="2">3,500</td><td>110</td><td>3,580</td><td>1,610</td><td rowspan="13">50</td><td rowspan="8">18,478</td></tr>
<tr><td>Dock Abutment, 36-in Dia. Pile Installation, 30’ Socket Depth and 36-in Dia. Pile 20’ Socket Depth</td><td>125</td><td>4,150</td><td>1,865</td></tr>
<tr><td>RHIB Fender Piles, 24-in Dia. Pile Installation, 20’ Socket - 2 pile/day</td><td rowspan="4">650</td><td rowspan="4">25</td><td rowspan="4">770</td><td rowspan="4">350</td></tr>
<tr><td>24-in Dia. Template Piles, 10’ Socket Depth - 4 piles/day</td></tr>
<tr><td>24-in Dia Wave Attenuator Piles, 20’ Socket Depth - 2 pile/day</td></tr>
<tr><td>Retaining Wall - HP Pile inserted in Drilled 24-in Dia Sockets, 20’ Socket Depth - 2 piles/day</td></tr>
<tr><td>Dock, 36-in Dia. Pile Installation, 20’ Socket Depth - 1 pile/day and Wave Attenuator, 24-in Dia. Pile Installation, 20’ Socket - 1 pile/day</td><td>2,050</td><td>75</td><td>2,400</td><td>1,080</td></tr>
<tr><td>Dock 36-in Dia. Pile Installation 30’ Socket Depth and 24-in Dia Pile Installation 20’ Socket Depth</td><td>2,900</td><td>105</td><td>3,500</td><td>1,545</td></tr>
<tr><td>36-in Dock 20’ socket x 2
Dock Abutment</td><td>45</td><td rowspan="5">10</td><td>65</td><td>30</td><td>34,146</td></tr>
<tr><td>RHIB Fender Piles 24-in x 2</td><td rowspan="2">20</td><td rowspan="2">30</td><td rowspan="4">10</td><td rowspan="4">15,849</td></tr>
<tr><td>24-in template 10’socket x 4</td></tr>
<tr><td>24-in wave attenuator piles-10’socket x 2</td><td>35</td><td>50</td></tr>
<tr><td>24-in wave attenuator piles-20’socket x 2</td><td>35</td><td>50</td></tr>
</table>

18 Appendix B: Acoustic Data and Isopleths.

Table 1. Sound Source Levels

Measured Sound Levels					Source
Activity	Peak	RMS	SEL[1]	TL	
24-in Piles					
DTH pile installation	190	166	154	15	Denes *et al.,* (2016)
Vibratory Driving[2]	170	165	165	15	Caltrans (2015)
Impact Driving	195	181	168	15	Caltrans (2015)
36-in Piles					
DTH pile installation	194	166	164	15	The DTH sound source proxy of 164 dB SEL is from 42-in piles, Reyff (2020) and Denes *et al.,* (2019)
Vibratory Driving	180	170	170	15	Caltrans (2015)
Impact Driving	210	193	183	15	Caltrans (2015)
H Piles inserted in 24-in. Sockets					
DTH pile installation	190	166	154	15	Denes *et al.,* (2016)
Vibratory Driving	170	165	165	15	Caltrans (2015)
Impact Driving	195	180	170	15	Caltrans (2015)
Removal of 24-in Template Piles					
Vibratory Driving	175	165	165	15	Caltrans (2015)
Removal of Sheet Piles					
Vibratory Driving	175	160	160	15	Caltrans (2015)
Rock Chipping					
Hydraulic Breaker	197	184	175	22	Reyff (2018)

[1]SEL is single strike for impact driving and DTH pile installation. SEL for vibratory installation is per second.
[2]Includes removal of 24-in. piles

Table 2. Level A and Level B Harassment Isopleth Distances in Meters for Non-Simultaneous Pile Installation Activities

