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

Endangered Species Act (ESA) Section 7(a)(2) Biological and Conference Opinion

Auke Bay East Terminal
Improvements Project
Juneau, Alaska

NMFS Consultation Number: AKRO-2022-02777
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Action Agencies: Alaska Department of Transportation and Public Facilities Permits and Conservation Division; Office of Protected Resources, National Marine Fisheries Service, NOAA; Federal Transit Administration; US Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Steller Sea Lion, Western DPS (*Eumetopias jubatus)*	Endangered	Yes	No	No	No
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	Yes	No	No	No
Sunflower Sea Star (*Pycnopodia helianthoides*)	Proposed Threatened	Yes	N/A	No	N/A

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

For Jonathan M. Kurland
Regional Administrator

Date: December 22, 2023

Accessibility of this Document

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TERMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
AMHS	Alaska Marine Highway System
BA	Biological Assessment
BMPs	Best management practices
CFR	Code of Federal Regulations
dB	decibels
DPS	Distinct Population Segment
EDPS	Eastern Distinct Population Segment
ESA	Endangered Species Act
ESCA	Endangered Species Conservation Act
FR	Federal Register
ft	feet
GOA	Gulf of Alaska
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
kHz	kilohertz
m	Meter(s)
mi	Mile(s)
min	Minute(s)
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
PBFs	Physical or biological features
PCE	Primary constituent element
PR1	Office of Protected Resources, NMFS Headquarters
PRD	Protected Resources Division, Alaska NMFS
PSMMP	Protected Species Monitoring and Mitigation Plan
PSO	Protected Species Observer
PTS	Permanent Threshold Shifts
RPA	Reasonable and Prudent Alternative
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSL	Steller sea lion
SSV	Sound source verification
TTS	Temporary Threshold Shifts
USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service

1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. § 1536(a)(2)), requires each Federal agency to ensure that any action it authorizes, funds, or carries 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 of such species. When a Federal agency's action "may affect" a protected species, that agency is required to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14(a)). Federal agencies may fulfill this general requirement informally if they conclude that an action may affect, but "is not likely to adversely affect" endangered species, threatened species, or designated critical habitat, and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14(b)(1)).

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 agency's action is likely to affect ESA-listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking, specifies those reasonable and prudent measures necessary or appropriate to minimize such impact, and sets forth terms and conditions to implement those measures.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand with vacating the 2019 regulations. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different. New proposed rules were published in the *Federal Register* on June 22, 2023 (88 FR 40753).

In this document, the action agencies are the U.S. Department of Transportation Federal Highway Administration (FHWA), which proposes to conduct construction activities associated with the Auke Bay East Terminal, and the NMFS Office of Protected Resources, Permits and Conservation Division (PR1), which proposes to issue an incidental harassment authorization (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. § 1361 *et seq.*) for the harassment of marine mammals incidental to construction operations. The environmental review, consultation, and other actions required of the FHWA by applicable federal environmental laws for this project, such as the ESA, are being carried out by the Alaska Department of Transportation and Public Facilities (ADOT) pursuant to 23 U.S.C. § 326 and a Memorandum of Understanding executed by FHWA and ADOT.

ADOT is the lead agency for purposes of section 7 consultation; the other action agencies include the U.S. Army Corps of Engineers (USACE) and the Federal Transit Authority (FTA). The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's Biological and Conference Opinion (opinion) on the effects of this proposal on endangered, threatened, and proposed threatened species and designated critical habitat.

The opinion and ITS are in compliance with the Data Quality Act (44 U.S.C. § 3504(d)(1)) and underwent pre-dissemination review.

1.1 Background

ADOT proposes to remove old pilings and replace them with new pilings to support replacement of the existing dock structure, including above-water construction to replace a catwalk access gangway, refurbish the catwalks, upgrade lighting of the dolphins and catwalk, remove and replace electrical components needed to perform dolphin replacement work, and install cathodic protection devices anodes on all pilings. The purpose of the project is to restore the service life of the Alaska Marine Highway Service (AMHS) Auke Bay East Berth ferry terminal, which was originally built in 1982.

The proposed project site is located at Latitude 58.3814, Longitude -134.6852, on the northwest side of Auke Bay (Figure 1). Auke Bay is located approximately 18 km north-northwest of Juneau, AK.

This opinion considers the effects of construction activities associated with maintenance and improvements at the AMHS East Terminal in Auke Bay in Juneau, Alaska, and the associated proposed issuance of an Incidental Harassment Authorization (IHA). These actions may affect the Mexico distinct population segment (DPS) of humpback whales, Western DPS of Steller sea lions, and sunflower sea stars. No designated critical habitat is located within the action area. The nearest designated critical habitat, for Steller sea lions, is Benjamin Island located ~27 km northwest of the project area.

This opinion is based on information provided in the Biological Assessment (BA) and revised BA submitted by ADOT in March 2023 and May 2023, respectively; the IHA application submitted by PR1 on October 18, 2022; the proposed IHA published by PR1 on April 13, 2023, email and telephone conversations between NMFS Alaska Region, ADOT, and NMFS PR1 staff; and other sources of information cited in the References section.

