UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Endangered Species Act Section 7(a)(2) Biological Opinion

Replacement of the UniSea, Inc. G1 Dock and Associated Proposed Issuance of an Incidental Harassment Authorization in Iliuliuk Harbor, Unalaska, Alaska

NMFS Consultation Number: AKR-2016-9518

Action Agencies: Alaska District, U.S. Army Corps of Engineers

Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, NOAA

Affected Species and Effects Determinations:

ESA-Listed Species	Status	Is the Action Likely to: Adversely Affect Species or Critical Habitat?	Jeopardize the Species?	Destroy or Adversely Modify Critical Habitat?
Steller sea lion, western DPS (*Eumetopias jubatus*)	Endangered	Yes	No	No
Humpback whale (*Megaptera novaeangliae*)	Endangered	No	No	N/A

Consultation Conducted by: Alaska Region, National Marine Fisheries Service, NOAA

Issued by:

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Date: 2·16·16

TABLE OF CONTENTS **PAGE**

TABLES **PAGE**

FIGURES **PAGE**

Abbreviations and Acronyms

dB	decibel
DPS	distinct population segment
ESA	Endangered Species Act
FRP	fiber-reinforced polymer
GPS	global positioning system
IHA	incidental harassment authorization
IWC	International Whaling Commission
kHz	kilohertz
kts	knots
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Observer	protected species observer
Opinion	this biological opinion
Permits Division	NMFS Office of Protected Resources, Permits and Conservation
p-p	peak-to-peak
PTS	permanent threshold shift
RMS	root mean square
TTS	temporary threshold shift
µPa	micropascal
0-p	peak

1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536(a)(2)), requires Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. When a Federal agency's action may affect ESA-listed species or critical habitat, consultation with National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service is required (50 CFR 402.14(a)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agencies' actions will affect ESA-listed species and their critical habitat under their jurisdiction. If an incidental take is expected, section 7(b)(4) requires the consulting agency to provide an Incidental Take Statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

The U.S. Army Corps of Engineers, Alaska District (Corps), proposes to issue permit POA-1988-735-M6 to UniSea, Inc. (UniSea), to replace their existing G1 Dock in Iliuliuk Harbor, Unalaska, Alaska. The NMFS Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division"), proposes to issue an incidental harassment authorization (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 et seq.), to UniSea for harassment of marine mammals incidental to the G1 Dock replacement activities (80 FR 79822).

The NMFS Alaska Region (sometimes hereafter referred to as "we") consulted with the Corps and Permits Division on the proposed actions. This document represents our biological opinion (Opinion) on the proposed actions and their effects on endangered and threatened species and designated critical habitat for those species.

The Opinion and Incidental Take Statement were prepared by NMFS Alaska Region in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402. The Opinion and Incidental Take Statement are in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) et seq.) and underwent pre-dissemination review.

1.1 Background

This Opinion considers the effects of the proposed replacement of the G1 dock and the associated proposed issuance of an IHA. These actions have the potential to affect the following species and designated critical habitat: the endangered humpback whale (*Megaptera novaeangliae*), the endangered western Distinct Population Segment (DPS) of Steller sea lion (*Eumetopias jubatus*), and designated critical habitat for Steller sea lion.

This Opinion is based on information provided to us in the December 2015, IHA application (PND 2015c), marine mammal monitoring plan (PND 2015b), biological assessment (PND 2015a), and proposed IHA (80 FR 79822); updated project proposals, emails and telephone conversations between NMFS Alaska Region and NMFS Permits Division staff and the Corps' designated non-Federal representative (PND Engineers, Inc. [PND]); and other sources of information. A complete record of this consultation is on file at NMFS's field office in Anchorage, Alaska.

1.2 Consultation History

Our communication with the Permits Division and the Corps' designated non-Federal representative (PND) regarding this consultation is summarized as follows:

- **April 7, 2015:** recommended PND pursue an IHA for the proposed G1 Dock replacement project.
- **June 10, 2015:** PND summited a draft IHA application to the Permits Division.
- **August to December, 2015:** discussed on many dates, by phone and email, the proposed take estimates and mitigation and monitoring measures in the draft IHA with the Permits Division and PND.
- **December 11, 2015:** received a section 7 consultation initiation request from the Permits Division in a package that included the PND's marine mammal monitoring plan and final IHA application and the Permit Division's proposed IHA.
- **December 16, 2015:** received the biological assessment, prepared by PND, from the Permits Division.
- **December 24, 2015:** provided comments to the Permits Division and PND on the proposed IHA marine mammal monitoring plan, and biological assessment.
- **December 28, 2015:** received comments on the proposed IHA provided to the Permits Division by the Marine Mammal Commission
- **December 29 to January 28:** discussed on many dates, by phone and email, the mitigation and monitoring measures in the marine mammal monitoring plan; requested clarification on aspects of the final IHA application, proposed IHA, marine mammal monitoring plan, and biological assessment from the Permits Division and PND.

2 DESCRIPTION OF THE ACTIONS

The proposed action for this consultation consists of two related components:

1. the proposed issuance of Corps permit POA-1988-735-M6 to UniSea to replace the existing G1 Dock in Iliuliuk Harbor, Unalaska, Alaska; and
2. the Permits Division's proposed issuance of an IHA for harassment of marine mammals incidental to the dock replacement.

2.1 UniSea's G1 Dock Replacement Project

UniSea proposes to demolish existing G1 Dock structures and construct new facilities in Iliuliuk Harbor, Unalaska, Alaska. The purpose of the dock replacement project is to replace the existing, partially-condemned G1 Dock to provide a safer, larger berthing facility.

2.1.1 General Overview

The proposed project will replace the existing dock with 0.03 hectare (ha [0.7 acres (ac)]) of new dock and permanently fill 0.4 ha (1.0 ac), below high tide line, with 18,502 cubic meters (m^3 [24,200 cubic yards (yd^3)]) of shot rock fill and 287 m^3 (375 yd^3) of armor rock.

The proposed project will require the installation of steel and fiber-reinforced polymer (FRP) pipe piles and sheet piles. The project will also require the removal of steel pipe and timber piles. Table 1 shows the type and number of piles that will be installed and removed.

Table 1. Material, size, shape, and amounts of piles proposed to be removed and installed for the G1 Dock replacement project in Iliuliuk Harbor, Unalaska, Alaska.

Activity Type and Pile Material	Pile Shape	Size (cm)	Number
Removal			
Steel	Pipe	Not provided	73
Timber	Not provided	Not provided	72
Installation			
Steel (temporary installation)	Pipe	46	180
Steel	Pipe	46	4
		61	24
	Sheet	N/A	887
FRP	Pipe	61	50

Table adapted from PND (2015c)

2.1.2 Demolition and Construction Activities

The proposed project will include the following elements, with a construction sequence in the same general order:

1. Demolition of existing dock and removal of any existing riprap and obstructions.
2. Installation of new sheet pile bulkhead dock and sheet pile seawater intake structure.
3. Installation of temporary utilities and fendering to provide functional seafood processing capability for the 2016/17 season (i.e., October 2016 to May 2017).
4. Installation of dock face fender piles.
5. Installation of dolphin support piles and caps.
6. Installation of fender support piles and pre-assembled fender systems (energy absorbers, sleeve piles, steel framing, and fender panels).
7. Installation of miscellaneous support piles (including catwalk and dock face support piles).
8. Installation and removal of temporary support piles.
9. Installation of electrical, water, and storm drainage utilities.
10. Installation of concrete dock surfacing and concrete utilidor.

Additional details for each project element are provided in the sections below.

2.1.2.1 Demolition of Existing Dock

Demolition of the existing dock and removal of any existing riprap/obstructions will be performed with track excavators, loaders, cranes, barges, cutting equipment, a vibratory hammer (for pile extraction), and human labor. The existing dock (consisting of steel support piles, steel superstructure, and concrete deck) will be completely removed for construction of the new dock.

Vibratory pile removal will generally consist of clamping the "jaws" of the vibratory hammer to the pile to be removed, and extracting the pile (with vibratory hammer turned on) to the point where the pile will be temporarily secured and removal can be completed with crane line rigging. The pile will then be

completely removed from the water by hoisting with crane line rigging and placing on the ground or deck of the barge.

The contractor will be required to dispose of (or salvage) demolished items in accordance with all Federal, state, and local regulations. Dewatering will not be required as all extraction will take place from the existing dock, from shore, and/or from a work barge.

2.1.2.2 Sheet Pile Bulkhead Dock

The new sheet pile bulkhead dock and seawater intake structure will be installed using a crane and vibratory hammer. It is anticipated that the largest size vibratory hammer used for the project will be an APE 200-6 (eccentric moment of 6,600 inch-pounds).[1] After several sheet pile cells have been installed, clean rock fill will be placed within the sheet pile cells from the shore. This process will continue sequentially until all of the sheet pile cells are installed and backfilled.

2.1.2.3 Temporary Utilities

Temporary utilities (and fendering, described in Section 2.1.2.6 of this Opinion, as needed) will be installed to provide functional seafood processing capability for the 2016/17 season (Oct 2016 – May 2017). Typical utility installation equipment such as track excavators, wheel loaders, and compaction equipment will be used.

2.1.2.4 Dock Face Fender Piles

The FRP composite fender piles will be installed along the face of the new sheet pile dock, fastened to the face at the top, and cut to elevation. Initial driving of the fender pile will be done with a vibratory or impact hammer, and final seating of the pile into the shallow bedrock will be done with an impact hammer.

2.1.2.5 Dolphin Support Piles

Dolphin support piles will be installed and cut to elevation for installation of a structural steel cap. The support piles will be driven and seated into shallow bedrock with an impact hammer. After the piles have been firmly seated into the bedrock, drilling equipment will be used to drill a shaft in the bedrock (down the center of the pipe pile) for installation of rock anchors. The rock anchors will consist of a high-strength steel rod grouted into the drilled shaft and tensioned against bearing plates inside the pile. Rock anchors are required in shallow bedrock conditions for the piles to resist tensile loads from vessel mooring and berthing.

2.1.2.6 Fender Support Piles and Fender Systems

Fender support piles will be installed and cut to elevation. The fender support piles will be installed into the shallow bedrock using one of three techniques:

- Rock anchor system (described in Section 2.1.2.5 of this Opinion)
- Down-the-hole drilling (described in Section 2.1.2.7 of this Opinion)
- Rock socket (described here)

The rock socket technique will require drilling a socket either slightly larger or slightly smaller than the outside diameter of the pile. If the socket is drilled larger than the outside diameter of the pile, then the annulus space between the rock and pile wall will be grouted to create a bond. If the socket is drilled

[1] Or a comparable vibratory hammer from another manufacturer such as ICE or HPSI.

smaller than the outside diameter of the pile, then the pile will be driven down into the rock with an impact hammer to the required depth and/or bearing capacity. A vibratory hammer may also be used to dive the pile down into the socket.

Pre-assembled fender systems (energy absorbers, sleeve piles, steel framing, and fender panels) will be lifted and installed onto fender support piles via crane.

2.1.2.7 Miscellaneous Support Piles

Miscellaneous support piles (including catwalk and dock face support piles) will be installed and cut to elevation. Installation methods for the miscellaneous support piles will be similar to the fender and dolphin support piles (described in Sections 2.1.2.5 and 2.1.2.6 of this Opinion). A description of the down-the-hole drilling method is provided here.

Down-the-hole drilling is a technique that uses a rotary drill bit that is impacted when hard material is encountered. The pounding action takes place where the drill bit encounters the resistant material underground rather than at the surface, as would be the case for impact or vibratory pile driving. Down-the-hole drilling is considered a pulsed noise source due to periodic impacts from the drill below ground level. The piling is fit over the drill with the drill head extending beneath the pile. As the drill advances downward, so does the pile. When the proper depth is achieved, the drill is retracted and the piling is left in place. This method eliminates high-energy sounds associated with traditional pile driving methods. A likely explanation for this much lower underwater noise level is that all of the impact is taking place below the substrate rather than at the top of the piling as it does with impact and vibratory pile driving, thus limiting transmission of noise through the water column.

2.1.2.8 Temporary Support Piles

Temporary support piles for pile driving template structures will be installed to aid with construction and removed after the permanent sheet piles or support piles have been installed. Temporary support piles will likely be steel H-piles (18-inch or smaller) or steel round piles (18- inch diameter or smaller). The sheet pile structures will consist of 14 cells, as well as two dolphin and two catwalk support structures. It is estimated that as many as 10 temporary support piles will be used per cell for the sheet pile structures, and as many as eight piles per dolphin and catwalk support location.[2]

Installation methods for the temporary support piles will be similar to the fender and dolphin support piles (described in Sections 2.1.2.5 and 2.1.2.6 of this Opinion).

2.1.2.9 Permanent Utilities

Permanent electrical, water, and storm drainage utilities will be installed with typical utility installation equipment similar to the temporary utilities. All storm water (and any other waste water) from the dock will be processed through the facility treatment system via piping in the utilidor (described in Section 2.1.2.10 of this Opinion).

2.1.2.10 Utilidor and Dock Surfacing

The concrete dock surfacing and concrete utilidor will be installed using forms and reinforced steel. This work will take place at or near the surface of the dock and will be above water.

[2] Estimated number of temporary piles has been provided; however, the actual number will be determined by the selected contractor's means and methods.

2.1.3 Dates and Duration

UniSea plans to conduct all in-water construction work between March 1, 2016, and February 28, 2017. Total construction time, including removal of existing structures and construction of the new dock, is expected to take no more than 180 days. Durations are conservative, and the actual amount of time to install and remove piles may be less than estimated. Pile installation will occur in two phases:

- Phase 1 (i.e., all sheet pile installation and some pipe pile installation) is estimated to occur between the approximate dates of March 1, 2016, and October 31, 2016.
- Phase 2 (i.e., remaining pipe pile installation) is estimated to occur between the approximate dates of November 1, 2016, and December 1, 2016.

In summer months (May to August), 12-hour workdays are planned, given the extended daylight hours in Alaska. In winter months (September to April), 8- to 10-hour workdays will be more likely. The daily construction window for pile-driving and removal will begin no sooner than 30 minutes after sunrise to allow for initial marine mammal monitoring to take place, and will end 30 minutes before sunset to allow for post-construction marine mammal monitoring. It is estimated 1,080 hrs, total, will be required for pile-driving and removal and drilling activities.

2.1.4 Mitigation Measures

The following measures will be incorporated by UniSea to minimize potential impacts from project activities:

- Unconfined bubble curtains will be used during all impact pile driving associated with the proposed project.
- Fill placed in the tidelands will be clean blasted rock with relatively few fines to reduce impacts from turbidity and/or sedimentation.
- Fill will be placed after the installation of the sheet piles is completed for each cell. The sheet pile wall will act as a silt curtain and contain rocks and sediment.
- The dock will be maintained in a manner that does not introduce any pollutants or debris into the harbor or cause a migration barrier for fish.
- Storm water drainage from the surface of the dock will be captured, combined and treated with the facility's existing processed water treatment system.
- Fuels, lubricants, and other hazardous substances will not be stored below the ordinary high water mark.
- Properly sized equipment will be used.
- Oil booms will be readily available for containment should any releases occur.
- The contractor will check for leaks regularly on any equipment, hoses, and fuel stored at the project site.
- All chemicals and petroleum products will be properly stored to prevent spills.
- No petroleum products, cement, chemicals, or other deleterious materials will be allowed to enter surface waters.
- In accordance with U.S. Environmental Protection Agency and Alaska Division of Environmental Conservation requirements, plans will be in place and materials available for spill prevention and cleanup activities at the dock to limit potential contamination.