Activity	Method	Level A: LF	Level A: MF	Level B
Dock, 36-in Dia. Pile Installation, 20' Socket Depth - 1 pile/day	DTH Pile Drilling	1,891	67	11,659
Dock Abutment, 36-in Dia. Pile Installation, 30' Socket Depth - 1 pile/day	DTH Pile Drilling	2,478	88	11,659
RHIB Fender Piles, 24-in Dia. Pile Installation, 20' Socket - 1 pile/day	DTH Pile Drilling	407	15	11,659
24-in Dia. Template Piles, 10' Socket Depth - 2 piles/day	DTH Pile Drilling	407	15	11,659
24-in Dia Wave Attenuator Piles, 20' Socket Depth - 1 pile/day	DTH Pile Drilling	407	15	11,659
Retaining Wall HP Pile inserted in Drilled 24-in Dia Sockets, 20' Socket Depth - 1 pile/day	DTH Pile Drilling	407	15	11,659
Removal of 24-in Dia. Template Piles - 16 piles	Vibratory	51	5	10,000
Removal of Sheet Piles	Vibratory	23	2	4,642
Rock Chipping/Floor Preparation	Hydraulic Breaker	403	50	123

Table 3. Simultaneous Source Decibel Addition

Hammer Types	Difference in SSL	Level A Zones	Level B Zones
Vibratory, Impact	Any	Use impact zones	Use largest zone
Impact, Impact	Any	Use zones for each pile size and number of strikes	Use zone for each pile size
Vibratory, Vibratory	0 or 1 dB	Add 3 dB to the higher source level	Add 3 dB to the higher source level
	2 or 3 dB	Add 2 dB to the higher source level	Add 2 dB to the higher source level
	4 to 9 dB	Add 1 dB to the higher source level	Add 1 dB to the higher source level

	10 dB or more	Add 0 dB to the higher source level	Add 0 dB to the higher source level

Table 4. Level A and Level B Harassment Isopleth Distances in Meters for Simultaneous Pile Installation Activities

Activity	Method	Level A: LF	Level A: MF	Level B
Dock, 36-in Dia. Pile Installation, 20' Socket Depth - 2 pile/day	DTH Pile Drilling	3,002	107	18,478
Dock Abutment, 36-in Dia. Pile Installation, 30' Socket Depth and 36-in Dia. Pile 20' Socket Depth	DTH Pile Drilling	3,484	124	18,478
RHIB Fender Piles, 24-in Dia. Pile Installation, 20' Socket - 2 pile/day	DTH Pile Drilling	647	23	18,478
24-in Dia. Template Piles, 10' Socket Depth - 4 piles/day	DTH Pile Drilling	647	23	18,478
24-in Dia Wave Attenuator Piles, 20' Socket Depth - 2 pile/day	DTH Pile Drilling	647	23	18,478
Retaining Wall HP Pile inserted in Drilled 24-in Dia Sockets, 20' Socket Depth - 2 pile/day	DTH Pile Drilling	647	23	18,478
Dock, 36-in Dia. Pile Installation, 20' Socket Depth - 1pile/day and Wave Attenuator, 24-in Dia. Pile Installation, 20'Socket - 1 pile/day	DTH Pile Drilling	2,011	72	18,478
Dock 36-in Dia. Pile Installation30' Socket Depth and 24-in Dia Pile Installation 20' Socket Depth	DTH Pile Drilling	2,885	103	18,478

19 APPENDIX C: NMFS TECHNICAL GUIDANCE (2018) COMPANION USER SPREADSHEET - DATA INPUTS.

Table 1. NMFS Technical Guidance User Spreadsheet Inputs to Calculate PTS Isopleths for Non-Simultaneous Vibratory Pile Installation Activities

	36-in (Dock Dock Abutment)	RHIB Fender Piles 24-in	24-in template 10'socket)	24-in wave attenuator piles-in	24-in Template pile removal	Sheet Pile Removal
Spreadsheet Tab Used	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.
Source Level (SPL RMS)	170	165	165	165	165	160
15Transmission Loss Coefficient	15	15	15	15	15	15
Weighting Factor Adjustment (kHz)	2.5	2.5	2.5	2.5	2.5	2.5
Time to install / remove single pile (minutes)	30	30	30	30	30	30
Piles to install / remove per day	1	1	2	1	16	16