A complete record of this consultation is on file at NMFS's Juneau, Alaska office.

1.2 Consultation History

Our communication with PR1 and ADOT regarding this consultation is summarized as follows:

- **December 12, 2022:** PR1 submitted to ADOT a list of initial questions and comments regarding the draft IHA application submitted by ADOT
- **January 5, 2023:** ADOT provided responses to PR1's questions
- **January 11, 2023:** ADOT submitted a revised IHA application
- **February 2, 2023:** PR1 submitted several questions to ADOT regarding the marine mammal monitoring plan and action description
- **February 7, 2023:** ADOT and NMFS met to discuss the potential to include sunflower sea stars as a conference species in this consultation
- **March 8, 2023:** ADOT provided NMFS with an early draft version of the Biological Assessment (BA)
- **March 10, 2023:** ADOT provided NMFS with the BA and requested formal consultation on the proposed action
- **April 7, 2023:** NMFS received a PR1 request for ESA section 7 consultation for the IHA issuance for the proposed action
- **April 12, 2023:** ADOT and NMFS met to discuss revised acoustic analysis and the protected species monitoring and mitigation plan (PSMMP)
- **April 13, 2023:** PR1 published the proposed IHA (88 FR 22411)
- **April 24, 2023:** ADOT led NMFS on a site visit at the Auke Bay Ferry Terminal
- **May 1, 2023:** ADOT provided NMFS with a revised BA and PSMMP
- **May 18, 2023:** PR1 and NMFS met to discuss the revised acoustic analysis, monitoring plan, and reference material
- **June 5, 2023:** NMFS, PR1, and ADOT met to discuss sound source levels and transmission loss values to use in the final acoustic analysis
- **July 21, 2023:** ADOT provided new information resulting in an updated estimate of take of sunflower sea stars
- **July 31, 2023:** ADOT notified NMFS of a change to the mitigation measures and action description relative to sunflower sea star monitoring
- **August 3, 2023:** ADOT and NMFS met to discuss the proposed action description changes
- **August 10, 2023:** ADOT provided NMFS with a description of changes in the action
- **September 20, 2023:** ADOT informed NMFS via email that there may be a change in lead action agency for this consultation. Consultation paused
- **October 11, 2023:** ADOT notified NMFS of a recent sunflower sea star survey at the

proposed action area resulting in a revised estimate of harassment take

- **October 11, 2023:** ADOT and FTA notified NMFS via email that ADOT will remain the lead action agency/responsible entity for this consultation. Consultation resumed on October 11, 2023
- **December 7-15, 2023:** ADOT, FTA, and PR1 reviewed and commented on the draft opinion per requests by those agencies

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States and upon the high seas (50 CFR 402.02).

2.1.1 Proposed Activities

The AMHS East Berth marine terminal was originally constructed in 1982. The dolphins have undergone several repair projects and are currently in need of full replacement to keep the facility safe and useable. The berthing dolphin pilings are severely corroded and in some locations the pilings have open holes or are completely severed as a result of section loss. The timber fender system on the dolphins is also severely rotted and beginning to loosen. This is one of the most highly used facilities by the AMHS ferry system. Thus, ADOT is proposing remove and replace the dolphin pilings, as part of a larger project to replace the existing dock structure.

The proposed project would remove 47 existing 18-inch diameter steel pilings that support the current dock structure. Up to 32 temporary 24-inch steel pilings and 32 permanent steel pipe pilings would be installed. The new permanent steel pilings would include up to 20 30-inch diameter (10 plumb, 10 battered) pilings as berthing dolphins, four 24-inch diameter pilings for gangway and platform support, and eight 24-inch diameter (four plumb, four battered) pilings as float restraints. The temporary pilings would be installed to support permanent piling installation and would be removed following completion of permanent piling installation. In addition, above-water construction would include replacement of the catwalk access gangway.

Piling removal would be conducted using a vibratory hammer and piling installation would be conducted using both vibratory and impact hammers. Pilings may be proofed using an impact hammer to verify structural capacity. Installation method used will depend on sediment depth and conditions at each piling location. Piling installation and removal will occur in waters 15-18 meters (50-60 feet) in depth.

Figure 1. *Location of the proposed action north of Juneau, Alaska, within Southeast Alaska.*

Figure 2. *Google Earth image showing the detailed area where construction and repair work would occur for the proposed action.*

There are multiple existing large vessel terminals at the AMHS facility in Auke Bay. This proposed action would repair and refurbish the East Terminal (Figure 2). Vessel operations are expected to continue at existing levels following the proposed action.

A summary of the number of pilings, size, pile driving strikes per day (duration in minutes), duration of activity, and days of piling removal and installation are presented in Table 1.