2.1.5 Protected Species Mitigation and Monitoring

UniSea developed a marine mammal monitoring plan (PND 2015b) as a part of its IHA application. The plan includes:

- Qualifications for protected species observers (observers)
- General methods in which observers will conduct monitoring activities
- Equipment required by observers
- Descriptions of the areas that will be monitored
- Locations of the observers
- Monitoring techniques specific to pile-driving and removal and drilling activities

The following list provides additional details about each of these elements of the plan:

1. Observer Qualifications
    1.1. Monitoring will be conducted by qualified, trained observers that must meet the following requirements:
        1.1.1. Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance.
        1.1.2. Experience and ability to conduct field observations and collect data according to assigned protocols.
        1.1.3. Experience or training in the field identification of marine mammals, including the identification of behaviors, with ability to accurately identify marine mammals in Alaskan waters to species.
        1.1.4. Sufficient training, orientation or experience with the construction operation to provide for personal safety during observations.
        1.1.5. Writing skills sufficient to prepare a report of observations.
        1.1.6. Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.
2. General Methods
    2.1. Observers will be land-based and located on-site before, during, and after in-water construction activity at sites appropriate for monitoring all harassment zones (as shown in Table 2).
    2.2. An employee of the construction contractor will be identified as the main point of contact for observers (hereafter referred to as the "monitoring coordinator") at the start of each construction day.
    2.3. During periods of observation, observers will:
        2.3.1. Continuously scan the area for marine mammals using binoculars and the naked-eye during daylight hours.
        2.3.2. Work a maximum of four consecutive hours followed by an observer rotation or a one-hour break; observers will work no more than 12 hours in any 24 hour period.
        2.3.3. Collect data including, but not limited to:
            2.3.3.1. Environmental conditions (e.g., sea state, precipitation, and glare)
            2.3.3.2. Marine mammal sightings (e.g., species, numbers, location, behavior, and responses to construction activity)
            2.3.3.3. Construction activity at the time of sighting
            2.3.3.4. Number of marine mammal "taken" during project activities
        2.3.4. Follow observer protocols

2.3.5. Meet training requirements
2.3.6. Fill out data forms and report findings in accordance with protocols reviewed and approved by NMFS.
2.3.7. Implement mitigation measures, including:
2.3.7.1. Monitoring of the Level A and B harassment zones
2.3.7.2. Clearing of the zones
2.3.7.3. Shutdown procedures
2.3.8. Be in continuous contact with the construction personnel via two-way radio.
2.3.8.1. A cellular phone will be used as a back-up for communications and for safety purposes.
2.3.9. Report directly to the monitoring coordinator if/when a shutdown is necessary.

3. Required Equipment
3.1. The following equipment will be required to conduct marine mammal monitoring:
3.1.1. Hearing protection for observers within the airborne impact injury zone
3.1.2. Portable radios and headsets for the observers to communicate with the monitoring coordinator, construction contractor, and other observers
3.1.3. Cellular phone and the contact information for the other observers, monitoring coordinator, and NMFS point(s) of contact
3.1.4. Green flags and red flags (one each, per observing location) to be used in addition to radio communication
3.1.5. Daily tide tables for the project area
3.1.6. Watch or chronometer
3.1.7. Binoculars with built-in rangefinder or reticles (magnification and aperture of 7x 50 mm or greater)
3.1.8. Hand-held global positioning system (GPS) unit and/or map and compass to record locations of marine mammals
3.1.9. Monitoring plan, IHA permit, and/or other relevant permit requirement specifications in sealed clear plastic cover
3.1.10. Notebook with pre-standardized monitoring marine mammal observation record forms on waterproof paper (e.g. Rite in the Rain®)

4. Monitoring Zones
4.1. Table 2 shows the zones UniSea has established to delineate areas in which marine mammals would experience Level A or Level B harassment due to exposure to underwater sound from construction activity and the mitigative action that will be taken if animals are observed in or appear likely to enter those zones (see Section 7.1.2.2 of this Opinion for additional details about how the size of these zones were determined).

Table 2. Monitoring zones and mitigative actions for pile-driving and removal, drilling, and other in-water construction activities associated with the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

Activity Type	Species Group	Harassment Level	Underwater Harassment Threshold (dB re 1 μPa_{rms})	Radius of Harassment Zone (m)	Mitigative Action for Animals Observed in Zone
Impact pile-driving	Cetacean	A	180	40	Shutdown
		B	160	900	
	Pinniped	B	160	900	Monitor
Vibratory pile-driving and drilling	Cetacean	A	180	10	Shutdown
		B	120	1,300	
	Pinniped	B	120	1,300	Monitor
Vibratory and impact pile-driving	Pinniped	A	190	10	Shutdown
In-water construction	Cetacean	N/A	N/A	10	Shutdown
	Pinniped				

Table adapted from (PND 2015b).

4.2. During drilling, impact pile driving and vibratory pile-driving and removal, the Level A harassment zone for Steller sea lions will include all areas where the underwater sound pressure levels are anticipated to equal or exceed the Level A (injury) harassment criteria for pinnipeds (190 dB isopleth).

4.2.1. The Level A harassment zone encompasses a radius 10 meters around the pile being driven or removed.

4.2.2. Predicted distances to the 190 dB isopleth do not exceed 9 meters for any activity. Take in the form of Level A harassment, of any species, is not authorized. To prevent Level A take of pinnipeds, a conservative "shutdown zone" of 10 meters will be in effect around the pile being driven or removed during all pile installation and removal activities, regardless of predicted noise levels.

4.3. During impact pile driving, the Level B harassment zone for Steller sea lions will include all areas where the underwater sound pressure levels are anticipated to equal or exceed the Level B harassment criteria for marine mammals during impact pile driving (160 dB isopleth).

4.3.1. These areas will constitute a "shutdown zone" for all other animals under NMFS's jurisdiction (e.g., humpback whales).

4.4. During drilling and vibratory pile driving and removal, the Level B harassment zone for Steller sea lions will include all areas where the underwater sound pressure levels are anticipated to equal or exceed the Level B harassment criteria for marine mammals during vibratory pile driving (120 dB isopleth).

4.4.1. These areas will constitute a "shutdown zone" for all other animals under NMFS's jurisdiction (e.g., humpback whales).

4.5. The Level A and B harassment zones will be monitored throughout the time required to drive or remove a pile (including pre-activity monitoring). If a Steller sea lion enters or

appears likely to enter the Level B harassment zone, an exposure will be recorded and animal behaviors documented.

4.5.1. However, the construction activity will be completed without cessation, unless the sea lion enters or appears likely to enter the Level A harassment zone.

4.6. During other in-water construction activities not involving pile-driving, to prevent injury to these species from physical interaction with construction equipment, a shutdown zone of 10 m (33 ft) will be in effect.

4.6.1. These activities could include, but are not limited to:

4.6.1.1. Positioning of piles on substrate via crane (i.e., "stabbing" the pile)

4.6.1.2. Removal of piles from the water column or substrate via crane (i.e. "deadpull")

4.6.1.3. Placement of sound attenuation devices around piles

5. Observer Locations

5.1. Observers will be stationed at locations that provide adequate visual coverage for the Level A and B harassment zones.

5.1.1. One observer will be placed at a suitable location near the G1 Dock in order to observe the Level A harassment zones.

5.1.1.1. This observer's monitoring will be primarily dedicated to observing Level A harassment zones; however, this observer will also record all marine mammal sightings beyond the radius of the Level A harassment zone, provided it does not interfere with their effectiveness at carrying out the shutdown procedures.

5.1.2. Additionally, one observer will be stationed on shore, and will be responsible for monitoring and recording data on any marine mammals that enter the Level B harassment zones.

5.1.3. Proposed observer monitoring locations are shown in Figure 1.

Figure 1. Proposed observer locations during construction activities for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

6. Monitoring Techniques
   6.1. Observers will collect sighting data and behaviors of marine mammal species within NMFS's jurisdiction that are observed in the Level A and B zones during periods of construction.
      6.1.1. All observers will be qualified and trained in marine mammal identification and behaviors, as described in Item 1 in this Section of the Opinion (page 12).
      6.1.2. Observers will have no other construction-related tasks while conducting monitoring.
      6.1.3. Monitoring of Level A and B zones will take place from 30 minutes prior to initiation through 30 minutes post-completion of all pile-driving and removal and drilling activities.
   6.2. Pre-activity Monitoring
      6.2.1. Prior to the start of pile-driving and removal or other in-water construction activities, observers will monitor the Level A and B harassment zones for 30 minutes.
         6.2.1.1. They will ensure that no marine mammals within NMFS's jurisdiction are present within the Level A harassment zone, and no marine mammals within NMFS's jurisdiction other than Steller sea lions and harbor seals are present within the Level B harassment zone.
         6.2.1.2. If Steller sea lions or harbor seals are present within, or appear likely to enter, the Level A harassment zone prior to pile-driving and removal or other in-water construction activities, the monitoring will continue and the start of these activities will be delayed until the animal(s) leave the Level A harassment zone voluntarily and have been visually confirmed beyond the Level A harassment zone, or 15 minutes has elapsed without re-detection of the animal in the Level A harassment zone.
         6.2.1.3. If any cetacean or pinniped other than Steller sea lions or harbor seals are present in, or appear likely to enter, the Level A or Level B harassment zones prior to pile-driving and removal or other in-water construction activities, activities will be delayed until the animal leaves the Level B zone voluntarily and has been visually confirmed beyond the zone, or 15 minutes (for pinnipeds) or 30 minutes (for cetaceans) has elapsed without re-detection of the animal in the Level B harassment zone.
      6.2.2. When all applicable zones have been cleared, as described above, the observers will raise a green flag and radio the monitoring coordinator.
         6.2.2.1. Pile-driving and removal or other in-water construction activities will commence when the monitoring coordinator receives verbal confirmation from the observers the zones are clear.
      6.2.3. If Steller sea lions or harbor seals are present within the Level B harassment zone (but outside the Level A harassment zone), the start of pile-driving and removal or other in-water construction activities will not be delayed, but observers will monitor and document the behavior of Steller sea lions or harbor seals that remain in the Level B harassment zone.
         6.2.3.1. Marine mammal observation record forms will be used to document observations.[3]
      6.2.4. Observers will use binoculars and the naked eye to search continuously for marine mammals.

[3] The form appears as Appendix A of the marine mammal monitoring plan (PND 2015b).

6.2.5. In case of fog or reduced visibility, observers must be able to see the entirety of the Level A and B harassment zones, or pile-driving and removal and in-water construction activities will not be initiated until these zones are visible in their entirety.

6.3. Monitoring During Activity

6.3.1. The Level A and B harassment zones will be monitored throughout the time required to install or remove a pile (including soft-start procedures), or complete other in-water construction.

6.3.2. The following survey methodology will be implemented during pile driving/removal and other in-water construction activities:

6.3.2.1. If a Steller sea lion or harbor seal is observed entering or appears likely to enter the Level B harassment zone during pile-driving and removal and drilling, an exposure would be recorded and behaviors documented.

6.3.2.1.1. However, the pile segment would be completed without cessation, unless the animal enters or appears likely to enter the Level A harassment zone.

6.3.2.2. If a marine mammal enters or appears likely to enter the Level A harassment zone:

6.3.2.2.1. The observers shall immediately radio to alert the monitoring coordinator and raise a red flag.

6.3.2.2.2. All pile-driving and removal and other in-water construction activities will be immediately halted.

6.3.2.3. In the event of a shutdown, activities may resume only when:

6.3.2.3.1. The Steller sea lion or harbor seal that was within, or appeared likely to enter, the Level A harassment zone has been visually confirmed beyond the Level A zone, or 15 minutes have passed without re-detection of the animal;

6.3.2.3.2. Any other marine mammal under NMFS' jurisdiction that was within, or appeared likely to enter, the Level A or B harassment zones has been visually confirmed beyond the Level B zone, or 15 minutes (in the case of pinnipeds other than Steller sea lion or harbor seal) or 30 minutes (in the case of a cetacean) have passed without re-detection of the animal;

6.3.2.3.3. Observers radio the monitoring coordinator that activities can re-commence and will raise a green flag.

6.3.2.4. During an in-water construction delay, the Level A and B harassment zones will continue to be monitored.

6.3.2.5. If Steller sea lions or harbor seals are detected outside the Level A harassment zone, the observers will continue to monitor these individuals and record their behavior, but pile driving and other in-water construction may proceed.

6.3.2.6. Any Steller sea lions or harbor seals detected outside the Level A harassment zone after pile driving or other in-water construction activities are initiated shall likewise continue to be monitored and their behaviors recorded.

6.3.2.7. Marine mammal observation record forms will be used to document observations.

6.3.2.8. Observers will use binoculars and the naked eye to search continuously for marine mammals.

6.3.2.9. In case of fog or reduced visibility, observers must be able to see the entirety of the Level A and B harassment zones, or pile-driving and removal and in-water

construction activities will not be initiated until these zones are visible in their entirety.

6.4. Post-activity Monitoring

6.4.1. Monitoring of the Level A and B harassment zones will continue for 30 minutes following completion of pile-driving activities.

6.4.1.1. These surveys will record marine mammal observations, and will focus on observing and reporting unusual or abnormal behavior of marine mammals.

6.4.1.2. Marine mammal observation record forms will be used to document observations.

6.4.1.3. In general, the same protocols described in Item 6.3, above, will apply.

6.4.1.4. If any injured, sick, or dead marine mammals are observed, procedures outlined in the proposed IHA will be followed.

2.2 Incidental Harassment Authorization

The Permits Division proposes to issue an IHA for non-lethal "takes"[4] of marine mammals by Level B harassment (as defined by the MMPA) incidental to UniSea's proposed action (80 FR 27901). When issued, the IHA will be valid from March 1, 2016, to February 28, 2017, and will authorize the incidental harassment of 2,177 Steller sea lions and 385 harbor seals.[5] Section 7.2.1 of this Opinion contains more information about the methods used to calculate take for Steller sea lions.

The IHA, when finalized, will incorporate the protected species mitigation and monitoring measures from the marine mammal monitoring plan (and described in Section 2.1.5 of this Opinion) and reporting requirements that UniSea must adhere to.

3 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 CFR 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur. The project is located at the UniSea G1 Dock in Iliuliuk Harbor, Unlaska, Alaska (Figure 2). The action area includes the area in which demolition and construction activities will take place, and extends 1,290 m into Iliuliuk Harbor and Captains Bay (see Figure 7, page 42). See Section 7.1.2.2 of this Opinion for additional details about how this area was determined.

[4] The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild" (referred to 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" (referred to as Level B harassment). 16 U.S.C. 1362(18)(A) and (B). For the purposes of this consultation, NMFS considers that a take by "harassment" occurs when an animal is exposed to certain sound levels described below in Section 7 of this Opinion.

[5] Please see proposed IHA for MMPA-authorized takes of marine mammal species not listed under the ESA (80 FR 79822).