Table 2. NMFS Technical Guidance User Spreadsheet Input To Calculate PTS Isopleths for Non-Simultaneous Impact Pile Installation Activities

	36-in (Dock, Dock Abutment)	24-in RHIB, (template, wave attenuator)	Rock Chipping
Spreadsheet Tab Used	E.1) Impact pile driving	E.1) Impact pile driving	E) Stationary Source: Impulsive, Intermittent
Source Level (Single Strike/shot SEL)	183	168	197

Transmission Loss Coefficient	15	15	22
Weighting Factor Adjustment (kHz)	2	2	0
Number of pulses in 1-hr period	10	10	2,700
Piles per day	1	1	

Table 3. NMFS Technical Guidance User Spreadsheet Input To Calculate PTS Isopleths for Non-Simultaneous DTH Pile Installation Activities

	36-in Dock 20' socket	Dock Abutment-36-in 30' socket	24-in RHIB, template, wave attenuator
Spreadsheet Tab Used	E.2) DTH Pile Driving	E.2) DTH Pile Driving	E.2) DTH Pile Driving
Source Level (Single Strike/Shot SEL)	164	164	154
Transmission Loss Coefficient	15	15	15
Strike rate (Strikes/sec)	10	10	10
Duration (min)	345	518	345
Weighting Factor Adjustment (kHz)	2	2	2
SStrikes/pile	207000	310500	207000
Piles to install / remove per day	1	1	1

Table 4. NMFS Technical Guidance User Spreadsheet Input To Calculate PTS Isopleths for Simultaneous DTH Pile Installation Activities.

	36-in Dock 20' socket x 2	Dock Abutment-36-in 30' and 20' socket	24-in template 10'socket x 4	24-in wave attenuator piles-10'socket x 2/ RHIB Fender Piles 24-in x 2
Spreadsheet Tab Used	E.2) DTH Pile Driving	E.2) DTH Pile Driving	E.2) DTH Pile Driving	E.2) DTH Pile Driving

Source Level (Single Strike/Shot SEL)	164	164	154	154
Transmission Loss Coefficient	15	15	15	15
Strike rate (Strikes/sec)	10	10	10	10
Duration (min)	345	430	172.5	345
Weighting Factor Adjustment (kHz)	2	2	2	2
Strikes/pile	414,000	517,500	103500	207000
Piles to install per day	2	2	4	2

20 APPENDIX D: COPY OF DETAILED TAKE ESTIMATES FROM NSF.

Plamer Pier IHA Application
Appendix B Take Estimates

Color Key:
- Species for which no nearshore density esimtate is available so offshore density is used.
- Indicates density NOT used to calculate take. Changed density to 0 if number was not used.
- Higher of two densities used for take estimate per NMFS request.