Table 1. *Number and types of pilings to be installed and removed for each project component.*

Pile Diameter and Type	Number of Piles	Impact Strikes per Pile (duration in minutes)	Vibratory Duration per Pile (duration in minutes)	Total Duration of Activity per Pile (hours)	Production Rate Piles per Day (range)	Days of Installation or Removal
Pile Installation						
30" Steel Plumb Piles (Permanent; Berthing Dolphins)	10	1,000 (120)	60	3.0	1.5 (1–2)	7
30" Steel Batter Piles (Permanent; Berthing Dolphins)	10	1,000 (120)	60	3.0	1.5 (1–2)	7
24" Steel Plumb Piles (Permanent; Float Restraint)	4	1,000 (120)	60	3.0	1.5 (1–2)	3
24" Steel Batter Piles (Permanent; Float Restraint)	4	1,000 (120)	60	3.0	1.5 (1–2)	3
18" Steel Plumb Piles (Permanent; Gangway/Platform Support)	4	800 (100)	60	2.67	1.5 (1–2)	3
24" Steel Piles (Temporary)	32	500 (60)	30	1.5	3 (2–4)	11
Pile Removal						
18" Steel Plumb Piles (Existing)	47	NA	30	0.5	3 (2–4)	16
24" Steel Piles (Temporary)	32	NA	30	0.5	3 (2–4)	11
TOTALS	**143**					**61**

Note: NA = not applicable

Vibratory pile installation is expected to result in a 120 db acoustic isopleth, or harassment zone (referred to as a Level B isopleth for purposes of the MMPA) of up to 11.66 km. Impact pile driving will result in some cases in a larger potential injury zone than the estimated behavioral harassment zone, based on pile size and number of pilings driven in a day (Table 2). The largest estimated acoustic injury zone (Level A under the MMPA) for the proposed action is 2,513 m for driving up to two 30-inch steel pilings with an impact hammer per day (Table 2). The estimated acoustic injury zone for driving up to three 30-inch steel pilings with an impact hammer per day is 3,293 m, but the proposed action will only include up to two 30-inch pilings being driven per day.

Table 2. *Acoustic isopleths for estimated injury (Level A) and harassment (Level B) zones for humpback whales and Steller sea lions for impact and vibratory pile driving and removal of pilings for the proposed action (Navy 2015, CALTRANS 2020).*

Activity	Source Level	120 dB Isopleth Harassment Threshold	160 dB Isopleth Harassment Threshold	Injury Isopleth Humpback Whales	Injury Isopleth Steller Sea Lions
Vibratory Pile Driving 30"	166 dB at 10m	11.66 km	N/A	31 m (60 min)	2 m (60 min)
Vibratory Pile Driving 24"	161 dB at 10m	5.4 km	N/A	15 m (60 min)	1 m (60 min)
Vibratory Pile Driving 18"	161 dB at 10m	5.4 km	N/A	15 m (60 min)	1 m (60 min)
Impact Pile Driving 30"	195 dB at 10m	N/A	2.2 km	3,293 m (3 piles/day) 2,513 m (2 piles/day) 1,583 (1 pile/day)	129 m (3 piles/day) 98 m (2 piles/day) 62 m (1 pile/day)
Impact Pile Driving 24"	193 dB at 10m	N/A	1.6 km	965 m (3 piles/day; 1,000 strikes) 736 m (2 piles/day; 1,000 strikes) 464 m (1 pile/day; 1,000 strikes) 608 m (3 piles/day; 500 strikes) 464 m (2 piles/day; 500 strikes) 293 m (1 pile/day; 500 strikes)	38 m (3 piles/day; 1,000 strikes) 29 m (2 piles/day; 1,000 strikes) 19 m (1 pile/day; 1,000 strikes) 24 m (3 piles/day; 500 strikes) 19 m (2 piles/day; 500 strikes) 12 m (1 pile/day; 500 strikes)
Impact Pile Driving 18"	187 dB at 10m	N/A	0.63 km	741 m (4 piles/day; 800 strikes) 612 m (3 piles/day; 800 strikes) 467 m (2 piles/day; 800 strikes) 294 (1 pile/day; 800 strikes)	29 m (4 piles/day; 800 strikes) 24 m (3 piles/day; 800 strkes) 19 m (2 piles/day; 800 strikes) 12 m (1 pile/day; 800 strikes)
Vibratory Pile Removal 24"	161 dB at 10m	5.4 km	N/A	15 m (60 min)	1 m (60 min)
Vibratory Pile Removal 18"	161 dB at 10m	5.4 km	N/A	15 m (60 min)	1 m (60 min)