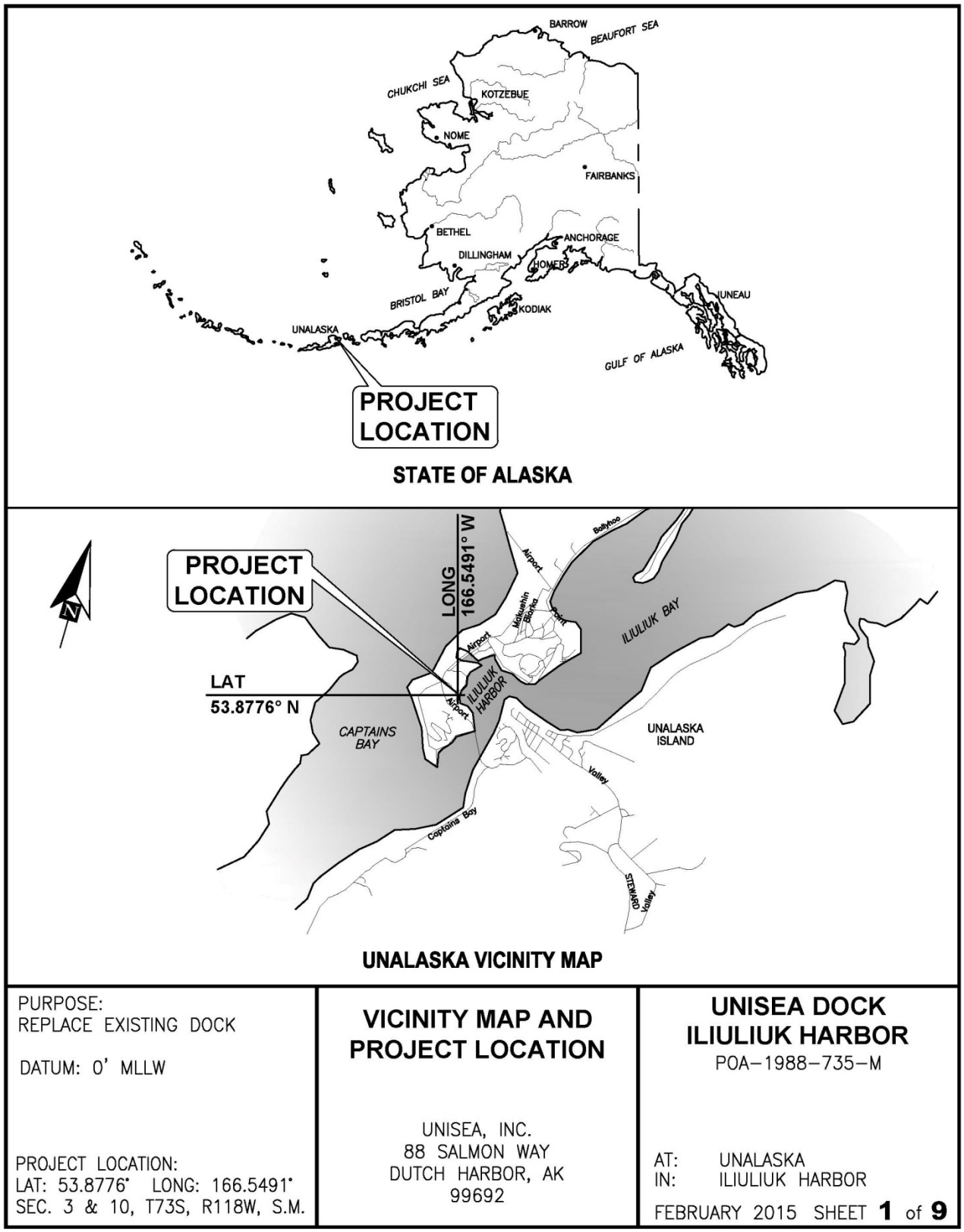

Figure 2. Project location overview for UniSea's G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

4 APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934).

We used the following approach to determine whether the proposed actions described in Section 2 of this Opinion are likely to jeopardize listed species or destroy or adversely modify critical habitat:

1. We identified the proposed actions and those aspects (or stressors) of the proposed actions that are likely to have direct or indirect effects on the physical, chemical, and biotic environment within the action area, including the spatial and temporal extent of those stressors.
2. We identified the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time.
3. We described the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, impacts of state or private actions that are contemporaneous with the consultation in process.
4. We identified the number, age (or life stage), and sex of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong. This is our exposure analysis.
5. We evaluated the available evidence to determine how those ESA-listed species are likely to respond given their probable exposure. This is our response analyses.
6. We assessed the consequences of these responses to the individuals that may be exposed, the populations those individuals represent, and the species those populations comprise. This is our risk analysis.
7. The adverse modification analysis considered the impacts of the proposed action on the critical habitat features and conservation value of designated critical habitat. This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. [6]
8. We described any cumulative effects of the proposed action in the action area. Cumulative effects, as defined in our implementing regulations (50 CFR §402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation.

[6] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

9. We integrated and synthesized the above factors by considering the effects of the actions to the environmental baseline and the cumulative effects to determine whether the actions could reasonably be expected to:
   9.1. Reduce appreciably the likelihood of both survival and recovery of the ESA-listed species in the wild by reducing its numbers, reproduction rate, or distribution; or
   9.2. Reduce the conservation value of designated or proposed critical habitat. These assessments are made in full consideration of the status of the species and critical habitat.
10. We stated our conclusions regarding jeopardy and the destruction or adverse modification of critical habitat.

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 or destroy or adversely modify designated critical habitat, we must identify a reasonable and prudent alternative to the action. The reasonable and prudent alternative must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

For all analyses, we used the best available scientific and commercial data. For this consultation, we relied on:

- Information submitted by the Corps and Permits Division, as described in Section 1.1 of this Opinion
- Government reports
- Past reports for similar activities
- General scientific literature

5 STATUS OF THE SPECIES AND CRITICAL HABITAT

Table 3 shows the ESA-listed species and critical habitat that occur in the action area.

Table 3. ESA-listed species and critical habitat that occur in the action area for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

Common Name	Scientific Name	Population	Status[1]	Critical Habitat FR Notice
Cetaceans				
Humpback whale	*Megaptera novaeangliae*	N/A	E	N/A
Pinnipeds				
Steller sea lion	*Eumetopias jubatus*	Western DPS[2]	E	58 FR 45269

[1] Status: E = endangered

[2] DPS = distinct population segment

5.1 Species Not Considered Further in this Opinion

If an action's effects on ESA-listed species will be insignificant, discountable, or completely beneficial, we conclude that the action is not likely to adversely affect those species and further analysis is not required. Insignificant effects relate to the size of impact and are those that one would not be able to meaningfully measure, detect, or evaluate, and should never reach the scale where take occurs.

Discountable effects are those that are extremely unlikely to occur. Similarly, if proposed activities are not likely to destroy or adversely modify critical habitat, further analysis is not required. In this section, we describe the species that are not likely to be adversely affected by the proposed action.

5.1.1 Humpback Whale

The humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA) on December 2, 1970 (35 FR 18319). Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered. NMFS recently conducted a global status review and proposed changing the status of humpback whales under the ESA. Under this proposal, the Western North Pacific DPS (which includes whales found in the Aleutian Islands and Bering Sea) would be listed at threatened and the Hawaii DPS (which includes whales found in southeast Alaska) and Mexico DPS (which includes whales found in the northern and western Gulf of Alaska, Aleutian Islands, and Bering Sea) would not be listed (80 FR 22304; April 21, 2015). Information on humpback whale biology and habitat is available at:

- http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html
- http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2014_final.pdf

Unalaska Island is situated between Unimak and Umnak Passes, important humpback whale migration routes and feeding areas. Humpback whales have been tagged in Unalaska Bay during August and September (Kennedy et al. 2014). Additionally, one humpback whale was observed in Iliuliuk Harbor in September 2015 during marine mammal surveys conducted by UniSea personnel (L. Baughman, personal communication, PND Engineers, Inc., January 4, 2016). Given the documented presence of humpback whales in the action area, we assume humpback whales may occasionally be present during the proposed project activities.

Humpback whales produce a variety of vocalizations ranging from 0.02 to 10 kHz (Winn et al. 1970, Tyack and Whitehead 1983, Payne and Payne 1985, Silber 1986, Thompson et al. 1986, Richardson et al. 1995, Au 2000, Frazer and Mercado III 2000, Erbe 2002, Au et al. 2006, Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group. As a group, it is estimated that low-frequency cetaceans can hear frequencies between 0.007 and 25 kHz (NOAA 2015).

We do not anticipate that this project will expose humpback whales to sound pressure levels that reach the Level A or B acoustic threshold because:

1. We expect few humpback whales to be present near the action area.
2. The project incorporates monitoring and mitigation measures (described in Section 2.1.5 of this Opinion) that include shutdown zones which minimize the risk of exposure to harmful or harassing sounds to any individual that enters the action area.

We expect that noise would occur at levels below which any observable effects to humpback whales would be likely, and mitigation measures would make exposure to sound levels equal to, or in excess of, Level A or Level B MMPA take thresholds extremely unlikely. We conclude such effects are insignificant and discountable. Therefore, humpback whales are not likely to be adversely affected by this action, and they are not discussed further in this Opinion.

5.2 Species Likely to be Adversely Affected by the Action

This Opinion examines the status of each listed species that may be affected by the proposed action. The Status of the Species (Section 5 of this Opinion) helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

5.2.1 Steller Sea Lion (Western DPS)

We used information available in the most recent stock assessment (Allen and Angliss 2015), the revised recovery plan (NMFS 2008), NMFS species information (NMFS 2015c, NMML 2015), and recent biological opinions (NMFS 2015a, b) to summarize the status of the species, as follows.

5.2.1.1 Distribution

Steller sea lions are distributed throughout the northern Pacific Ocean, including coastal and inland waters in Russia (Kuril Islands and the Sea of Okhotsk), east to Alaska, and south to central California (Año Nuevo Island) (Figure 3). Animals from the eastern DPS occur primarily east of Cape Suckling, Alaska (144° W) and animals from the endangered western DPS occur primarily west of Cape Suckling. The western DPS includes Steller sea lions that reside primarily in the central and western Gulf of Alaska, Aleutian Islands, and those that inhabit and breed in the coastal waters of Asia (e.g., Japan and Russia). The eastern DPS includes sea lions living primarily in southeast Alaska, British Columbia, California, and Oregon. The action area considered in this Opinion occurs in the range of the western DPS Steller sea lion.

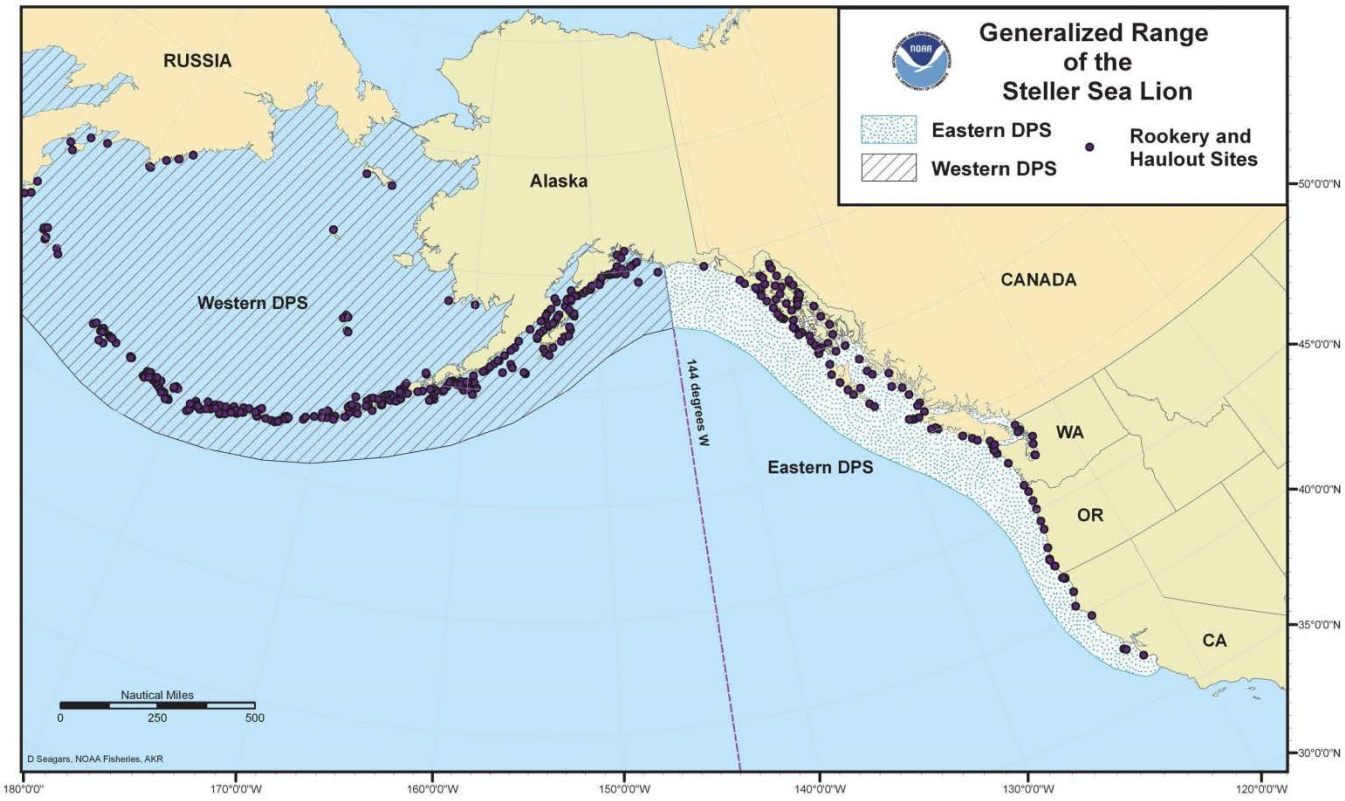

Figure 3. Generalized range of Steller sea lion, including rookery and haulout locations.

Steller sea lions are not known to migrate, but individuals may disperse widely outside the breeding season (late May to early July). At sea, Steller sea lions commonly occur near the 200-m (656-ft) depth

contour, but have been seen from near shore to well beyond the continental shelf (Kajimura and Loughlin 1988).

The action area for this project is located within designated Steller sea lion critical habitat around one rookery and two haulouts (see Section 5.2.1.5 of this Opinion for more information related to critical habitat) and there are 12 additional haulouts within a 36-km (19-mi) radius of the UniSea G1 dock (Table 4).

Table 4. Steller sea lion sites and types, their distances from the UniSea G1 dock, and the number of individuals present during June 2014 National Marine Mammal Laboratory surveys. Sites designated as critical habitat shown in bold.

Steller Sea Lion Site Name and Type	Distance from UniSea G1 Dock (km)	Number of Individuals Present in June 2014	
		Non-pup	Pup
Rookeries			
Akutan/Cape Morgan	**36**	**1,127**	**748**
Haulouts			
Baby	34	0	0
Egg	33	0	0
Egg/SE Tip	33	10	0
Egg/West	32	0	0
Inner Signal	32	49	0
Old Man Rocks	**31**	**15**	**0**
Outer Signal	34	1	0
Unalaska/Bishop Point	29	208	3
Unalaska/Brundage Head	24	0	0
Unalaska/Cape Sedanka	**31**	**0**	**0**
Unalaska/Cape Wislow	20	0	0
Unalaska/Makushin Bay	36	47	0
Unalaska/Priest Rock	18	105	0
Unalaska/W of Makushin Bay	36	N/A	N/A

Steller sea lion counts from Fritz et al. (2015).

The distances shown in Table 4 are straight-line measurements from the G1 dock to rookeries and haulouts. If the geography of the surrounding area is taken into account, it is likely that Steller sea lions in Iliuliuk Bay originate only from the Priest Rock haulout (L. Fritz, personal communication, NMML, August 17, 2015).

We assume Steller sea lions may be present year-round in the action area for the following reasons:

1. Steller sea lions are highly mobile and have large ranges.
2. During Steller sea lion surveys conducted by the National Marine Mammal Laboratory in June 2014, Steller sea lions were present at eight of the 15 sites within a 37-km radius around the G1 dock (Table 4).

3. Presence of Steller sea lions in Iliuliuk Harbor was noted during Steller's eider surveys conducted by the Corps from November to March (i.e., the Steller sea lion non-breeding season) from 2003 to 2013 (PND 2015a).
4. Steller sea lions were documented in Iliuliuk Harbor during protected species surveys conducted by UniSea from April to October, 2015 (i.e., during Steller sea lion breeding and non-breeding seasons) (PND 2015a).
5. Potential prey are seasonally present in the Iliuliuk River, a coho, pink, and silver salmon and Dolly Varden-bearing waterbody that empties into Iliuliuk Harbor approximately 0.4 km (0.2 mi) across the harbor from the G1 dock (ADF&G 2014).
6. There are several fish processing plants and waste outfalls located in and near Iliuliuk Harbor (ADEC 2014).
    6.1. Based on accounts from UniSea personnel, Steller sea lions are sighted more often when fishing boats are docked near the project site and are often observed foraging near fishing boats that are docked at the UniSea facility (80 FR 79822).
    6.2. It is expected that operations at the G2 Dock (i.e., the next nearest UniSea dock to G1) and associated processing facilities will continue as usual during the G1 Dock replacement (PND 2015a).

5.2.1.2 Life History

Steller sea lions are the largest of the eared seals (Otariidae), though there is significant difference in size between males and females: males reach lengths of 3.3 m (10.8 ft) and can weigh up to 1,120 kg (2469 lb) and females reach lengths of 2.9 m (9.5 ft) and can weigh up to 350 kg (772 lb). Their fur is light buff to reddish brown and slightly darker on the chest and abdomen; their skin is black. Sexual maturity is reached and fist breeding occurs between 3 and 8 years of age. Pupping occurs on rookeries in May and June and females breed 11 days after giving birth. Implantation of the fertilized egg is delayed for about 3.5 months, and gestation occurs until the following May or June.

Most adult Steller sea lions occupy rookeries during pupping and breeding season. During the breeding season, most juvenile and non-breeding adults are at haulouts, though some occur at or near rookeries. During the non-breeding season many Steller sea lions disperse from rookeries and increase their use of haulouts.

Steller sea lions are generalist predators that eat a variety of fishes and cephalopods and occasionally consume marine mammals and birds.

The ability to detect sound and communicate underwater and in-air is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group. As a group, it is estimated that otariid pinnipeds can hear frequencies between 0.1 and 48 kHz in water (NOAA 2015). Southall et al. (2007) categorizes Steller sea lion in the pinniped function hearing group[7] and estimated, as a group, that pinnipeds can hear frequencies between 0.075 to 30 kHz in air.