DTH Pile Driving- Level A

	Species	Level A Impact Area (km2)	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# pile driving days	NEARSHORE Density Estimated Level A Exposure (density*area* days)	OFFSHORE Density Estimated Level A Exposure (density*area* days)
36-Inch Pile	Antarctic Minke Whale (LF)	3.38	0.0018	0.093	47	0.00	14.77
	Arnoux's Beaked Whale (MF)	0.03	n/a	0.000038		n/a	0.0001
	Blue Whale (LF)	3.38	n/a	0.00005		n/a	0.01
	Fin Whale (LF)	3.38	0.0839	0.0072		13.33	0.00
	Hourglass Dolphin (HF)	4.4	0.0015	n/a		0.31	n/a
	Humpback Whale (LF)	3.38	0.0361	0.0001		5.73	0.00
	Killer Whale (MF)	0.03	0.0015	0.0313		0.00	0.04
	Long-finned Pilot Whale (MF)	0.03	0.0076	0.0079		0.00	0.01
	Southern Bottlenose Whale (MF)	0.03	0.0006	0.0066		0.00	0.01
	Sei Whale (LF)	3.38	n/a	0.00025		n/a	0.04
	Southern Right Whale (LF)	3.38	0.0004	n/a		0.06	n/a
	Sperm Whale (MF)	0.03	0.0006	0.01699		0.00	0.02
	Antarctic Fur Seal (OW)	0.03	0.0999	n/a		0.14	n/a
	Crabeater Seal (PW)	1.4	1.76	0.00762		115.81	0.00
	Southern Elephant Seal (PW)	1.4	0.0003	n/a		0.02	n/a
	Leopard Seal (PW)	1.4	0.0003	0.00005		0.02	0.00
	Weddell Seal (PW)	1.4	0.054	0.00013		3.55	0.00
24-Inch Pile	Antarctic Minke Whale (LF)	0.3	0.0018	0.093	16	0.00	0.45
	Arnoux's Beaked Whale (MF)	0.0015	n/a	0.000038		n/a	0.0000
	Blue Whale (LF)	0.3	n/a	0.00005		n/a	0.0002
	Fin Whale (LF)	0.3	0.0839	0.0072		0.40	0.00
	Hourglass Dolphin (HF)	0.4	0.0015	n/a		0.01	n/a
	Humpback Whale (LF)	0.3	0.0361	0.0001		0.1733	0.0000
	Killer Whale (MF)	0.0015	0.0015	0.0313		0.00	0.0008
	Long-finned Pilot Whale (MF)	0.0015	0.0076	0.0079		0.00	0.0002
	Southern Bottlenose Whale (MF)	0.0015	0.0006	0.0066		0.00	0.0002
	Sei Whale (LF)	0.3	n/a	0.00025		n/a	0.0012
	Southern Right Whale (LF)	0.3	0.0004	n/a		0.0019	n/a
	Sperm Whale (MF)	0.0015	0.0006	0.01699		0.00	0.0004
	Antarctic Fur Seal (OW)	0.0017	0.0999	n/a		0.0027	n/a
	Crabeater Seal (PW)	0.11	1.76	0.00762		3.10	0.00
	Southern Elephant Seal (PW)	0.11	0.0003	n/a		0.0005	n/a
	Leopard Seal (PW)	0.11	0.0003	0.00005		0.0005	0.0000
	Weddell Seal (PW)	0.11	0.054	0.00013		0.10	0.0000

*For the purposes of estimating exposures, the areas for MF cetaceans during installation of the dolphon are assumed to be the same as the 36-in piles shown in Rows 4-20 for MF.
The same approach is also used for OW.

Vibratory Template Pile and Sheetile Removal (non-simultaneous) Level A							
	Species	Level A Impact Area (km2)[1]	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# vibratory removal days	NEARSHORE Density Estimated Level A Exposure (density*area*days)	OFFSHORE Density Estimated Level A Exposure (density*area*days)
Sheetpile Removal	Antarctic Minke Whale (LF)	0.006	0.0018	0.093	16	0.00	0.01
	Arnoux's Beaked Whale (MF)	0	n/a	0.000038		n/a	0.00
	Blue Whale (LF)	0.006	n/a	0.00005		n/a	0.00
	Fin Whale (LF)	0.006	0.0839	0.0072		0.01	0.00
	Hourglass Dolphin (HF)	0.012	0.0015	n/a		0.0001	n/a
	Humpback Whale (LF)	0.006	0.0361	0.0001		0.0035	0.0000
	Killer Whale (MF)	0	0.0015	0.0313		0.00	0.00
	Long-finned Pilot Whale (MF)	0	0.0076	0.0079		0.00	0.00
	Southern Bottlenose Whale (MF)	0	0.0006	0.0066		0.00	0.00
	Sei Whale (LF)	0.006	n/a	0.00025		n/a	0.0000
	Southern Right Whale (LF)	0.006	0.0004	n/a		0.0000	n/a
	Sperm Whale (MF)	0	0.0006	0.01699		0.00	0.00
	Antarctic Fur Seal (OW)	0	0.0999	n/a		0.01	n/a
	Crabeater Seal (PW)	0.0006	1.76	0.00762		0.17	0.0000
	Southern Elephant Seal (PW)	0.0006	0.0003	n/a		0.0000	n/a
	Leopard Seal (PW)	0.0006	0.0003	0.00005		0.0000	0.0000
	Weddell Seal (PW)	0.0006	0.054	0.00013		0.01	0.0000

*For the purposes of estimating takes, the areas for removing template piles and sheetpiles were added together and then multiplied by density and number of days. This does not mean, removal of template piles and sheetpiles occur simultaneously.