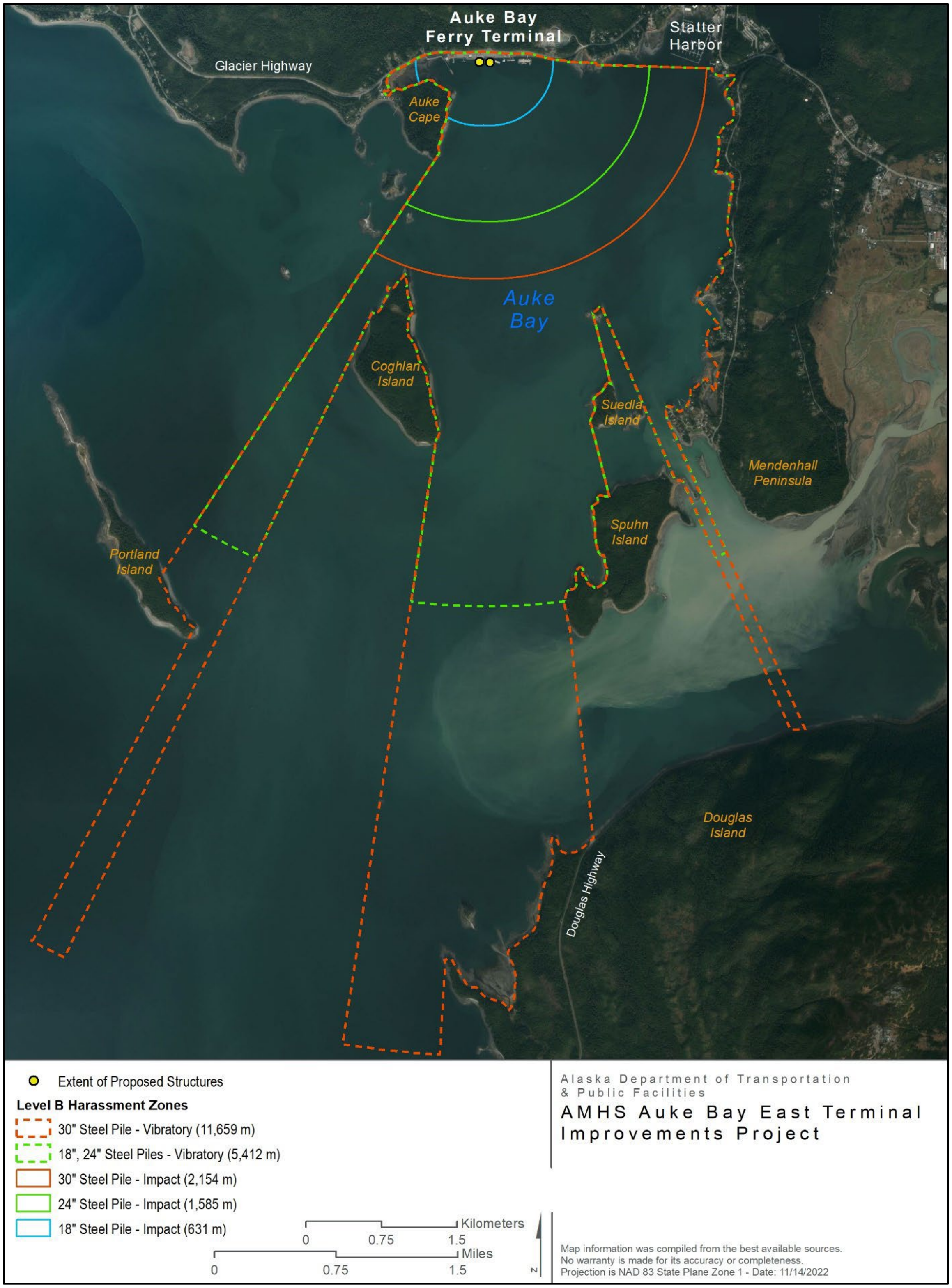

Figure 3. *Aerial image showing the estimated 120dB and 160dB harassment zones for piling installation and removal at the Auke Bay AMHS Ferry Terminal. The solid lines represent approximate shutdown distances to avoid harm/injury of humpback whales.*

No more than two 30-inch pilings will be driven using an impact hammer daily. Therefore, the maximum Level A zone (injury) is 2,513 m for humpback whales and 98 m for Steller sea lions (Table 2). ADOT will implement a 2,600 m and 100 m shutdown zone, respectively, to avoid Level A take (injury) of those two species.

The work will occur over approximately four months beginning as early as January 2024. Pile installation and removal would be intermittent during this period, depending on weather, construction and mechanical delays, protected species shutdowns, and other potential delays and logistical constraints. Pile installation will occur intermittently during the work period for minutes to hours at a time over 61 non-consecutive days within the four-month construction period.

Two barges will be used during the proposed action: one with a crane mounted on it, and a staging/work barge that will be moved into place with a tugboat. Additional barges and tugs may be used to deliver equipment as needed. The number of vessels will be limited to reduce costs and reduce the risk of potential impacts on marine mammals. All vessels associated with the proposed action will follow well-established, frequently used navigation lanes, and are expected to travel at speeds of less than 10 knots within the action area. Lines may be used for towing, moorage, and anchoring during the proposed action.

2.1.2 Mitigation Measures

ADOT has incorporated the following mitigation measures into the project design to avoid and minimize potential impacts to Western DPS Steller sea lions, Mexico DPS humpback whales, and sunflower sea stars in the action area, including:

General Mitigation Measures

1. If contaminated or hazardous materials are spilled or released during construction, all work in the vicinity of the contaminated site will be stopped until the Alaska Department of Environmental Conservation (ADEC) is contacted and a corrective action plan is approved by ADEC and implemented.
2. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, and similar equipment will be checked regularly for drips or leaks, and will be maintained and stored properly to prevent spills.
3. ADOT will ensure any contractor will provide and maintain a spill cleanup kit on-site at all times to be implemented as part of the Spill Prevention, Control, and Countermeasure Plan, as well as the Hazardous Material Control Plan and Work Quality Control Plan, in the event of a spill or if any oil products are observed in the water.
4. Before impact pile installation begins, a soft start or ramp-up procedure will be employed to minimize impacts. This will entail an initial set of three strikes from the impact hammer at reduced energy, followed by a 30-second waiting period and then two

subsequent three-strike sets. This soft start will be applied prior to the beginning of impact pile installation each day or after an impact hammer has been idle for more than 30 minutes. No soft-start or ramp-up procedures are possible during vibratory pile installation.