5.2.1.3 Population Dynamics

The western DPS population declined approximately 75 percent from 1976 to 1990 (the year of ESA-listing). The western DPS population decreased another 40 percent between 1991 and 2000. The most

[7] Note that all pinnipeds (i.e., both otariid and phocid pinnipeds) are included in this functional hearing group.

recent comprehensive (pup and non-pup) abundance estimate for the western DPS is 82,516 sea lions. The minimum comprehensive population estimate of western DPS Steller sea lions in Alaska is 48,676 individuals. From 2000 to 2012, the western DPS population increased at an average rate of 1.7 percent annually for non-pups and 1.5 percent annually for pups, though considerable regional variation exists among populations; populations east of Samalga Pass are increasing at an average rate of 2.9 percent annually and populations west of Samalga Pass are decreasing at a rate of -1.5 percent annually. The action area for this project is located east of Samalga Pass.

5.2.1.4 Status

The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345); at that time the eastern DPS was listed as threatened and the western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66139). Factors affecting the continued existence of the western DPS at the time of its listing included changes in the availability or quality of prey as a result of environmental changes or human activities and removals of Steller sea lions from the wild. Concern about possible adverse effects of contaminants was also noted.

Steller sea lions are hunted for subsistence purposes. As of 2009, data on community subsistence harvest are no longer being collected; therefore, the most recent estimate of annual statewide (excluding St. Paul Island) harvest[8] is 173 individuals from the 5-year period from 2004 to 2008. More recent data from St. Paul are available; the annual harvest is 27 sea lions from the 5-year period from 2007 to 2011.

Additional threats to the species include environmental variability, competition with fisheries, predation by killer whales, toxic substances, incidental take due to interactions with active fishing gear, illegal shooting, entanglement in marine debris, disease and parasites, and disturbance from vessel traffic, tourism, and research activities. All threats to the species in the action area are discussed further in Section 6 of this Opinion.

5.2.1.5 Critical Habitat

NMFS designated critical habitat for Steller sea lions on August 27, 1993 (58 FR 45269). The following essential features were identified at the time of listing:

1. Alaska rookeries, haulouts, and associated areas identified at 50 CFR 226.202(a), including:
    1.1. Terrestrial zones that extend 914 m (3,000 ft) landward
    1.2. Air zones that extend 914 m (3,000 ft) above the terrestrial zone
    1.3. Aquatic zones that extend 914 m (3,000 ft) seaward from each major rookery and major haulout east of 144° W. longitude
    1.4. Aquatic zones that extend 37 km (23 mi) seaward from each major rookery and major haulout west of 144° W. longitude
2. Three special aquatic foraging areas identified at 50 CFR 226.202(c):
    2.1. Shelikof Strait
    2.2. Bogoslof
    2.3. Seguam Pass

[8] These numbers included both harvested and struck and lost sea lions.

The action area is within critical habitat surrounding the Akutan/Cape Morgan rookery and the Old Man Rocks and Unalaska/Cape Sedanka haulouts (Table 4) and is located in the Bogoslof special aquatic foraging area (Figure 4).

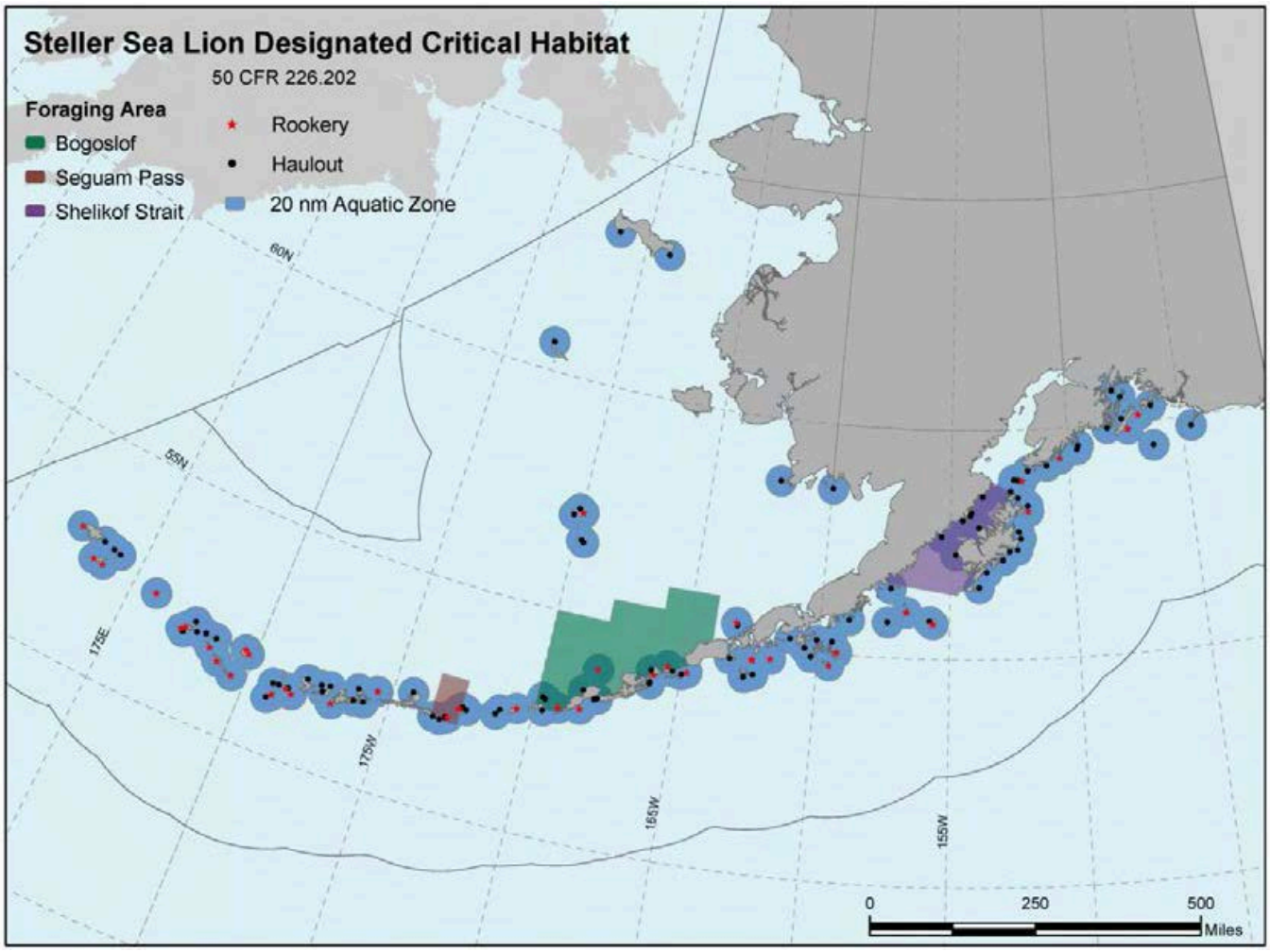

Figure 4. Designated critical habitat for western DPS Steller sea lions.

At the time of designation, the following human activities (and their generalized area of occurrence) were identified as having the potential to disrupt the essential life functions that occur in critical habitat:

1. Wildlife viewing (primarily south-central and southeastern Alaska and California)
2. Boat and airplane traffic (throughout the range of the Steller sea lion)
3. Research activities(on permitted sites and during specified times throughout the year)
4. Commercial, recreational, and subsistence fisheries for groundfish, herring, salmon, and invertebrates, e.g., crab, shrimp, sea urchins/cucumbers (throughout the range of the Stellar sea lion)
5. Timber harvest (primarily southeastern and south-central Alaska)
6. Hard mineral extraction (primarily southeastern Alaska)
7. Oil and gas exploration (primarily Bering Sea and Gulf of Alaska)
8. Coastal development, including pollutant discharges (specific sites throughout range)
9. Subsistence harvest (Alaska)

All threats to designated critical habitat in the action area are discussed further in Section 6 of this Opinion.

In the biological assessment prepared for the proposed action, PND reported that the benthic habitat around the G1 Dock was surveyed in 2005 by Pentec Environmental. The substrate in the areas adjacent to the shoreline was made up of a "narrow portion of riprap that quickly grades to larger cobbles and rock," while deeper areas were made up of areas of gravel and cobble interspersed among shell-covered silty-sand. Kelp, rockweed, mussels, and urchins were found within the shallow, intertidal areas 0 to -3.0 m (0 to -10 ft). In the subtidal areas -3.0 to -6.1 m (-10 to -20 ft), plumose anemones, sculpins, and several crab species were seen. Shell debris with mussels and clams, sea cucumbers, urchins, and algae were found within -30 ft waters. Beyond -30 ft, tubeworms, nudibranchs, and marine snails were common. No eelgrass or dense kelp beds were found to be in the surveyed area (PND 2015a).

6 ENVIRONMENTAL BASELINE

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 (50 CFR 402.02).

Focusing on the impacts of activities specifically within the action area allows us to assess the prior experience and condition of the animals that will be exposed to effects from the actions under consultation. This focus is important because individuals of ESA-listed species may commonly exhibit, or be more susceptible to, adverse responses to stressors in some life history states, stages, or areas within their distributions than in others. These localized stress responses or baseline stress conditions may increase the severity of the adverse effects expected from proposed actions.

6.1 Factors Affecting Species within the Action Area

In the revised Steller sea lion recovery plan (NMFS 2008), the recovery team identified and described 13 factors that may have led to past population declines of the species:

- Commercial harvest
- Disease and parasitism
- Disturbance
- Entanglement in marine debris
- Food web interactions
- Global climate change
- Incidental take by fisheries
- Illegal shooting
- Killer whale predation
- Nutritional stress due to reduced prey biomass and/or quality
- Shark predation
- Subsistence harvest
- Toxic substances

Of those 13 factors, the team identified 11 factors that may be threats to the recovery of the species (NMFS 2008). Table 5 shows the age class and sex most vulnerable to, and the frequency of occurrence of, each threat; the amount of uncertainty about each threat's influence on Steller sea lion population dynamics; and the relative impact of each threat to the recovery of the species.

Table 5. Summary of threats to Steller sea lion recovery, including the ages and sexes most vulnerable, frequency of threat occurrence, uncertainty of threat impact to recovery, feasibility of threat mitigation, and relative impact of threat to recovery.

Threat	Age Class Most Vulnerable	Sex Most Vulnerable	Frequency of Occurrence of Threat	Uncertainty of Threat Impact to Recovery	Feasibility of Mitigation	Relative Impact to Recovery
Alaska Native subsistence harvest	Adult Juvenile	M	Medium	Low	High	Low
Competition with fisheries	Adult Juvenile	F M, F	High	High	High	Potentially high
Disease and parasites	Adult Pup	F M, F	High	Medium	Low	Low
Disturbance due to research activities	Pup	M, F	Medium	Low	High	Low
Disturbance from vessel traffic and tourism	Pup	M, F	Medium	Medium	High	Low
Entanglement in marine debris	Juvenile	M, F	Medium	Medium	Medium	Low
Environmental variability	Adult Juvenile	F M, F	High	High	Low	Potentially high
Illegal shooting	Juvenile Adult	M, F	Low	Medium	Medium	Low
Incidental take due to active fishing gear interactions	Juvenile	M, F	Medium	Medium	Medium	Low
Predation by killer whales	Juvenile Pup	M, F	High	High	Low	Potentially high
Toxic substances	Adult Pup	F M, F	High	High	Medium	Medium

Table adapted from NMFS (2008).

In addition to the above threats, it is likely that Steller sea lions in the action area have become conditioned to associate fishing vessels with easy access to food.

The factors that have likely had the greatest impact on western DPS Steller sea lions in the action area are discussed in the sections below. For more information on the threats and factors listed above, but not discussed in the sections below, please see the "Recovery Plan for the Steller Sea Lion" (NMFS 2008), available online at http://www.fisheries.noaa.gov/pr/pdfs/recovery/stellersealion.pdf.

6.1.1 Climate Change

The average global surface temperature rose by 0.85º C from 1880 to 2012, and it continues to rise at an accelerating pace (IPCC 2014); the 15 warmest years on record since 1880 have occurred in the 21st century, with 2015 being the warmest (NCEI 2016). The warmest year on record for average ocean

temperature is also 2015 (NCEI 2016). Direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, oceanic pH, patterns of precipitation, and sea level. Indirect effects of climate change have impacted, are impacting, and will continue to impact marine species in the following ways (IPCC 2014):

- Shifting abundances
- Changes in distribution
- Changes in timing of migration
- Changes in periodic life cycles of species

The effects of these changes to the marine ecosystems of the Bering Sea, Aleutian Islands, and the Gulf of Alaska, and how they may affect Steller sea lions are uncertain. Warmer waters could favor productivity of some species of forage fish, but the impact on recruitment of important prey fish of Steller sea lions is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years, but the distribution and recruitment of other fish (e.g., osmerids) could be negatively affected (NMFS 2008).

6.1.2 Natural and Anthropogenic Noise

Steller sea lions in the action area are exposed to several sources of natural and anthropogenic noise. Natural sources of underwater noise include sea ice, wind, waves, precipitation, and biological noise from marine mammals, fishes, and crustaceans. Anthropogenic sources of noise in the action area include:

- Vessels
  - Fishing
  - Shipping
  - Transportation
  - Research
- Marine and coastal construction
  - Drilling
  - Dredging
  - Pile-driving
- Aircraft

The combination of anthropogenic and natural noises contribute to the total noise at any one place and time.

Fish processing plants are not known to contribute large amounts of noise to their immediate surroundings; prior to its construction, the maximum noise level of the Goodnews Bay salmon processing facility (i.e., operational facility post-construction) was estimated to have an in-air, A-

weighted[9] sound pressure level (dBA) of 80 dBA re 20 μPa_{rms} (USFWS 2008). Numerous docks capable of assisting with fish off-loading as well as domestic and international cargo transportation are located in Iliuliuk Harbor, the adjacent Iliuliuk Bay, and Dutch Harbor. Airborne noise emissions from marine container cranes, like those in use in the adjacent Iliuliuk Bay at a dock dedicated to APL, an international shipping company, can range from 110 to 115 dBA re 20 μPa_{rms} during typical operations (Khoo and Nguyen 2011). Furthermore, commercial ships that frequent Iliuliuk Harbor can have sound exposure levels of over 120 dB re 1 μPa_{rms} at distances of 3 km (1.86 mi) (McKenna et al. 2012).

Because responses to anthropogenic noise vary among species and individuals within species, it is difficult to determine long-term effects. Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003). Habitat abandonment due to anthropogenic noise exposure has been found in terrestrial species (Francis and Barber 2013). Clark et al. (2009) identified increasing levels of anthropogenic noise as a habitat concern for whales because of its potential effect on their ability to communicate (i.e., masking). Some research (Parks 2003, McDonald et al. 2006, Parks 2009) suggests marine mammals compensate for masking by changing the frequency, source level, redundancy, and timing of their calls. However, the long-term implications of these adjustments, if any, are currently unknown.

As we discussed in Section 5.2.1.1 of this Opinion, Steller sea lions are sighted more often when fishing boats are docked at the project site and are often observed foraging near fishing boats that are docked at the UniSea facility, suggesting sea lions in the Iliuliuk Harbor area are habituated to the presence of fishing vessels and, presumably, to the presence of shipping vessels and noises associated with the industrial activities in and around Iliuliuk Harbor.

6.1.3 Fisheries

Commercial fisheries operate in and around Iliuliuk Harbor. The UniSea processing facility has the capacity to process more than 2.5 million pounds of fish per day. The adjacent G2 facility is "one of the most efficient, highest volume Pollock processing facilities in the world" (Graham 2009).

The following sections discuss the activities associated with the fishing industry that may contribute to the baseline condition of Steller sea lions in the action area.

6.1.3.1 Competition with Fisheries

The potential impact of competition with fisheries, through a reduction in the amount and quality of Steller sea lion prey species, has caused considerable debate among the scientific community. The primary issue of contention is whether fisheries reduce Steller sea lion prey biomass and quality at both local and regional spatial scales that may lead to a reduction in Steller sea lion survival and reproduction, and if sustained, their carrying capacity. The effect of fisheries on the distribution, abundance, and age structure of the Steller sea lion prey field, at the spatial scale of foraging sea lions and over short and long temporal scales, is largely unknown (NMFS 2008).

6.1.3.2 Incidental Take and Entanglement

The most recent minimum total annual mortality of western DPS Steller sea lions associated with commercial fisheries is 31.5 individuals (Table 6).