* The distance to Level A for MF cetaceans is 5m or less. Similarly, the distance to Level A for otariids is 2m or less. For the purpose of estimating take, the area ensonified is assumed 0.

Total Level A Exposure

Species	NEARSHORE Density Estimated Level A Exposure	OFFSHORE Density Estimated Level A Exposure	TOTAL Level A
Antarctic Minke Whale (LF)	0.00	15.23	15.23
Arnoux's Beaked Whale (MF)	n/a	0.0001	0.0001
Blue Whale (LF)	n/a	0.008	0.01
Fin Whale (LF)	13.74	0.00	13.74
Hourglass Dolphin (HF)	0.32	n/a	0.32
Humpback Whale (LF)	5.91	0.00	5.91
Killer Whale (MF)	0.00	0.04	0.04
Long-finned Pilot Whale (MF)	0.00	0.01	0.01
Southern Bottlenose Whale (MF)	0.00	0.009	0.01
Sei Whale (LF)	n/a	0.04	0.04
Southern Right Whale (LF)	0.07	n/a	0.07
Sperm Whale (MF)	0.00	0.02	0.02
Antarctic Fur Seal (OW)	0.15	n/a	0.15
Crabeater Seal (PW)	119.07	0.00	119.07
Southern Elephant Seal (PW)	0.02	n/a	0.02
Leopard Seal (PW)	0.02	0.00	0.02
Weddell Seal (PW)	3.65	0.00	3.65

*If both nearshore and offshore densities are available, the higher of the two densities have been used to estimate takes (i.e., Antarctic minke, killer whale, long-finned pilot whale, southern bottlenose whale, and sperm whale).

DTH Pile Driving - Level B							
Pile Size	Species	Level B Impact Area (km2)[a]	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# pile driving days	NEARSHORE Density Level B Exposure Estimated (density*area*days)	OFFSHORE Density Level B Exposure Estimated (density*area*days)
36-in	Antarctic Minke Whale (LF)	51.62	0.0018	0.093	47	0.00	225.63
	Arnoux's Beaked Whale (MF)	54.97	n/a	0.000038		n/a	0.10
	Blue Whale (LF)	51.62	n/a	0.00005		n/a	0.12
	Fin Whale (LF)	51.62	0.0839	0.0072		203.55	0.00
	Hourglass Dolphin (HF)	50.6	0.0015	n/a		3.57	n/a
	Humpback Whale (LF)	51.62	0.0361	0.0001		87.58	0.00
	Killer Whale (MF)	54.97	0.0015	0.0313		0.00	80.87
	Long-finned Pilot Whale (MF)	54.97	0.0076	0.0079		0.00	20.41
	Southern Bottlenose Whale (MF)	54.97	0.0006	0.0066		0.00	17.05
	Sei Whale (LF)	51.62	n/a	0.00025		n/a	0.61
	Southern Right Whale (LF)	51.62	0.0004	n/a		0.97	n/a
	Sperm Whale (MF)	54.97	0.0006	0.01699		0.00	0.00
	Antarctic Fur Seal (OW)	54.97	0.0999	n/a		258.10	n/a
	Crabeater Seal (PW)	53.6	1.76	0.00762		4433.79	0.00
	Southern Elephant Seal (PW)	53.6	0.0003	n/a		0.76	n/a
	Leopard Seal (PW)	53.6	0.0003	0.00005		0.76	0.00
	Weddell Seal (PW)	53.6	0.054	0.00013		136.04	0.00
24-in	Antarctic Minke Whale (LF)	51.62	0.0018	0.093	16	0.00	76.81
	Arnoux's Beaked Whale (MF)	54.97	n/a	0.000038		n/a	0.03
	Blue Whale (LF)	51.62	n/a	0.00005		n/a	0.04
	Fin Whale (LF)	51.62	0.0839	0.0072		69.29	0.00
	Hourglass Dolphin (HF)	50.6	0.0015	n/a		1.21	n/a
	Humpback Whale (LF)	51.62	0.0361	0.0001		29.82	0.00
	Killer Whale (MF)	54.97	0.0015	0.0313		0.00	27.53
	Long-finned Pilot Whale (MF)	54.97	0.0076	0.0079		0.00	6.95
	Southern Bottlenose Whale (MF)	54.97	0.0006	0.0066		0.00	5.80
	Sei Whale (LF)	51.62	n/a	0.00025		n/a	0.21
	Southern Right Whale (LF)	51.62	0.0004	n/a		0.33	n/a
	Sperm Whale (MF)	54.97	0.0006	0.01699		0.00	14.94
	Antarctic Fur Seal (OW)	54.97	0.0999	n/a		87.86	n/a
	Crabeater Seal (PW)	53.6	1.76	0.00762		1509.38	0.00
	Southern Elephant Seal (PW)	53.6	0.0003	n/a		0.26	n/a
	Leopard Seal (PW)	53.6	0.0003	0.00005		0.26	0.00
	Weddell Seal (PW)	53.6	0.054	0.00013		46.31	0.00