5. For in-water heavy machinery and construction work (e.g., tug and barge movements, and pile positioning), a 10-meter shutdown zone will be implemented for humpback whales and Steller sea lions. If a humpback whale or Steller sea lion comes within 10 meters of these activities, the activity will cease as quickly as can be accomplished safely, and vessels will reduce speed to the minimum level required to maintain steerage and safe working conditions (less than 10 knots). The activity may resume after the humpback whale or Steller sea lion is observed leaving the shutdown zone or has not been observed for 15 minutes.
6. Work in waters of the United States will be conducted in accordance with the terms and conditions of the USACE permits to be obtained for the Project.
7. Pile installation/removal will occur only during daylight hours, when visual monitoring of humpback whales and Steller sea lions can be conducted.
8. Vessels used in the proposed action will follow established transit routes and will travel at slow speeds (less than 10 knots) while in the action area.
9. To prevent direct placement of a pile on a sunflower sea star, a pre-construction survey and monthly surveys of the pilings and seafloor near the project area will take place.
    a. Monitoring of the seafloor at the location of every pile in lieu of a pre-construction or monthly surveys.
    b. The lead Protected Species Observer (PSO) will monitor all piling removals and visually inspect each pile to determine if it is clear of sunflower sea stars. If a sunflower sea star is attached to a piling, the lead PSO or other PSO present will gently remove the sunflower sea star and relocate it immediately into the water at a nearby intertidal area.

<u>Monitoring Measures and Shutdown Protocol</u>

10. Trained PSOs will monitor the portion of the action area that is marine waters (i.e., the monitoring zones) for humpback whales, Steller sea lions, and non-ESA-listed marine mammals. These monitoring zones are the same as the harassment zones which are defined by the estimated propagation of sound due to pile installation and removal and vary depending on the in-water work occurring at the time and the resultant isopleths. Harassment zones (Level B zones) are shown in Figure 3 and are defined by relevant 120 or 160 dB acoustic islopeths for pile installation and removal. PSOs will monitor the zone for marine mammals from publicly accessible shoreside areas at the Auke Bay facility, along Fritz Cove Road, and elsewhere along the waterfront. Additional monitoring locations along North Douglas Highway will be used to monitor the larger harassment

zones.

11. Shutdown zones will be implemented to prevent and minimize the likelihood of injury of humpback whales and Steller sea lions. The shutdown zones are larger than the injury zones (Level A harassment zones, per MMPA) to ensure that the risk of injury is reduced. If a Steller sea lion or humpback whale is observed approaching the shutdown zone, all pile installation or removal will stop immediately and will not continue until the animal has left the shutdown zone or the animal has not been re-sighted near the shutdown zone for 15 minutes (Steller sea lion) or 30 minutes (humpback whale) of continuous monitoring. The shutdown zones for humpback whales and Steller sea lions will vary depending on the pile installation or removal method in use at the time and are listed in Table 3.

Table 3. *Shutdown zones shown in meters for humpback whales and Steller sea lions based on pile driving method and pile size for the AMHS Auke Bay East Terminal Improvements project.*

Activity	**Piles per day**	**Shutdown Zones (m)**	
		Humpback Whales	**Steller Sea Lions**
All vibratory installation and removal	N/A	75	30
30-in impact (1,000 strikes)	2	2,600	100
	1	1,600	75
24-in impact (1,000 strikes)	3	970	40
	2	740	30
	1	470	
24-in impact (500 strikes)	3	610	30
	2	470	
	1	300	
18-in impact (800 strikes)	4	750	30
	3	620	
	2	470	
	1	300	

12. The PSOs will have the following equipment to be able to perform their duties:
    - Binoculars (7x50 or higher magnification) with built-in rangefinder or reticules;
    - Rangefinder;
    - Daily tide tables;
    - Large (11- by 17-inch or similar) waterproof maps of the project area and monitoring zones;
    - Two-way radio or cell phone communication with construction foreman/superintendent. Phone numbers for all PSOs and the Construction Contractor point of contact; and
    - A log book of all activities, of which a digital copy (e.g., Excel spreadsheet) will be made available to NMFS upon request at any time.
13. Specific to sunflower sea star surveys, an ROV may be used. The ROV will be capable of:
    - Live video transmittal to surface observers;
    - Storing videos or still images to include in reports to NMFS; and
    - Being deployed in low light conditions using on-board lighting as needed.
14. Marine mammal and sunflower sea star monitoring will be conducted by NMFS-approved PSOs with the following qualifications:
    a. PSOs will be independent observers (i.e., not construction personnel).
    b. One PSO will be designated the lead PSO or monitoring coordinator. The lead PSO must have prior experience working as a PSO or a marine mammal observer.
    c. Other observers (besides the lead PSO) may substitute education (undergraduate degree in biological science or related field) or training for experience.
    d. Electronic data collection or paper sheets will be reviewed and corrected by the lead PSO at the end of each monitoring day. If information is not available or not applicable, the field will be populated with an "NA" or dash. The data will also be reviewed once it is entered electronically.
    e. PSOs must have:
       - The ability to conduct field observations and collect data according to assigned protocols;
       - Experience or training in field identification of marine mammals, including the identification of behaviors;
       - Sufficient training, orientation, or experience with construction operations to provide for personal safety during observations; and
       - The ability to communicate verbally, by radio, phone, or in person, with Project personnel to provide real-time information on marine mammals observed in the area.