[9] "A-weighted" refers to frequency-dependent weighting factors applied to sound in accordance with the sensitivity of the human ear to different frequencies; sound energy is deemphasized at frequencies below 1 kHz and above 6 kHz (Richardson et al. 1995).

Table 6. Summary of most recent data available for western DPS Steller sea lion incidental mortalities associated with commercial fisheries in Alaska.

Fishery Name	Year(s)	Mean Annual Mortality
Bering Sea/Aleutian Islands		
Atka mackerel trawl	2008 – 2012	0.2
Flatfish trawl	2008 – 2012	6.4
Pacific cod trawl	2008 – 2012	0.4
Pollock trawl	2008 – 2012	8.2
Gulf of Alaska		
Pacific cod longline	2008 – 2012	0.5
Pacific cod trawl	2008 – 2012	0.2
Sablefish longline	2008 – 2012	1.1
Prince William Sound		
Salmon drift gillnet	1990 – 1991	14.5
Salmon set gillnet	1990	0
Alaska Peninsula/Aleutian Islands		
Salmon drift gillnet	1990	0
Cook Inlet		
Salmon set gillnet	1999 – 2000	0
Salmon drift gillnet	1999 – 2000	0
Kodiak Island		
Salmon set gillnet	2002	0
MINIMUM TOTAL ANNUAL MORTALITY		**31.5**

Table adapted from Allen and Angliss (2015).

Take, in the form of serious injury or mortality, is authorized from 2014 to 2016 resulting from entanglement or hooking by fishing gear in the Bering Sea/Aleutian Islands groundfish fisheries, and is limited to 42 Steller sea lions, combined, during that three-year period (NMFS 2014).

The most recent minimum total annual mortality of western DPS Steller sea lions reported to the NMFS stranding network is 4.2 individuals (Table 7). This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported. Steller sea lions reported to the stranding network as having been shot are not included in this estimate, as they may result from animals struck and lost in the Alaska Native subsistence harvest.

Table 7. Summary of most recent mortalities of western DPS Steller sea lions reported to the NMFS stranding network in Alaska.

Cause of Injury	Year(s)	Mean Annual Mortality
Swallowed troll gear	2008 – 2012	1
Ring neck entanglement (packing band)	2008 – 2012	1.8
Ring neck entanglement (unknown marine debris/gear)	2008 – 2012	1.2
Swallowed unknown fishing gear	2008 – 2012	0.2
MINIMUM TOTAL ANNUAL MORTALITY		**4.2**

Table adapted from Allen and Angliss (2015).

6.1.3.3 Conditioning and Habituation

Steller sea lions are likely drawn to the action area by the abundant and predictable sources of food provided by commercial fishing vessels and fish processing facilities. Based on accounts from UniSea personnel, sea lions are sighted more often when fishing boats are docked at the project site and are often observed foraging near fishing boats that are docked at the UniSea facility, suggesting sea lions in the Iliuliuk Harbor area are habituated to the presence of fishing vessels and are likely conditioned to associating fishing boats with easy access to food (80 FR 79822).

6.1.4 Toxic Substances

During World War II, the U.S. Army and Navy established Fort Mears and the Dutch Harbor Naval Station, respectively, in the Dutch Harbor area. Unalaska was attacked on June 3 and 4, 1942, by Japanese bombers. Fuel tanks in the surrounding area were drained prior to the attack, releasing more than one million gallons of petroleum fuel. Several fuel tanks farms were destroyed during World War II, releasing several thousand gallons of fuel. Additional leaks and spills have been reported from other fuel tanks and tank farms in the Unalaska area. The State of Alaska Department of Environmental Conservation (ADEC) listed Iliuliuk Harbor as "impaired" on the 1990 Clean Water Act section 303(d) list of impaired waters due to non-attainment of water quality standard for petroleum hydrocarbons and petroleum products (i.e., oil and grease). In its 2010 (i.e., most recent) section 303(d) total maximum daily load assessment of the area, ADEC found that Iliuliuk Harbor met applicable water quality standards and removed the waterbody from the 303(d) list. However, areas of Iliuliuk Harbor are still considered impaired due to oil sheens in sediments (ADEC 2010).

6.2 Factors Affecting Critical Habitat within the Action Area

The action area is located within designated critical habitat surrounding the Akutan/Cape Morgan rookery and the Old Man Rocks and Unalaska/Cape Sedanka haulouts and is located in the Bogoslof special aquatic foraging area (see Section 5.2.1.1 of this Opinion). However, the action area is also located in an industrialized port with ongoing disturbance. We expect the factors affecting the species discussed in Section 6.1 of this Opinion have also contributed to the baseline condition of critical habitat in the action area, in particular the following factors:

- Climate change
- Anthropogenic noise
- Fisheries
- Toxic substances

7 EFFECTS OF THE ACTION

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. The proposed activities will expose western DPS Steller sea lions to sounds from pile driving, pile removal, and drilling.

The proposed action is expected to result in non-lethal, non-injurious harassment of Steller sea lions. The ESA does not define harassment and NMFS has not defined this term through regulation pursuant to the ESA. As noted above in Footnote 4 of this Opinion, the MMPA includes definitions for Level A and B harassment.

Since 1997 NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871). NMFS is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption to marine mammals. However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels[10], expressed in root mean square[11] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA:

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1 μPa_{rms}

NMFS uses the following conservative thresholds for underwater sound pressure levels from broadband sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA:

- 180 dB re 1 μPa_{rms} for whales
- 190 dB re 1 μPa_{rms} for pinnipeds (seals and sea lions)

NMFS uses the following conservative thresholds for in-air sound pressure levels from broadband continuous and impulsive sounds that cause Level B harassment:[12]

- 90 dB re 20 μPa_{rms} for harbor seals
- 100 dB re 20 μPa_{rms} for all other pinnipeds

No thresholds have been established for in-air Level A harassment.

Our analysis considers that behavioral harassment or disturbance is not limited to the Level B thresholds. Our analysis considers an individual to be harassed if the individual changes its behavioral state (e.g., from resting to traveling away from the acoustic source or from traveling to evading),

[10] Sound pressure is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 μPa, and the units for underwater sound pressure levels are decibels (dB) re 1 μPa.

[11] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

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

regardless of the received sound level to which it was exposed (i.e., animals could be harassed at received levels less than 120 or 160 dB re 1 μPa_{rms} or 100 dB re 20 μPa_{rms}).

7.1 Stressors

During the course of this consultation, we identified the following potential stressors from the proposed activities:

- In-air and underwater sounds from:
  - Vibratory pile-driving and removal
  - Impact pile-driving
  - Drilling
- Direct contact with:
  - Piles, during placement
  - Sound attenuation devices, during placement and removal
  - Existing structures and riprap, during removal
- Disturbance of sediment
- Direct loss of critical habitat

Below we discuss each stressor's potential to affect ESA-listed species.

7.1.1 Stressors Not Likely to Adversely Affect ESA-listed Species and Critical Habitat

Based on a review of available information, we determined which of the possible stressors may occur, but are discountable or insignificant and, therefore, need not be evaluated further in this Opinion.

7.1.1.1 Direct Contact

Though it is possible that western DPS Steller sea lions could come in direct contact with, and suffer injury from, piles and sound attenuation devices during their placement or existing structures and riprap during removal, it is highly unlikely. Furthermore, a 10-m shutdown zone will be implemented during these activities to further reduce risk of injury. This mitigation measure will make these activities extremely unlikely to impact Steller sea lions; therefore, we conclude the effects from this stressor are discountable.

7.1.1.2 Disturbance of Sediment

A small amount of sediment will be disturbed and may temporarily impact water quality during pile-driving and removal, drilling, and removal of existing structures and riprap. We expect this will occur in the area immediately surrounding the sediment-disturbing activity and we expect suspended sediment will re-settle on the seafloor quickly. Silt curtains will be placed prior to driving of sheet piles, further reducing the area in which sediment may travel. For these reasons, we do not expect project activities will affect water quality to any measurable degree; therefore, we conclude the effects from this stressor are insignificant.

7.1.1.3 Direct Loss of Critical Habitat

The project will result in the direct loss of 0.4 ha (1.0 ac) of critical habitat that is located 36 km (22.4 mi) from the nearest rookery designated as critical habitat (i.e., Akutan/Cape Morgan) and 31 km (19.3 mi) from the nearest haulout designated as critical habitat (i.e., Old Man Rocks and Unalaska/Cape Sedanka) and within the Bogoslof special aquatic foraging area; however, the area in which the loss will occur is an industrialized port (i.e., Iliuliuk Harbor), an area which does not currently function as high

quality Steller sea lion habitat or foraging area due to ongoing disturbance. It is extremely unlikely that the loss of habitat in such an area will affect designated critical habitat for western DPS Steller sea lions to any measurable degree; therefore, we conclude such effects are insignificant.

7.1.1.4 Summary of Stressors Not Likely to Adversely Affect ESA-listed Species

In conclusion, based on review of available information, we determined effects from direct contact, and physical injury from, pile-driving and removal, drilling, and removal of existing structures and riprap are extremely unlikely to occur. We consider the effects to western DPS Steller sea lions from this stressor to be discountable.

We determined disturbance of sediment will have insignificant effects on western DPS Steller sea lions and the direct loss of critical habitat will have insignificant effects on designated critical habitat for the species.

7.1.2 Stressors Likely to Adversely Affect ESA-listed Species

The following sections analyze the one stressor likely to adversely affect ESA-listed species: in-air and underwater sounds from vibratory pile-driving and removal, impact pile-driving, and drilling. First, we present a brief explanation of the sound measurements used in the discussions of acoustic effects in this Opinion.

7.1.2.1 Sound Measurements Used in this Document

"Sound pressure" is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. "Sound pressure level" is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in in-air acoustics is 20 μPa, and the units for sound pressure levels are decibels (dB) re 20 μPa. The commonly used reference pressure in underwater acoustics is 1 μPa, and the units for sound pressure levels are dB re 1 μPa. Sound pressure level (in dB) = 20 log (pressure/reference pressure).

Sound pressure level is an instantaneous measurement and can be expressed as "peak" (0-p), "peak-to-peak" (p-p), or "root mean square" (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates. All references to sound pressure level in this document are expressed as rms, unless otherwise indicated. In instances where sound pressure levels for airguns were originally expressed as 0-p or p-p, we used the following rough conversions in order to express those values in rms (Harris et al. 2001):

- rms is approximately 10 dB lower than 0-p
- rms is approximately 16 dB lower than p-p

We reported the original 0-p or p-p measurements in footnotes. It should also be noted that sound pressure level does not take the duration of a sound into account.

7.1.2.2 In-air and Underwater Sounds

UniSea used the practical spreading loss model (Equation 1), where *TL* is the transmission loss (in dB), R_1 is the range of the sound pressure level, and R_2 is the distance from the source of the initial measurement, to model the transmission loss of sounds from impact and vibratory pile-driving.

$$TL = 15 \log(R_1/R_2) \quad \text{(Equation 1)}$$

Using Equation 1 and representative source levels for vibratory pile-driving (165 dB re 1 μPa_{rms} at 10 m; ICF Jones & Stokes and Illingworth and Rodkin Inc. 2012), vibratory pile removal (163 dB re 1 μPa_{rms} at 10 m; Illingworth &Rodkin Inc. 2013), and impact pile-driving (189 dB re 1 μPa_{rms} at 10 m; ICF Jones & Stokes and Illingworth and Rodkin Inc. 2012), UniSea estimated the radii of the areas ensonified to 120-, 160-, 180-, and 190-dB harassment thresholds (to the nearest 10 m for the 180- and 190-dB thresholds and nearest 100 m for the 120- and 160-dB thresholds)(Table 8).

Table 8. Calculated radii (in m) of the areas ensonified to behavioral harassment thresholds for the G1 Dock replacement project, Iliuliuk Harbor, Alaska.

	Calculated Radii (in m) of the Areas Ensonified to Behavioral Harassment Thresholds			
Source	**190 dB**	**180 dB**	**160 dB**	**120 dB**
Impact pile-driving	10	40	900	N/A
Vibratory pile removal	10	10	N/A	7,400
Vibratory pile-driving	10	10	N/A	10,000

Table adapted from (PND 2015b).

Less information is available related to underwater sounds or source levels produced by drilling activities. UniSea proposed the use of a representative source level of 165 dB re 1 $\mu Pa_{0\text{-}p}$ at 1 m (URS Australia 2011); however, this source level is from hydro-hammering, not drilling. URS Australia (2011) does present a source spectrum for a typical drilling signal, which appears to have a peak of approximately 150 dB re 1 µPa. Dazey et al. (2012) reported minimum, maximum, and average calculated source sound pressure levels (117.5, 182.7, and 150.5 dB re 1 μPa_{rms}, respectively) during construction monitoring, an unspecified portion of which occurred during down-the-hole pneumatic percussion drilling. In addition to the uncertainty surrounding how much of the time spent recording sounds that contained drilling during construction monitoring, the source levels were calculated using the cylindrical spreading loss model (i.e., a model that assumes a value of 10 log *R*, instead of the 15 log *R* presented in Equation 1) and not enough information was given regarding the distances at which measurements were taken so that Equation 1 can be applied. In the absence of representative source levels for the proposed drilling activities, UniSea will apply the harassment radii calculated for vibratory pile-driving (i.e., the largest harassment zone).

The modeled radius of the 120-dB isopleth for vibratory pile-driving (10,000 m) is shown in Figure 5 and the modeled radius of the of 120-dB isopleth for vibratory pile removal (7,400 m) is shown in Figure 6. Sound from vibratory pile-driving and removal will not reach the extent of the modeled distances due to the land masses surrounding Iliuliuk Harbor. When these land masses are considered, the area that will actually be ensonified to at least 120 dB re 1 μPa_{rms} during vibratory pile-driving and removal is much smaller (i.e., a distance of approximately 1,300 m at its greatest extent) (Figure 7). The modeled radius of the 160-dB isopleth for impact pile-driving is 900 m and the area actually ensonified

to at least 160 dB re 1 µPa_{rms} during impact pile-driving is shown in Figure 8. Due to the scale of Figures 5 to 8, the 10- and 40-m calculated radii for 190- and 180-dB (i.e., Level A take) thresholds are not shown.

The monitoring zones (adjusted for land masses) and mitigative measures that will be applied during project activities are shown in Table 2 (page 14 of this Opinion).

The frequency of vibratory and impact pile-driving is estimated to range from 0.01 to 1.5 kHz (i.e., mostly within the expected hearing range of Steller sea lions).