[a] Level B impact area is equal to 55 km2 minus the Level A impact areas shown above because if an animal enters the Level A zone, it is counted as a Level A take.

Vibratory Template Pile Removal (non-simultaneous) Level B							
	Species	Level B Impact Area (km2)[1]	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# vibratory removal days	NEARSHORE Density Estimated Level B Exposure (density*area* days)	OFFSHORE Density Estimated Level B Exposure (density*area* days)
Template Pile Removal	Antarctic Minke Whale (LF)	20.78	0.0018	0.093	4	0.00	7.73
	Arnoux's Beaked Whale (MF)		n/a	0.000038		n/a	0.00
	Blue Whale (LF)		n/a	0.00005		n/a	0.00
	Fin Whale (LF)		0.0839	0.0072		6.97	0.00
	Hourglass Dolphin (HF)		0.0015	n/a		0.12	n/a
	Humpback Whale (LF)		0.0361	0.0001		3.00	0.00
	Killer Whale (MF)		0.0015	0.0313		0.00	2.60
	Long-finned Pilot Whale (MF)		0.0076	0.0079		0.00	0.66
	Southern Bottlenose Whale (MF)		0.0006	0.0066		0.00	0.55
	Sei Whale (LF)		n/a	0.00025		n/a	0.02
	Southern Right Whale (LF)		0.0004	n/a		0.03	n/a
	Sperm Whale (MF)		0.0006	0.01699		0.00	1.41
	Antarctic Fur Seal (OW)		0.0999	n/a		8.30	n/a
	Crabeater Seal (PW)		1.76	0.00762		146.29	0.00
	Southern Elephant Seal (PW)		0.0003	n/a		0.02	n/a
	Leopard Seal (PW)		0.0003	0.00005		0.02	0.00
	Weddell Seal (PW)		0.054	0.00013		4.49	0.00

Vibratory Sheetpile Removal (non-simultaneous) Level B							
	Species	Level B Impact Area (km2)[1]	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# vibratory removal days	NEARSHORE Density Estimated Level B Exposure (density*area* days)	OFFSHORE Density Estimated Level B Exposure (density*area* days)
Sheetpile Removal	Antarctic Minke Whale (LF)	5.27	0.0018	0.093	4	0.00	1.96
	Arnoux's Beaked Whale (MF)		n/a	0.000038		n/a	0.00
	Blue Whale (LF)		n/a	0.00005		n/a	0.00
	Fin Whale (LF)		0.0839	0.0072		1.77	0.00
	Hourglass Dolphin (HF)		0.0015	n/a		0.03	n/a
	Humpback Whale (LF)		0.0361	0.0001		0.76	0.00
	Killer Whale (MF)		0.0015	0.0313		0.00	0.66
	Long-finned Pilot Whale (MF)		0.0076	0.0079		0.00	0.17
	Southern Bottlenose Whale (MF)		0.0006	0.0066		0.00	0.14
	Sei Whale (LF)		n/a	0.00025		n/a	0.01
	Southern Right Whale (LF)		0.0004	n/a		0.01	n/a
	Sperm Whale (MF)		0.0006	0.01699		0.00	0.36
	Antarctic Fur Seal (OW)		0.0999	n/a		2.11	n/a
	Crabeater Seal (PW)		1.76	0.00762		37.10	0.00
	Southern Elephant Seal (PW)		0.0003	n/a		0.01	n/a
	Leopard Seal (PW)		0.0003	0.00005		0.01	0.00
	Weddell Seal (PW)		0.054	0.00013		1.14	0.00