f. Lead PSOs must have writing skills sufficient to prepare a report of observations, including, but not limited to:
  - The number, species, and behavior of marine mammals observed;
  - Dates and times when in-water pile installation and removal were conducted;
  - Dates and times when in-water pile installation and removal were suspended to avoid potential harassment of marine mammals observed within the harassment zones; and
  - Dates, times, and conditions associated with observations of sunflower sea stars on pilings, and steps taken to move the animals back into the marine environment.

g. Lead PSOs must also have knowledge or training in sunflower sea star identification and sea star wasting disease.

Unauthorized Take

15. If a listed marine mammal is determined by the PSO to have been disturbed, harassed, harmed, injured, or killed (e.g., a listed marine mammal is observed entering a shutdown zone before operations can be shut down, or is injured or killed as a direct or indirect result of this action), the PSO will immediately report the incident to NMFS AKR. The PSO will submit the incident information to akr.section7@noaa.gov. This only applies to species for which take authorization has not been granted, to any unauthorized take, or to a species for which take authorization has been granted but the authorized take amount has been met. The PSO record(s) will include:
    a. all information to be provided in the final report (see *Final Report* heading);
    b. number of animals of each threatened and endangered species affected;
    c. the date, time, and location of each event (provide geographic coordinates);
    d. description of the event;
    e. the time the animal(s) was first observed or entered the shutdown zone, and, if known, the time the animal was last seen or exited the zone, and the fate of the animal;
    f. mitigation measures implemented prior to and after the animal was taken;
    g. if a vessel struck a marine mammal, the contact information for the PSO on duty, or the contact information for the individual piloting the vessel if there was no PSO on duty; and
    h. photographs or video footage of the animal(s), if available.

Stranded, Injured, Sick or Dead Marine Mammal

16. If PSOs observe an injured, sick, or dead marine mammal (i.e., stranded marine mammal), they will notify the Alaska Marine Mammal Stranding Hotline at

1-877-925-7773. The PSOs will submit photos and available data to aid NMFS in determining how to respond to the stranded animal. If possible, data submitted to NMFS in response to stranded marine mammals will include date/time, location of stranded marine mammal, species and number of stranded marine mammals, description of the stranded marine mammal's condition, event type (e.g., entanglement, dead, floating), photos of the stranded animal(s), and behavior of live-stranded marine mammals.

Illegal Activities

17. If PSOs observe marine mammals being disturbed, harassed, harmed, injured, or killed (e.g., feeding or unauthorized harassment), these activities will be reported to NMFS Alaska Region Office of Law Enforcement at 1-800-853-1964 (Table 4).

    Data submitted to NMFS will include date/time, location, description of the event, and any photos or videos taken.

Monthly Reports

18. Interim monthly monitoring reports, including data sheets, will be submitted. These reports will include a summary of marine mammal species and behavioral observations, shutdowns or delays, and work completed.

    Monthly reports will be submitted to AKR.section7@noaa.gov by the 15th day of the month following the reporting period. For example, the report for activities conducted in December 2023, will be submitted by January 15, 2024.

Final Report

19. A draft final report will be submitted to NMFS at AKR.section7@noaa.gov (Table 4) within 90 calendar days of the completion of the project. A final report must be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. The report will summarize all in-water activities associated with the proposed action and results of PSO monitoring.

The final report will include:

a. summaries of monitoring effort, including dates and times of construction, dates and times of monitoring, dates and times and duration of shutdowns due to protected species presence;
b. date and time of protected species observations, geographic coordinates of protected species at their closest approach to the project site, species, numbers, age/size/sex categories (if determinable), and group sizes;
c. number of protected species observed (by species) during periods with and without project activities (and other variables that could affect detectability);

d. observed protected species behaviors and movement types versus project activity at time of observation;
e. numbers of protected species individuals seen versus project activity at time of observation;
f. distribution of protected species around the action area versus project activity at time of observation; and
g. detailed information about implementation of any mitigation measures (e.g., shutdowns and delays), a description of actions that ensued, and observed behaviors of the animal(s).