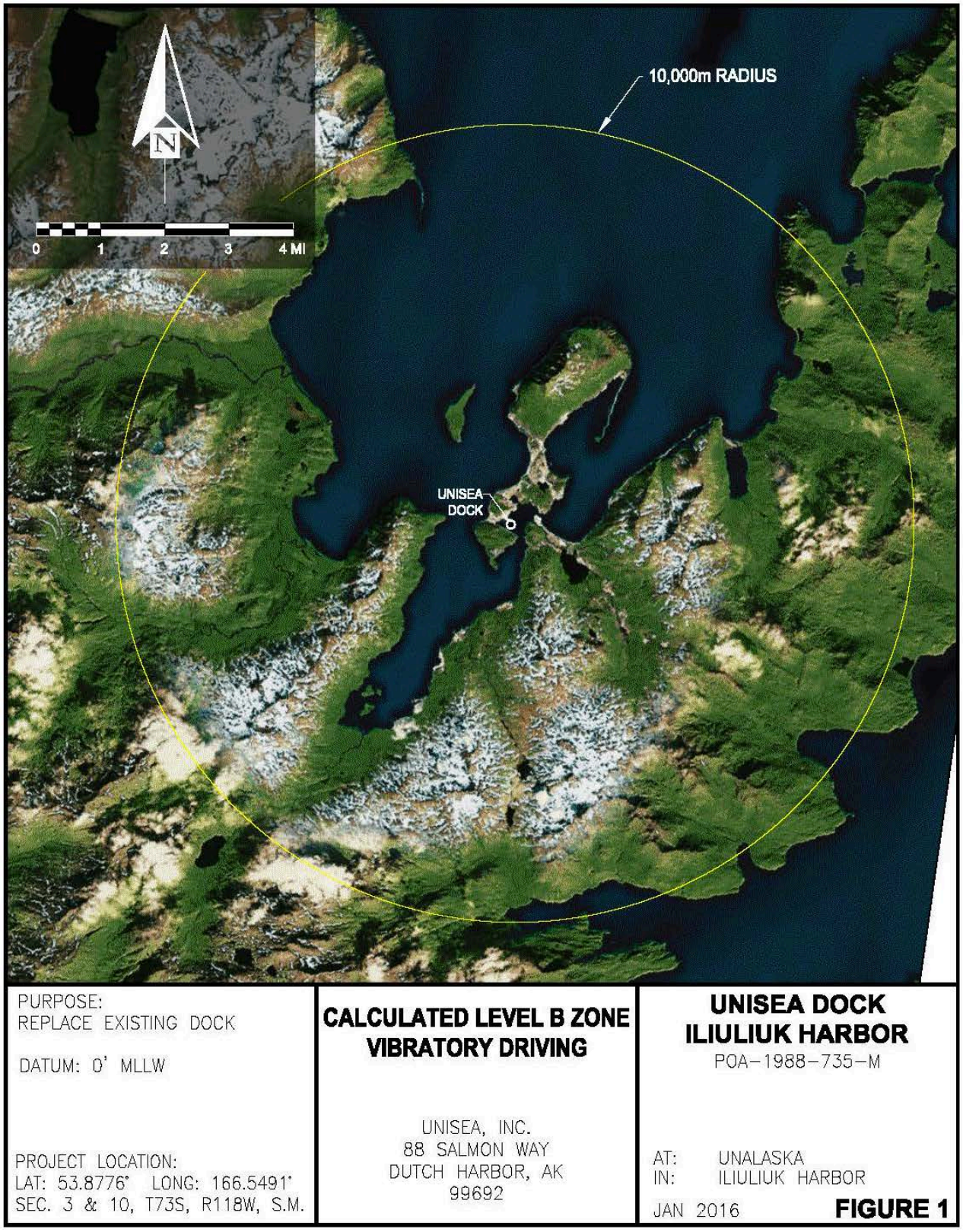

Figure 5. Modeled radius of 120-dB isopleth for vibratory pile-driving for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

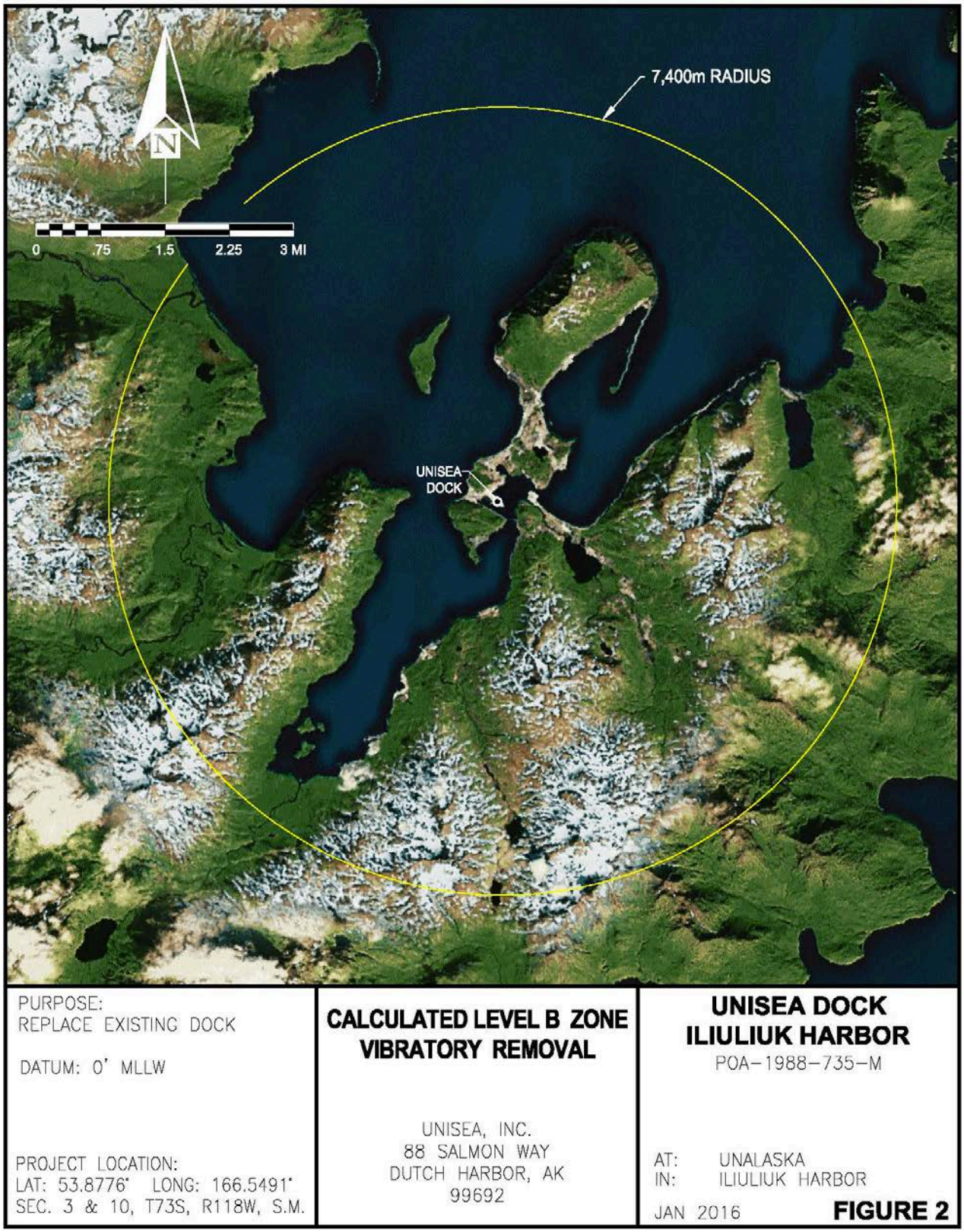

Figure 6. Modeled radius of 120-dB isopleth for vibratory pile removal for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

Figure 7. Actual area ensonified to at least 120 dB re 1 µPa$_{rms}$ during vibratory pile-driving and removal and drilling for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

Figure 8. Modeled 160-dB isopleth and actual area ensonified to at least 160 dB re 1 µPa$_{rms}$ during impact pile-driving for the G1 Dock replacement project, Iliuliuk Harbor, Unalaska, Alaska.

7.2 Exposure

Our exposure analyses are designed to identify the ESA-listed resources that are likely to co-occur with the action's effects in space and time, as well as the nature of that co-occurrence. In this step of our analysis, we try to identify 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.

7.2.1 Underwater Sounds

The number of marine mammals expected to be taken by behavioral harassment is usually calculated by multiplying the expected densities of marine mammals in the survey area by the area ensonified in excess of 120 and 160 dB re 1 μPa_{rms}, though the method to calculate take may vary from consultation to consultation, depending on the information available. In the early stages of this consultation, we reviewed with the Permits Division the available marine mammal occurrence data in or near the action area. Density data for marine mammal species in or near the action area are not available; therefore, we agreed the data collected from marine mammal surveys in Iliuliuk Harbor in 2015 represent the best available scientific information on marine mammal occurrence in the action area. Because the marine mammal observation data reflect an hourly rate of observation, the hours of pile-driving expected to occur over the duration of project was used in the calculation of an estimated takes by behavioral harassment, rather than the areas ensonified in excess of 120 and 160 dB re 1 μPa_{rms}. The Permits Division adopted UniSea's calculated exposures of marine mammals from their IHA application (PND 2015c) for use in the proposed IHA (80 FR 79822) and we have adopted them for our exposure analysis here.

Table 9 shows the number of western DPS Steller sea lions observed in Iliuliuk Harbor in 2015 by month, the number of hours of observation per month, and the rate of Steller sea lions observed per hour.

Table 9. Monthly western DPS Steller sea lion observations in 2015 in Iliuliuk Harbor, Alaska.

Month of Observation	Individual Steller Sea Lions Observed (Number)	Length of Observations (Hours)	Rate of Steller Sea Lion Observations (Number of Steller Sea Lions Observed Per Hour)
January	10	4.0	2.5
February	37	9.25	4.0
March	14	8.0	1.8
April	1	4.25	0.2
May	2	4.25	0.5
June	0	40.5	0.0
July	22	84.75	0.3
August	141	87.0	1.6
September	90	74.75	1.2
October	6	41.25	0.1
AVERAGE	**32.3**	**35.8**	**1.219**

Table adapted from PND (2015c)

To account for variability in the small data set, UniSea added the upper bound of the 95 percent confidence interval (0.798) to the average rate of Steller sea lion observations (1.219) to arrive at an estimated observation rate of 2.016 western DPS Steller sea lions per hour. This hourly observation rate was then multiplied by the total number of hours of pile driving expected over the life of the project (1,080 hours)[13] to arrive at an estimated exposure (i.e., take estimate) of 2,177 western DPS Steller sea lions.

We assume the estimated exposure of 2,177 western DPS Steller sea lions represents the maximum number of exposures of western DPS Steller sea lions to sound levels of at least 120 dB re 1 μPa_{rms} during vibratory pile-driving and drilling, and at least 160 dB re 1 μPa_{rms} (i.e., the number of times sea lions will be counted as "taken"); however, it is unlikely this estimated exposure reflects the number of individuals that may be taken during pile-driving and drilling activities for the following reasons:

- We assume some, if not all, western DPS Steller sea lions in Iliuliuk Harbor have become conditioned to the presence of fishing vessels. For this reason, we assume the following:
  - It is likely the monthly observation rate shown in Table 9 represents repeated observations of a few sea lions that frequent Iliuliuk Harbor.
  - At least some individual sea lions may enter and exit Iliuliuk Harbor many times a day as they follow fishing vessels in and out of the Harbor.
  - Individuals may be less motivated to move out of areas ensonified by pile-driving and drilling when fishing vessels are present.
- Because western DPS Steller sea lions do not haul out in Iliuliuk Harbor, it is unlikely observers will be able to identify individual sea lions when the majority of each sea lion's body will be underwater.

Therefore, we expect individuals could be exposed multiple times throughout the survey. Exposed individuals may be male or female and of any age.

We expect exposures will be limited to Level B harassment (i.e., Steller sea lions will not be within the area ensonified to 180 dB re 1 μPa_{rms} during vibratory pile-driving and drilling and 190 dB re 1 μPa_{rms} during impact pile-driving) for the following reasons:

- Mitigation measures require that observers must be able to see the entirety of the Level A shutdown and Level B harassment zones, or pile-driving will not begin.
- Any Steller sea lions within the Level B zones will be monitored to ensure they do not enter the Level A zones.
- Pile-driving operations will be shut down if Steller sea lions appear likely to enter the Level A zones.

The bubble curtain proposed for use by UniSea during impact pile-driving may result in some noise reduction; however, we are unable make assumptions about the extent of the attenuation that may be provided by it because the bubble curtain proposed for use is of a novel design that has not undergone sound source verification. Sound source verification is also not proposed for this project.

[13] This estimate is based on a 180-day project length, an average work day of 12 hours (work days may be longer than 12 hours in summer and shorter than 12 hours in winter), and an estimate that approximately 50 percent of time during those work days will include pile driving and removal activities (with the other 50 percent of work days spent on non-pile driving activities which will not result in marine mammal take [e.g., installing templating and bracing or moving equipment]).

7.2.2 In-air Sounds

Airborne sound pressure levels during vibratory pile driving were recorded during the Explosive Handling Wharf project at Naval Base Kitsap in Hood Canal, Washington (Illingworth & Rodkin Inc. 2013). Table 10 shows the minimum, average, and maximum radii of the areas ensonified to 100 dB re 20 μPa_{rms} (i.e., the Level B harassment zone for Steller sea lions considered in this Opinion) reported for vibratory and impact pile-driving of 61- and 91-cm piles for that project.

Table 10. The minimum, average, and maximum radii of the areas ensonified to 100 dB re 20 μPa_{rms} reported for vibratory and impact pile driving for the Explosive Handling Wharf project at Naval Base Kitsap in Hood Canal, Washington.

Pile-driving Method and Pile Size (cm)	Radii (m) of Area Ensonified to 100 dB re 20 μPa_{rms}		
	Minimum	Average	Maximum
Vibratory			
61	< 10	11	22
91	< 10	11	34
Impact			
61	16	21	26
91	10	20	27

Table adapted from Illingworth & Rodkin Inc. (2013).

The project did not include 46-cm or sheet piles, though we expect the zone for 46-cm piles would be similar, if not smaller than, those calculated for 61-cm piles and the zone for sheet piles would be similar to those for the 91-cm piles. We expect the airborne sound pressure levels from drilling would be less than for those reported for pile-driving.

Airborne sounds do not travel as far as sounds underwater. As shown in Table 2 (page 14 of this Opinion), the smallest underwater Level B harassment zone is 900 m, a distance many times that of the largest maximum in-air Level B harassment zone at Naval Base Kitsap (i.e., 34 m). Steller sea lions do not haul out in Iliuliuk Harbor; therefore, individuals entering the underwater Level B harassment zones for vibratory and impact pile-driving will have already been exposed to more intense (i.e., louder) underwater sounds by the time they reach an area in which in-air noise may rise to the point of Level B harassment. In other words, no individual western DPS Steller sea lion will be taken by Level B harassment due solely to exposure to in-air sounds from pile-driving or drilling.

We expect the numbers of individuals exposed to Level B harassment from in-air sounds will be much lower than the number of Steller sea lions we expect will be exposed to Level B harassment from underwater sounds; therefore, because of the already-conservative estimate of amount of take described in section 7.2.1 of this Opinion, we have not estimated additional take for Level B harassment from in-air sounds.

7.3 Response

Strong underwater sounds can result in physical effects on the marine environment that can affect marine organisms. Possible responses by western DPS Steller sea lions to the impulsive sound produced by impact pile-driving and continuous sound produced by vibratory pile-driving and removal and drilling considered in this analysis are:

- Threshold shifts
- Auditory interference (masking)
- Behavioral responses
- Non-auditory physical or physiological effects

This analysis also considers information on the potential effects on prey of western DPS Steller sea lions.

7.3.1 Threshold Shifts

Exposure of marine mammals to very strong sounds can result in physical effects, such as changes to sensory hairs in the auditory system, which may temporarily or permanently impair hearing. Temporary threshold shift (TTS) is a temporary hearing change and its severity is dependent upon the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). TTSs can last minutes to days. Full recovery is expected and this condition is not considered a physical injury. At higher received levels, or in frequency ranges where animals are more sensitive, permanent threshold shift (PTS) can occur. When PTS occurs, auditory sensitivity is unrecoverable (i.e., permanent hearing loss). Both TTS and PTS can result from a single pulse or from accumulated effects of multiple pulses from an impulsive sound source (i.e., impact pile-driving) or from accumulated effects of non-pulsed sound from a continuous sound source (i.e., vibratory pile-driving and removal and drilling). In the case of exposure to multiple pulses, each pulse need not be as loud as a single pulse to have the same accumulated effect. TTS and PTS occur only in the frequencies to which an animal is exposed.

Data are lacking on effects to pinnipeds exposed to impulsive sounds (Southall et al. 2007, NOAA 2015), and the energy levels required to induce TTS or PTS in pinnipeds are not known. Finneran et al. (2003) exposed two California sea lions to single underwater pulses up to 183 dB re 1 μPa_{p-p} and found no measurable TTS following exposure. Southall et al. (2007) estimated TTS will occur in pinnipeds exposed to a single pulse of sound at 212 dB re 1 μPa_{0-p} and PTS will occur at 218 dB re 1 μPa_{0-p}. Kastak et al. (2005) indicated pinnipeds exposed to continuous sounds in water experienced the onset of TTS from 152 to 174 dB re 1 μPa_{rms}[14]. Southall et al. (2007) estimated PTS will occur in pinnipeds exposed to continuous sound pressure levels of 218 dB re: 1 μPa_{0-p}.

It is possible that western DPS Steller sea lions that remain in the Level B harassment zones (i.e., the areas ensonified to at least 160, but less than 190, dB re 1 μPa_{rms} during impact pile-driving and at least 120, but less than 180, dB re 1 μPa_{rms} during vibratory pile-driving and drilling) may experience TTS during project activities. However, we expect it is highly unlikely that western DPS Steller sea lions will experience PTS during project activities because of the incorporation of shutdown measures if sea lions are seen entering or appear likely to enter the Level A harassment zones (i.e., the areas ensonified to at least 190 dB re 1 μPa_{rms} during impact pile-driving and at least 180 dB re 1 μPa_{rms} during vibratory pile-driving and drilling).