Anode Installation Using Hydrogrinder or Needle Scaler Level B							
	Species	Level B Impact Area (km2)[1]	NEARSHORE Density (animal per km^2)	OFFSHORE Density (animal per km^2)	# days	NEARSHORE Density Estimated Level B Exposure (density*area*days)	OFFSHORE Density Estimated Level B Exposure (density*area*days)
Anode Installation Using Hydrogrinder or Needle Scaler Level B	Antarctic Minke Whale (LF)	0.07	0.0018	0.093	18	0.00	0.12
	Arnoux's Beaked Whale (MF)		n/a	0.000038		n/a	0.00
	Blue Whale (LF)		n/a	0.00005		n/a	0.00
	Fin Whale (LF)		0.0839	0.0072		0.11	0.00
	Hourglass Dolphin (HF)		0.0015	n/a		0.00	n/a
	Humpback Whale (LF)		0.0361	0.0001		0.05	0.00
	Killer Whale (MF)		0.0015	0.0313		0.00	0.04
	Long-finned Pilot Whale (MF)		0.0076	0.0079		0.00	0.01
	Southern Bottlenose Whale (MF)		0.0006	0.0066		0.00	0.01
	Sei Whale (LF)		n/a	0.00025		n/a	0.00
	Southern Right Whale (LF)		0.0004	n/a		0.00	n/a
	Sperm Whale (MF)		0.0006	0.01699		0.00	0.02
	Antarctic Fur Seal (OW)		0.0999	n/a		0.13	n/a
	Crabeater Seal (PW)		1.76	0.00762		2.22	0.00
	Southern Elephant Seal (PW)		0.0003	n/a		0.00	n/a
	Leopard Seal (PW)		0.0003	0.00005		0.00	0.00
	Weddell Seal (PW)		0.054	0.00013		0.00	0.00

Total Level B Exposure (DTH+Vibratory Install & Removal+Anodes)			
Species	NEARSHORE Density Estimated Level B Exposure	OFFSHORE Density Estimated Level B Exposure	TOTAL Level B
Antarctic Minke Whale (LF)	0.00	312.25	312.25
Arnoux's Beaked Whale (MF)	n/a	0.14	0.14
Blue Whale (LF)	n/a	0.17	0.17
Fin Whale (LF)	281.70	0.00	281.70
Hourglass Dolphin (HF)	4.94	n/a	4.94
Humpback Whale (LF)	121.21	0.00	121.21
Killer Whale (MF)	0.00	111.70	111.70
Long-finned Pilot Whale (MF)	0.00	28.19	28.19
Southern Bottlenose Whale (MF)	0.00	23.55	23.55
Sei Whale (LF)	n/a	0.84	0.84
Southern Right Whale (LF)	1.34	n/a	1.34
Sperm Whale (MF)	0.00	16.73	16.73
Antarctic Fur Seal (OW)	356.50	n/a	356.50
Crabeater Seal (PW)	6128.78	0.00	6128.78
Southern Elephant Seal (PW)	1.04	n/a	1.04
Leopard Seal (PW)	1.04	0.00	1.04
Weddell Seal (PW)	187.97	0.00	187.97