Table 4. *Summary of agency contact information.*

Reason for Contact	**Contact Information**
Request S7 Consultation	akr.prd.section7@noaa.gov
Consultation Questions & Unauthorized Take	akr.prd.section7@noaa.gov & Sadie Wright: sadie.wright@noaa.gov
Reports & Data Submittal	akr.prd.section7@noaa.gov include NMFS AKRO tracking number in subject line (AKRO-2022-02777)
Stranded, Injured, Entangled, or Dead Marine Mammal	NOAA Fisheries Stranding Hotline (24/7 coverage) 1-877-925-7773
Oil Spill & Hazardous Materials Response	U.S. Coast Guard National Response Center 1-800-424-8802 & AKRNMFSspillResponse@noaa.gov
Illegal Activities	NMFS Office of Law Enforcement (AK Hotline): 1-800-853-1964
In the event that this contact information becomes obsolete	NMFS Anchorage Main Office: 907-271-5006 Or NMFS Juneau Main Office: 907-586-7236

2.2 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 action area for this opinion will include all proposed activities outlined above. We define the action area for this consultation to include the area within which project-related sound levels are ≥120 dB re 1 μPa (rms) (i.e., the point where sound from the project drops below the NMFS threshold of concern), and any vessel transit routes that occur due to this action. Sound levels associated with vibratory pile installation will extend further than other construction components of the proposed action, thus the action area extends 11.66 kilometers from the project site (Figure 3) where pile driving-related sound is expected to reach 120 dB. Pile driving sound will be blocked to the west and east of the project location by the mainland, and the south in some areas by the land masses of Portland, Coughlin, Spuhn, Seudla, and Douglas Islands (Figure 3).

3 APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of 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 reasonably 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 ((June 2, 1986)).

Under NMFS's regulations, the destruction or adverse modification of critical habitat means "a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR § 402.02).

Prior to 2016, designations of critical habitat used the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (81 FR 7414; February 11, 2016) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether the proposed action described in Section 2 of this opinion is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify those aspects (or stressors) of the proposed action that are likely to have effects on listed species or critical habitat. As part of this step, we identify the action area – the spatial and temporal extent of these effects.
- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the rangewide status of critical habitat by examining the condition of its PBFs - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this opinion.
- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; expected impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.
- Analyze the effects of the proposed actions. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat PBFs. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.
- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this opinion.
- Describe any cumulative effects. Cumulative effects, as defined in NMFS's 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. Cumulative effects are considered in Section 7 of this opinion.

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.
- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis, Section 8.
- If necessary, define a reasonable and prudent alternative (RPA) to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify an RPA to the action.

4 RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

This opinion considers the effects of the proposed action on the species and designated critical habitat specified below (Table 5). Although the sunflower sea star is not currently listed under the ESA, NMFS has proposed listing the species as threatened. NMFS advised, and ADOT agreed, that ADOT would request inclusion of a conference opinion under ESA section 7(a)(4), analyzing effects of the action on the sunflower sea star in case the species is listed prior to completion of the proposed action.

The nearest critical habitat for the Steller sea lion is over 15 miles from the action area. The nearest critical habitat for the Mexico DPS humpback whale is over 400 miles from the action area. Critical habitat has not been proposed for sunflower sea stars at this time.

Table 5. *Listing status and critical habitat designation for marine mammals considered in this opinion.*

Species	Status	Listing	Critical Habitat
Steller Sea Lion, WDPS (*Eumetopias jubatus*)	Endangered	May 5, 1997, 62 FR 24345	August 27, 1993, 58 FR 45269 (none in the action area)
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	September 8, 2016, 81 FR 62260	April 21, 2021 86 FR 21082 (none in the action area)
Sunflower Sea Star (*Pycnopodia helianthoides*)	Proposed Threatened	Proposed Rule March 16, 2023 88 FR 16212	Not designated

4.1 Species and Critical Habitat Not Likely to be Adversely Affected by the Action

NMFS uses two criteria to identify those endangered or threatened species or critical habitat that are likely to be adversely affected. The first criterion is exposure or some reasonable expectation of a co-occurrence between one or more potential stressors associated with ADOT's proposed activities and a listed species or designated critical habitat. The second criterion is the probability of a response given exposure.

We applied these criteria to the species and critical habitats listed above and determined that the following designated critical habitats are not likely to be adversely affected by the proposed action: Steller sea lion critical habitat and Mexico DPS humpback whale critical habitat.

4.1.1 Steller Sea Lion Critical Habitat

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

- Alaska rookeries, haulouts, and associated areas identified at 50 CFR § 226.202(a), including:
  - Terrestrial zones that extend 914 m (3,000 ft) landward

  - Air zones that extend 914 m (3,000 ft) above the terrestrial zone
  - Aquatic zones that extend 914 m (3,000 ft) seaward from each major rookery and major haulout east of 144° W. longitude
  - Aquatic zones that extend 37 km (23 mi) seaward from each major rookery and major haulout west of 144° W. longitude

- Three special aquatic foraging areas identified at 50 CFR § 226.202(c):
  - Shelikof Strait
  - Bogoslof
  - Seguam Pass

The ensonified area and transit routes associated with the project does not overlap with designated critical habitat. The nearest critical habitat is at Benjamin Island (blue dot near Juneau in Figure 4) located over 15 miles northwest of Auke Bay, and outside of the action area.