7.3.2 Auditory Interference (Masking)

Auditory interference, or masking, occurs when an interfering noise is similar in frequency and loudness to (or louder than) the auditory signal received by an animal while it is processing echolocation signals or listening for acoustic information from other animals (Francis and Barber 2013). Masking can

[14] Values originally reported as sound exposure level of 183 to 206 dB re 1 μPa^2-s.

interfere with an animal's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Francis and Barber 2013).

There are overlaps in frequencies between vibratory and impact pile-driving sounds and the expected hearing range of Steller sea lions. The proposed activities could mask vocalizations or other important acoustic information. This could affect communication among individuals or affect their ability to receive information from their environment. However, the project activities will occur in an industrialized port, an environment where masking from vessel sounds and dock activity likely occurs frequently. We expect any additional contributions that project activities may have to masking in the environment would be very small relative to the existing conditions.

7.3.3 Behavioral Responses

Steller sea lions may exhibit a variety of behavioral changes in response to underwater sound, which can be generally summarized as:

- Modifying or stopping vocalizations
- Changing from one behavioral state to another
- Movement out of feeding or breeding areas

In cases where response is brief (i.e., changing from one behavior to another, relocating a short distance, or ceasing vocalization), effects are not likely to be significant at the population level, but could rise to the level of take of individual sea lions.

Marine mammal responses to anthropogenic sound vary by species, state of maturity, prior exposure, current activity, reproductive state, time of day, and other factors (Ellison et al. 2012). This is reflected in a variety of aquatic, aerial, and terrestrial animal responses to anthropogenic noise that may ultimately have fitness consequences (Francis and Barber 2013).

Information on behavioral reactions of pinnipeds in water to multiple pulses is known from exposures to small explosives used in fisheries interactions, impact pile driving, and seismic surveys. In general, exposure of pinnipeds in water to multiple pulses of sound pressure levels ranging from approximately 150 to 180 dB re 1μPa_{rms} has limited potential to induce avoidance behavior (Southall et al. 2007). Less information is available on behavioral reactions of pinnipeds in water to continuous sounds. Using data from pinniped exposures to acoustic harassment devices, a research tomography source, and underwater data communication sources, Southall et al. (2007) suggested that exposure to continuous sound sources with sound pressure levels between approximately 90 to 140 dB re: 1 µPa have limited potential to induce strong behavioral responses in pinnipeds.

It is difficult to estimate the behavioral responses, if any, western DPS Steller sea lions in the action area may exhibit in response to project activities. As we discussed in Sections 6.1.2 and 6.1.3.3 of this Opinion, it appears that western DPS Steller sea lions in Iliuliuk Harbor have become habituated to the presence of shipping and fishing vessels in an industrialized harbor. Though the sounds that will be produced during project activities may not greatly exceed levels that Steller sea lions already experience in the industrialized harbor, the sources proposed for use in this project (pile-drivers and drills) are not among sound sources to which they are commonly exposed. Some Steller sea lions may find sounds produced by the project activities to be of greater annoyance than others and move out of the area or change from one behavioral state to another, while other Steller sea lions may exhibit no apparent behavioral changes at all. Because we do not expect western DPS Steller sea lions will exhibit strong

behavioral reactions to project activities, we do not expect project activities will impact feeding, breeding, or resting opportunities to a significant extent.

7.3.4 Physical and Physiological Effects

Individuals exposed to noise can experience stress and distress, where stress is an adaptive response that does not normally place an animal at risk, and distress is a stress response resulting in a biological consequence to the individual. Both stress and distress can affect survival and productivity (Curry and Edwards 1998, Cowan and Curry 2002, Herráez et al. 2007, Cowan and Curry 2008). Mammalian stress levels can vary by age, sex, season, and health status (St. Aubin et al. 1996, Gardiner and Hall 1997, Hunt et al. 2006, Keay et al. 2006, Romero et al. 2008).

Loud noises generally increase stress indicators in mammals (Kight and Swaddle 2011). During the time following September 11, 2001, shipping traffic and associated ocean noise decreased along the northeastern U.S. This decrease in ocean noise was associated with a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased noise levels, although not acutely injurious, can produce stress (Rolland et al. 2012). These levels returned to their previous level within 24 hrs after the resumption of shipping traffic. Exposure to loud noise can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011). In a variety of factors, including behavioral and physiological responses, females appear to be more sensitive or respond more strongly than males (Kight and Swaddle 2011).

Steller sea lions use hearing as a primary way to gather information about their environment and for communication; therefore, we assume that limiting these abilities is stressful. Stress responses may also occur at levels lower than those required for TTS (NMFS 2006); therefore, exposure to levels sufficient to trigger onset of PTS or TTS are expected to be accompanied by physiological stress responses (National Research Council 2003, NMFS 2006).

As discussed in the previous sections, we expect individuals may experience TTS, but are not likely to experience PTS, may experience masking, and may exhibit behavioral responses from project activities. Therefore, we expect Steller sea lions may experience stress responses. If Steller sea lions are not displaced and remain in a stressful environment (i.e. near sounds associated with the project activities), we expect the stress response will dissipate shortly after pile-driving or drilling activity ceases. However, in any of the above scenarios, we do not expect significant or long-term harm to individuals from a stress response.

7.3.5 Marine Mammal Prey

Anthropogenic noises may also have indirect, adverse effects on prey availability through lethal or sub-lethal damage, stress responses, or alterations in their behavior or distribution. Species-specific information about prey of Steller sea lions is generally not available; however, we expect their prey will react to anthropogenic noise in manners similar to the fish and invertebrates described below.

Effects from exposure to high-intensity sound sources have been documented in fish and invertebrates, including stress (Santulli et al. 1999), injury (McCauley et al. 2003), TTS (Popper et al. 2005), and changes in balance (Dalen and Knutsen 1986). In general, we expect fish will be capable of moving away from project activities if they experience discomfort. We expect the area in which stress, injury, TTS, or changes in balance, of prey species could occur will be limited to a few meters directly around the pile-drivers and drill. Prey species may startle and disperse when exposed to sounds from project

activities, but we expect any disruptions will be temporary. We do not expect effects to prey species will be sufficient to affect western DPS Steller sea lions.

7.3.6 Response Summary

Of the responses considered above, we expect TTS (but not PTS), masking, behavioral responses, and physical and physiological effects may occur in western DPS Steller sea lions. Though project activities may cause TTS, brief interruptions in communications (masking), avoidance of the action area, and stress associated with these disruptions in exposed western DPS Steller sea lions, we expect all effects will be temporary. Prey species may experience stress, injury, TTS, or changes in balance in a small radius directly around the pile-drivers and drill or startle and disperse when exposed to sounds from project activities, but we do not expect these effects to prey species will be sufficient to affect western DPS Steller sea lions.

8 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 (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation, per section 7 of the ESA.

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 6 of this Opinion). We expect climate change, noise, fisheries, and toxic substances will continue to be the primary factors impacting western DPS Steller sea lions in the action area.

9 INTEGRATION AND SYNTHESIS OF EFFECTS

The narrative that follows integrates and synthesizes the information contained in the Status of the Species (Section 5), the Environmental Baseline (Section 6) and the Effects of the Action (Section 7) sections of this Opinion to assess the risk that the proposed activities pose to western DPS Steller sea lions.

The survival and recovery of western DPS Steller sea lions within the action area may be affected by:

- Climate change
  - Prey distribution
- Anthropogenic noise
  - Habituation
- Fisheries interactions
  - Incidental take and entanglement
  - Conditioning and habituation to presence of commercial fishing vessels and processors
- Toxic substances
  - Petroleum hydrocarbons in water and sediment

Despite these pressures, available trend information indicates western DPS Steller sea lions populations east of Samalga Pass are increasing.

We concluded in the Effects of the Action (Section 7 of this Opinion) that western DPS Steller sea lions may be harassed by the proposed activities. We expect a maximum of 2,177 instances in which individual Steller sea lions will be exposed to sounds of at least 160, but less than 190, dB re 1 μPa_{rms} from impact pile-driving and sounds of at least 120, but less than 190, dB re 1 μPa_{rms} from vibratory pile-driving and removal and drilling (i.e., will be exposed to Level B harassment).

We note this number does not reflect the maximum number of individuals that will be exposed. Instead, we expect some smaller number of individual Steller sea lions will be exposed to harassment multiple times over the duration of the project.

We expect these exposures may cause TTS, interruptions in communication (i.e., masking) and avoidance of the action area. We expect low-level stress responses will accompany these responses. We do not expect western DPS Steller sea lions exposed to these sounds will experience a reduction in fitness.

Prey species may experience stress, injury, TTS, or changes in balance in a small radius directly around the pile-drivers and drill or startle and disperse when exposed to sounds from project activities. We do not expect these effects will limit prey available to western DPS Steller sea lions.

We concluded in "Stressors Not Likely to Adversely Affect ESA-listed Species and Critical Habitat" (Section 7.1.1.4 of this Opinion) that the effect of the direct loss 0.4 ha (1.0 ac) of critical habitat is insignificant.

In summary, we do not expect exposure to any of the stressors related to the proposed project to reduce fitness in any individual western DPS Steller sea lion. Therefore, we do not expect fitness consequences to western DPS Steller sea lions at the population or species level.

10 CONCLUSION

After reviewing the current status of western DPS Steller sea lions, the environmental baseline for the action area, the anticipated effects of the proposed activities, and the possible cumulative effects, it is NMFS's biological opinion that the proposed issuance of Corps permit POA-1988-735-M6 to UniSea to replace their existing G1 Dock in Iliuliuk Harbor, Unalaska, Alaska, and the Permits Division's proposed related action of issuing an IHA to UniSea are not likely to jeopardize the continued existence of western DPS Steller sea lions or destroy or adversely modify designated critical habitat.

11 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without special exemption. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct". "Incidental take" is defined as "take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Section 7(b)(4)(C) of the ESA specifies that in order to provide an Incidental Take Statement for an endangered or threatened species of marine mammal, the taking must be authorized under section 101(a)(5) of the MMPA. Accordingly, **the terms of this Incidental Take Statement and the**

exemption from Section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here. Absent such authorization, this Incidental Take Statement is inoperative.

The Terms and Conditions described below are nondiscretionary, and must be undertaken by the Corps and Permits Division so that they become binding conditions for the exemption in section 7(o)(2) to apply. Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species.

11.1 Amount or Extent of Take

NMFS anticipates the proposed G1 Dock replacement project in Iliuliuk Harbor, Unalaska, Alaska, is likely to result in the incidental take of ESA-listed species by harassment. As discussed in Section 2.2 of this Opinion, the proposed action is expected to take, by Level B harassment, 2,177 western DPS Steller sea lions. This number does not represent the take of 2,177 individuals; rather it represents the number of instances in which a smaller (unknown) number of individual Steller sea lions will be taken over the duration of the project.

Harassment will occur by exposure to impulsive sound sources (i.e., impact pile-driving) with received sound levels of least 160, but less than, 190 dB re 1 μPa_{rms} and exposure to continuous sound sources (i.e., vibratory pile-driving and removal and drilling) with received sound levels of at least 120, but less than 190 dB dB re 1 μPa_{rms}. The take estimate is based on the best available information of western DPS Steller sea lion occurrence in Iliuliuk Harbor, not density; therefore, we do not provide separate estimates for take from impulsive and continuous sound sources. Incidental take will result from exposure to acoustic energy pile-driving and drilling and will be in the form of harassment. Death or injury is not expected for any individual western DPS Steller sea lions exposed to these sounds.

Harassment is not expected for western DPS Steller sea lions exposed to received sound level less than 160 dB re 1 μPa_{rms} during impact pile-driving or received sound levels less than 120 dB re 1 μPa_{rms} during vibratory pile-driving and removal or drilling; however, if overt reactions (e.g., startle responses or rapid departures from the area) by individuals occur at these received sound pressure levels, this may constitute take that is not covered in this Incidental Take Statement. The Corps and/or the Permits Division must contact NMFS Alaska Region to determine whether reinitiation of consultation is required because of such operations.

Marine mammals observed within the Level A and B harassment zones identified in Table 2 during project activities will be considered to be taken, regardless of subsequent shut-downs, and even if they exhibit no overt behavioral reactions.

Any incidental take of western DPS Steller sea lions considered in this consultation is restricted to the permitted action as proposed. If the actual incidental take exceeds the predicted level or type, the Corps and Permits Division must reinitiate consultation. Likewise, if the action deviates from what is described in section 2 of this Opinion, the Corps and Permits Division must reinitiate consultation. All anticipated takes will be "takes by harassment", as described previously, involving temporary changes in behavior.

11.2 Effect of the Take

In this Opinion, NMFS has determined that the level of incidental take is not likely to jeopardize the continued existence of any ESA-listed species.

11.3 Reasonable and Prudent Measures

NMFS concludes the reasonable and prudent measure described below, along with its implementing terms and conditions, is necessary and appropriate to minimize the amount of incidental take of western DPS Steller sea lions resulting from the proposed actions. This measure is non-discretionary and must be a binding condition of the Corps' and Permits Division's authorizations for the exemption in section 7(o)(2) to apply. If the Corps and/or Permits Division fail to ensure UniSea's compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse:

- The Corps and Permits Division must require UniSea to implement and monitor the effectiveness of mitigation measures incorporated as part of the proposed authorization for the incidental taking of ESA-listed marine mammals pursuant to section 101(a)(5)(D) of the MMPA, as specified below.

11.4 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Corps and Permits Division must require UniSea to comply with the following terms and conditions, which implements the reasonable and prudent measure described above and outline the mitigation, monitoring, and reporting measures required by section 7 regulations (50 CFR 402.14(i)). These terms and conditions are non-discretionary. If the Permits Division fails to ensure compliance with these terms and conditions and their implementing reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

To implement the reasonable and prudent measure, the Corps and Permits Division shall ensure that UniSea adheres to all portions of the description of the action (Section 2 of this Opinion), especially mitigation and monitoring measures described in Sections 2.1.4 and 2.1.5 of this Opinion. The Corps and Permits Division shall also ensure that UniSea adheres to the following Terms and Conditions:[15]

1. Monthly observer reports, a final observer report, and completed marine mammal observation record forms (developed by PND) will be provided during the project. Items 1.1 through 1.4, below, provide details about what must be included in the reports.
   1.1. The reporting period for each monthly observer report will be the entire calendar month, and reports will be submitted by close of business on the 5th business day of the month following the end of the reporting period (e.g., The monthly report covering March 1 through 31, 2016, will be submitted to NMFS Alaska Region by close of business (i.e., 5:00 pm, AKST) on April 7, 2016).
      1.1.1. Completed marine mammal observation record forms, in electronic format, will be provided to NMFS Alaska Region in monthly reports.
      1.1.2. Observer report data will include the following for each listed marine mammal observation (or "sighting event" if repeated sightings are made of the same animal[s]):
         1.1.2.1. Species, date, and time for each sighting event
         1.1.2.2. Number of animals per sighting event and number of adults/juveniles/calves/pups per sighting event

[15] These terms and conditions are in addition to reporting requirements required by the Permits Division.