Total Level A and Level B Exposures		
Species	Level A Exposures	Level B Exposures
Antarctic Minke Whale (LF)	15.23	312.25
Arnoux's Beaked Whale (MF)	0.00	0.14
Blue Whale (LF)	0.01	0.17
Fin Whale (LF)	13.74	281.70
Hourglass Dolphin (HF)	0.32	4.94
Humpback Whale (LF)	5.91	121.21
Killer Whale (MF)	0.04	111.70
Long-finned Pilot Whale (MF)	0.01	28.19
Southern Bottlenose Whale (MF)	0.01	23.55
Sei Whale (LF)	0.04	0.84
Southern Right Whale (LF)	0.07	1.34
Sperm Whale (MF)	0.02	16.73
Antarctic Fur Seal (OW)	0.15	356.50
Crabeater Seal (PW)	119.07	6,128.78
Southern Elephant Seal (PW)	0.02	1.04
Leopard Seal (PW)	0.02	1.04
Weddell Seal (PW)	3.65	187.97

Total Summer Observations 2018 - 2020 (January - March) Compared to Estimated Level A and Level B Takes

Species	Jan - Mar 2019	Oct 2019 - Mar 2020	Est. Level A Take	Est. Level B Take
Humpback Whale	0	2	5.91	121.21
Antarctic Fur Seal	73	70	0.15	356.50
Crabeater Seal	20	24	119.07	6,128.78
Southern Elephant Seal	1	0	0.02	1.04
Leopard Seal	3	2	0.02	1.04
Weddell Seal	8	6	3.65	187.97

Total Level A and Level B Takes (Does not reflect adjusted Level A & B in Application*)				
Species	Level A Take	Level B Take	Total Takes	Takes As Whole Numbers
Antarctic Minke Whale (LF)*	15.23	312	327.48	327
Arnoux's Beaked Whale (MF)*	0.00	12	12.00	12
Blue Whale (LF)	0.01	2	2.01	2
Fin Whale (LF)	13.74	281.70	295.44	295
Hourglass Dolphin (HF)*	0.32	60	60.32	60
Humpback Whale (LF)*	5.91	121.21	127.12	127
Killer Whale (MF)	0.04	111.70	111.74	112
Long-finned Pilot Whale (MF)	0.01	28.19	28.20	28
Southern Bottlenose Whale (MF)	0.01	23.55	23.56	24
Sei Whale (LF)*	0.04	6	6.04	6
Southern Right Whale (LF)*	0.07	20	20.07	20
Sperm Whale (MF)	0.02	16.73	16.75	17
Antarctic Fur Seal (OW)*	80	356.50	436.50	437
Crabeater Seal (PW)	119.07	6128.78	6247.85	6249
Southern Elephant Seal (PW)*	0.02	1.04	1.06	1
Leopard Seal (PW)*	5	1.04	6.04	6
Weddell Seal (PW)*	10	187.97	197.97	198
*See descriptive text in IHA application as to why Level A & B has been adjusted based on NSF observation data or highest densities.				

Takes Requested As a Percentage of Abundance		
Species	Abundance	Takes as Percentage of Abundance
Antarctic Minke Whale (LF)	500,000	0.0654%
Arnoux's Beaked Whale (MF)	600,000	0.0020%
Blue Whale (LF)	2,300	0.0870%
Fin Whale (LF)	38,200	0.7723%
Hourglass Dolphin (HF)	144,000	0.0417%
Humpback Whale (LF)	50,000	0.2540%
Killer Whale (MF)	80,000	0.1400%
Long-finned Pilot Whale (MF)	200,000	0.0140%
Southern Bottlenose Whale (MF)	500,000	0.0048%
Sei Whale (LF)	626	0.9585%
Southern Right Whale (LF)	30,000	0.0667%
Sperm Whale (MF)	12,000	0.1417%
Antarctic Fur Seal (OW)	2,700,000	0.0162%
Crabeater Seal (PW)	7,000,000	0.0893%
Southern Elephant Seal (PW)	750,000	0.0001%
Leopard Seal (PW)	220,000	0.0027%
Weddell Seal (PW)	1,000,000	0.0198%