1.1.2.3. Primary, and, if observed, secondary behaviors of the marine mammals in each sighting event
1.1.2.4. Geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system)
1.1.2.5. Time of most recent pile-driving or other project activity prior to marine mammal observation
1.1.2.6. Environmental conditions as they existed during each sighting event, including, but not limited to:
1.1.2.6.1. Beaufort Sea State
1.1.2.6.2. Weather conditions
1.1.2.6.3. Visibility (km/mi)
1.1.2.6.4. Lighting conditions
1.1.2.6.5. Percentage of ice cover

1.1.3. Observer report data will also include the following for each take of a marine mammal that occurs in the manner and extent as described in Section 11.1 of this Opinion:
1.1.3.1. All information listed under Item 1.1.2, above
1.1.3.2. Cause of the take (e.g., Steller sea lion observed within Level B zone during vibratory pile driving)
1.1.3.3. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.1.3.4. Mitigation measures implemented prior to and after the animal entered the zone

1.2. A final technical report will be submitted to NMFS Alaska Region within 90 days after the final pile has been driven, removed, or drilled for the project. The report will summarize all pile-driving and other project activities and results of marine mammal monitoring conducted during project activities. The final technical report will include all elements from Item 1.1, above, as well as:
1.2.1. Summaries that include monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors that affect visibility and detectability of marine mammals)
1.2.2. Analyses on the effects from various factors that influences detectability of marine mammals (e.g., sea state, number of observers, fog, glare, etc.)
1.2.3. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.4. Species composition, occurrence, and distribution of marine mammal takes, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.5. Analyses of effects of project activities on listed marine mammals
1.2.6. Number of marine mammals observed and taken (by species) during periods with and without project activities (and other variables that could affect detectability), such as:
1.2.6.1. Initial sighting distances versus project activity at time of sighting
1.2.6.2. Observed behaviors and movement types versus project activity at time of sighting
1.2.6.3. Numbers of sightings/individuals seen versus project activity at time of sighting
1.2.6.4. Distribution around the action area versus project activity at time of sighting

1.3. If unauthorized take occurs, (i.e., Level B take of any ESA-listed species other than Steller sea lion or Level A or B take of any other ESA-listed species), it must be reported to NMFS Alaska Region within one business day to the contact listed in Item 1.4, below. Observation records for ESA-listed marine mammals taken in a manner or to the extent described in Section 11.1 of this Opinion must include:
1.3.1. All information listed under Item 1.1, above
1.3.2. Number of listed animals taken
1.3.3. Date and time of each take
1.3.4. Cause of the take (e.g., Steller sea lion observed within Level A zone or humpback whale observed in the Level B zone during vibratory pile driving)
1.3.5. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.3.6. Mitigation measures implemented prior to and after the animal entered the zone

1.4. NMFS Contacts:
Monthly and final reports and reports of unauthorized take will be submitted to:
NMFS Alaska Region, Protected Resources Division
Bridget Crokus
bridget.crokus@noaa.gov
907-271-1937 or 907-271-5006

12 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 endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, help implement recovery plans, or develop information (50 CFR 402.02).

We recommend the following conservation recommendation, which will provide information for future consultations involving the issuance of permits that may affect western DPS Steller sea lions:

- Behavioral responses of marine mammals: We recommend that the Permits Division summarize findings from past IHA holders about behavioral responses of ESA-listed species to sounds from pile-driving, drilling, and other sounds related to dock construction activities. Better understanding of how ESA-listed species have responded to sounds from past projects will better inform our exposure and response analyses in the future.

In order for the NMFS Alaska Region to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their habitats, the Permits Division should notify the NMFS Alaska Region of any conservation recommendations it implements.

13 REINITIATION NOTICE

This concludes formal consultation on the proposed issuance of Corps permit POA-1988-735-M6 and an IHA to UniSea for the G1 dock replacement project in Iliuliuk Harbor, Unalaska, Alaska. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

- The amount or extent of proposed take is exceeded.
- 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 considered in this opinion.

- The agency action is subsequently modified in a manner that causes an effect to the ESA-listed species, or critical habitat not considered in this opinion.
- A new species is ESA-listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of authorized take and/or effects to critical habitat is exceeded, the Corps and Permits Division must immediately request reinitiation of section 7 consultation.

14 LITERATURE CITED

ADEC. 2010. Total maximum daily loads (TMDLs) for petroleum hydrocarbons in the waters of Dutch Harbor and Iliuliuk Harbor in Unalaska, Alaska. Alaska Department of Environmental Conservation, Anchorage, Alaska.

ADF&G. 2014. Fish resource monitor, version 2.3.3.9775. Research and Tech Services, Division of Sport Fish, Alaska Department of Fish and Game. Available online at http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc.

Allen, B. M., and R. P. Angliss. 2015. Alaska marine mammal stock assessments, 2014. NOAA Technical Memorandum NMFS-AFSC-301, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington.

Au, W. W. L. 2000. Hearing in whales and dolphins: An overview. Pages 1-42 *in* W. W. L. Au, A. N. Popper, and R. R. Fay, editors. Hearing by Whales and Dolphins. Springer-Verlag, New York.

Au, W. W. L., A. A. Pack, M. O. Lammers, L. M. Herman, M. H. Deakos, and K. Andrews. 2006. Acoustic properties of humpback whale songs. Journal of the Acoustical Society of America **120**:1103-1110.

Baughman, L. Environmental Scientist, PND Engineers, Inc., Anchorage, Alaska. January 4, 2016. Personal communication, email to Bridget Crokus (contractor for NMFS Alaska Region) regarding humpbacks observations in Iliuliuk Harbor.

Clark, C., W. T. Ellison, B. Southall, L. Hatch, S. M. Van Parijs, A. S. Frankel, D. Ponirakis, and G. C. Gagnon. 2009. Acoustic masking of baleen whale communications: potential impacts from anthropogenic sources. Page 56 Eighteenth Biennial Conference on the Biology of Marine Mammals, Quebec City, Canada.

Cowan, D. E., and B. E. Curry. 2008. Histopathology of the alarm reaction in small odontocetes. Journal of Comparative Pathology **139**:24-33.

Cowan, D. F., and B. E. Curry. 2002. Histopathological assessment of dolphins necropsied onboard vessels in the eastern tropical Pacific tuna fishery. Administrative Report LJ-02-24C, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, La Jolla, California.

Curry, B. E., and E. F. Edwards. 1998. Investigation of the potential influence of fishery-induced stress on dolphins in the eastern tropical Pacific Ocean: research planning. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-254, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, La Jolla, California.

Dalen, J., and G. M. Knutsen. 1986. Scaring effects in fish and harmful effects on eggs, larvae and fry by offshore seismic explorations. Pages 93-102 *in* H. M. Merklinger, editor. Progress in Underwater Acoustics. Plenum, New York.

Dazey, E., B. McIntosh, S. Brown, and K. M. Dudzinski. 2012. Assessment of underwater anthropogenic noise associated with construction activities in Bechers Bay, Santa Rosa Island, California. Journal of Environmental Protection **3**:1286-1294.

Ellison, W. T., B. L. Southall, C. W. Clark, and A. S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology **26**:21-28.

Erbe, C. 2002. Hearing abilities of baleen whales. Atlantic report CR 2002-065. Contract Number: W7707-01-0828. Defence R&D Canada.

Finneran, J. J., R. Dear, D. A. Carder, and S. H. Ridgway. 2003. Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. Journal of the Acoustical Society of America **114**:1667-1677.

Finneran, J. J., and C. E. Schlundt. 2013. Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*). Journal of the Acoustical Society of America **133**:1819-1826.

Francis, C. D., and J. R. Barber. 2013. A framework for understanding noise impacts on wildlife: An urgent conservation priority. Frontiers in Ecology and the Environment **11**:305-313.

Frazer, L. N., and E. Mercado III. 2000. A sonar model for humpback whale song. IEEE Journal of Oceanic Engineering **25**:160-182.

Fritz, L., K. Sweeney, D. Johnson, and T. Gelatt. 2015. Memorandum re: results of Steller sea lion surveys in Alaska, June-July 2014. Alaska Ecosystem Program, National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington.

Fritz, L. W. Fishery biologist, National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, Seattle, Washington. August 17, 2015. Personal communication, email and email attachment to Bridget Crokus (contractor for NMFS Alaska Region) regarding pinnipeds in the Dutch Harbor area based on NMML data.

Gardiner, K. J., and A. J. Hall. 1997. Diel and annual variation in plasma cortisol concentrations among wild and captive harbor seals (*Phoca vitulina*). Canadian Journal of Zoology **75**:1773-1780.

Graham, E. 2009. UniSea, Inc., presentation given at the Aleutian Islands Risk Assessment Advisory Panel Meeting, September 1-3, 2009, Unalaska, Alaska.

Harris, R. E., G. W. Miller, and W. J. Richardson. 2001. Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. Marine Mammal Science **17**:795-812.

Herráez, P., E. Sierra, M. Arbelo, J. R. Jaber, A. Espinosa de los Monteros, and A. Fernández. 2007. Rhabdomyolysis and myoglobinuric nephrosis (capture myopathy) in a striped dolphin. Journal of Wildlife Diseases **43**:770-774.

Hunt, K. E., R. M. Rolland, S. D. Kraus, and S. K. Wasser. 2006. Analysis of fecal glucocorticoids in the North Atlantic right whale (*Eubalaena glacialis*). General and Comparative Endocrinology **148**:260-272.

ICF Jones & Stokes, and Illingworth and Rodkin Inc. 2012. Technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish. Final report prepared by ICF Jones & Stokes, Sacramento, California, and Illingworth and Rodkin, Inc., Petaluma, California, for California Department of Transportation.

Illingworth & Rodkin Inc. 2013. Naval Base Kitsap at Bangor, Trident Support Facilities Explosive Handling Wharf (EHW-2) project: acoustic monitoring report. Report prepared by Illingworth & Rodkin, Inc. for Navy Strategic Systems Programs, Bangor, Washington.

IPCC, editor. 2014. Summary for policymakers. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kajimura, H., and T. R. Loughlin. 1988. Marine mammals in the oceanic food web of the eastern subarctic Pacific. Bulletin of the Ocean Research Institute, University of Tokyo **26**:187-223.

Kastak, D., B. L. Southall, R. J. Schusterman, and C. R. Kastak. 2005. Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration. Journal of the Acoustical Society of America **118**:3154-3163.

Keay, J. M., J. Singh, M. C. Gaunt, and T. Kaur. 2006. Fecal glucocorticoids and their metabolites as indicators of stress in various mammalian species: A literature review. Journal of Zoo and Wildlife Medicine **37**:234-244.

Kennedy, A. S., A. N. Zerbini, B. K. Rone, and P. J. Clapham. 2014. Individual variation in movements of satellite-tracked humpback whales *Megaptera novaeangliae* in the eastern Aleutian Islands and Bering Sea. Endangered Species Research **23**:187-195.

Khoo, I.-H., and T.-H. Nguyen. 2011. Study of the noise pollution at container terminals and the surroundings. California State University, Long Beach, Long Beach, California.

Kight, C. R., and J. P. Swaddle. 2011. How and why environmental noise impacts animals: An integrative, mechanistic review. Ecology Letters.

McCauley, R. D., J. Fewtrell, and A. N. Popper. 2003. High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America **113**:638-642.

McDonald, M. A., J. A. Hildebrand, and S. M. Wiggins. 2006. Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. Journal of the Acoustical Society of America **120**:711-718.

McKenna, M. F., D. Ross, S. M. Wiggins, and J. A. Hildebrand. 2012. Underwater radiated noise from modern commercial ships. Journal of the Acoustical Society of America **131**:92-103.

National Research Council. 2003. Ocean noise and marine mammals. The National Academies Press, Washington, D.C.

NCEI. 2016. State of the climate: global analysis for annual 2015. National Centers for Environmental Information, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Published online at: http://www.ncdc.noaa.gov/sotc/global/201513.

NMFS. 2006. Endangered Species Act section 7 consultation biological opinion on the United States Navy's 2006 Rim-of-the-Pacific Joint Training Exercises. Office of Protected Resources, National Marine Fisheries ServiceNational Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2008. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Revision. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2014. Endangered Species Act section 7 consultation biological opinion for authorization of the Alaska goundfish fisheries under the proposed revised Steller sea lion protection measures. Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015a. Endangered Species Act section 7(a)(2) biological opinion on the Kodiak Ferry Dock and terminal improvements. Consultation Number AKR-2015-9446, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015b. Endangered Species Act: section 7 consultation biological opinion on the land survey and conveyance pursuant to section 14(h)(1) of the Alaska Native Claims Settlement Act, and issuance of an associated incidental take authorization pursuant to section 101(a)(5) of the Marine Mammal Protection Act. Consultation Number AKR-2015-9419, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015c. Steller sea lion (*Eumetopias jubatus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.fisheries.noaa.gov/pr/species/mammals/sealions/steller-sea-lion.html.

NMML. 2015. Steller sea lion (*Eumetopias jubatus*). National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.afsc.noaa.gov/nmml/species/species_steller.php.

NOAA. 2015. Draft guidance for assessing the effects of anthropogenic sound on marine mammal hearing: underwater acoustic threshold levels for onset of permanent and temporary threshold shifts. National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Parks, S. E. 2003. Response of North Atlantic right whales (*Eubalaena glacialis*) to playback of calls recorded from surface active groups in both the North and South Atlantic. Marine Mammal Science **19**:563-580.

Parks, S. E. 2009. Assessment of acoustic adaptations for noise compensation in marine mammals. Office of Naval Research.

Payne, K., and R. Payne. 1985. Large scale changes over 19 years in songs of humpback whales in Bermuda. Zeitschrift fur Tierpsychologie **68**:89-114.

PND. 2015a. Biological assessment for the G1 Dock replacement project. Assessment prepared by PND Engineers, Inc., Anchorage, Alaska, in collaboration with High Tide Environmental, Wasilla, Alaska, on behalf of Alaska District, U.S. Army Corpy of Engineers, for submission to Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland, and Protected Resources Division, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Anchorage, Alaska, and UniSea, Inc., Dutch Harbor, Alaska.

PND. 2015b. Marine mammal monitoring plan UniSea G1 Dock replacement project. Monitoring plan prepared by PND Engineers, Inc., Anchorage, Alaska, for submission to Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

PND. 2015c. Request for an incidental harassment authorization under the Marine Mammal Protection Act for the UniSea G1 Dock replacement project. Application prepared by PND Engineers, Inc., Anchorage, Alaska, on behalf of UniSea, Inc., Dutch Harbor, Alaska, for submission to Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

Popper, A. N., M. E. Smith, P. A. Cott, B. W. Hanna, A. O. Macgillicray, M. E. Austin, and D. A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. Journal of the Acoustical Society of America **117**:3958-3971.

Richardson, W. J., C. R. Greene Jr., C. I. Malme, and D. H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, California.

Rolland, R. M., S. E. Parks, K. E. Hunt, M. Castellote, P. J. Corkeron, D. P. Nowacek, S. K. Wasser, and S. D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proceedings of the Royal Society of London Series B Biological Sciences **279**:2363-2368.

Romero, L. M., C. J. Meister, N. E. Cyr, G. J. Kenagy, and J. C. Wingfield. 2008. Seasonal glucocorticoid responses to capture in wild free-living mammals. American Journal of Physiology-Regulatory Integrative and Comparative Physiology **294**:R614-R622.

Santulli, A., A. Modica, C. Messina, L. Ceffa, A. Curatolo, G. Rivas, G. Fabi, and V. D'Amelio. 1999. Biochemical responses of European sea bass (*Dicentrarchus labrax* L.) to the stress induced by offshore experimental seismic prospecting. Marine Pollution Bulletin **38**:1105-1114.

Silber, G. K. 1986. The relationship of social vocalizations to surface behavior and aggression in the Hawaiian humpback whales (*Megaptera novaeangliae*). Canadian Journal of Zoology **64**:2075-2080.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals **33**:411-521.

St. Aubin, D. J., S. H. Ridgway, R. S. Wells, and H. Rhinehart. 1996. Dolphin thyroid and adrenal hormones: Circulating levels in wild and semidomesticated *Tursiops truncatus*, and influence of sex, age, and season. Marine Mammal Science **12**:1-13.

Thompson, P. O., W. C. Cummings, and S. J. Ha. 1986. Sounds, source levels, and associated behavior of humpback whales, Southeast Alaska. Journal of the Acoustical Society of America **80**:735-740.

Tyack, P., and H. Whitehead. 1983. Male competition in large groups of wintering humpback whales. Behaviour **83**:132-154.

URS Australia. 2011. Ichthys Gas Field development project: potential effects of underwater blasting, piledriving and dredging on sensitive marine fauna in Darwin Harbor. Report prepared by URS Australia Pty Ltd., East Perth, Western Australia, Australia, for INPEX Browse, Ltd., Perth, Western Australia, Australia.

USFWS. 2008. Biological opinion on the effects of the Goodnews Bay Salmon Processing Plant project on Steller's eiders (*Polysticta stelleri*). Anchorage Fish and Wildlife Field Office, U.S. Fish and Wildlife Service, U.S. Department of the Interior, Anchorage, Alaska.

Vu, E. T., D. Risch, C. W. Clark, S. Gaylord, L. T. Hatch, M. A. Thompson, D. N. Wiley, and S. M. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aquatic Biology **14**:175-183.

Wartzok, D., A. N. Popper, J. Gordon, and J. Merrill. 2003. Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal **37**:6-15.

Winn, H. E., P. J. Perkins, and T. C. Poulter. 1970. Sounds of the humpback whale. Pages 39-52 Seventh Annual Conference on Biological Sonar and Diving Mammals, Stanford Research Institute, Menlo Park, California.