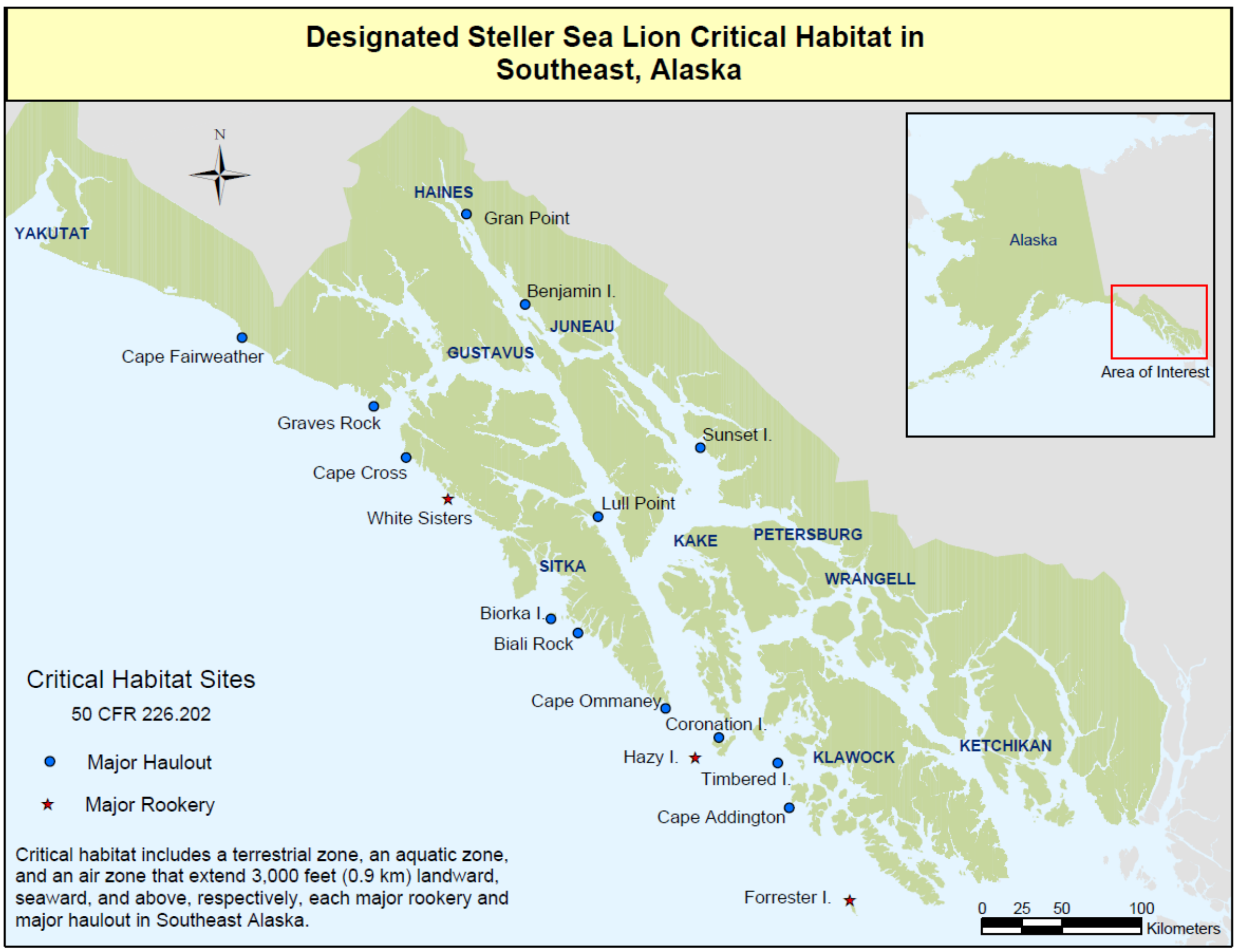

Figure 4. *Designated critical habitat for Steller sea lions in Southeast Alaska.*

It is unlikely that these activities will impact critical habitat surrounding haulouts and rookeries to any measureable degree. We conclude that any impacts to Steller sea lion critical habitat PBFs are likely to be insignificant. Therefore, we conclude that Steller sea lion critical habitat is not likely to be adversely affected by the proposed action.

4.1.2 Mexico DPS Humpback Whale Critical Habitat

NMFS designated critical habitat for Mexico DPS humpback whales on April 21, 2021 (86 FR 21082). The following PBF was identified at the time of listing:

- Prey species, primarily euphausiids (*Thysanoessa*, *Euphausia*, *Nyctiphanes*, and *Nematoscelis*) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea pallasii*), capelin (*Mallotus villosus*), juvenile walleye pollock (*Gadus chalcogrammus*), and Pacific sand lance (*Ammodytes personatus*) of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

The nearest humpback whale critical habitat is over 400 miles from the proposed action area (Figure 5). It is unlikely that the activities associated with the proposed action will impact critical habitat or prey species associated with critical habitat to any measureable degree. We conclude that any impacts to Mexico DPS humpback whale critical habitat PBFs are likely to be insignificant. Therefore, we conclude that Mexico DPS humpback whale critical habitat is not likely to be adversely affected by the proposed action.

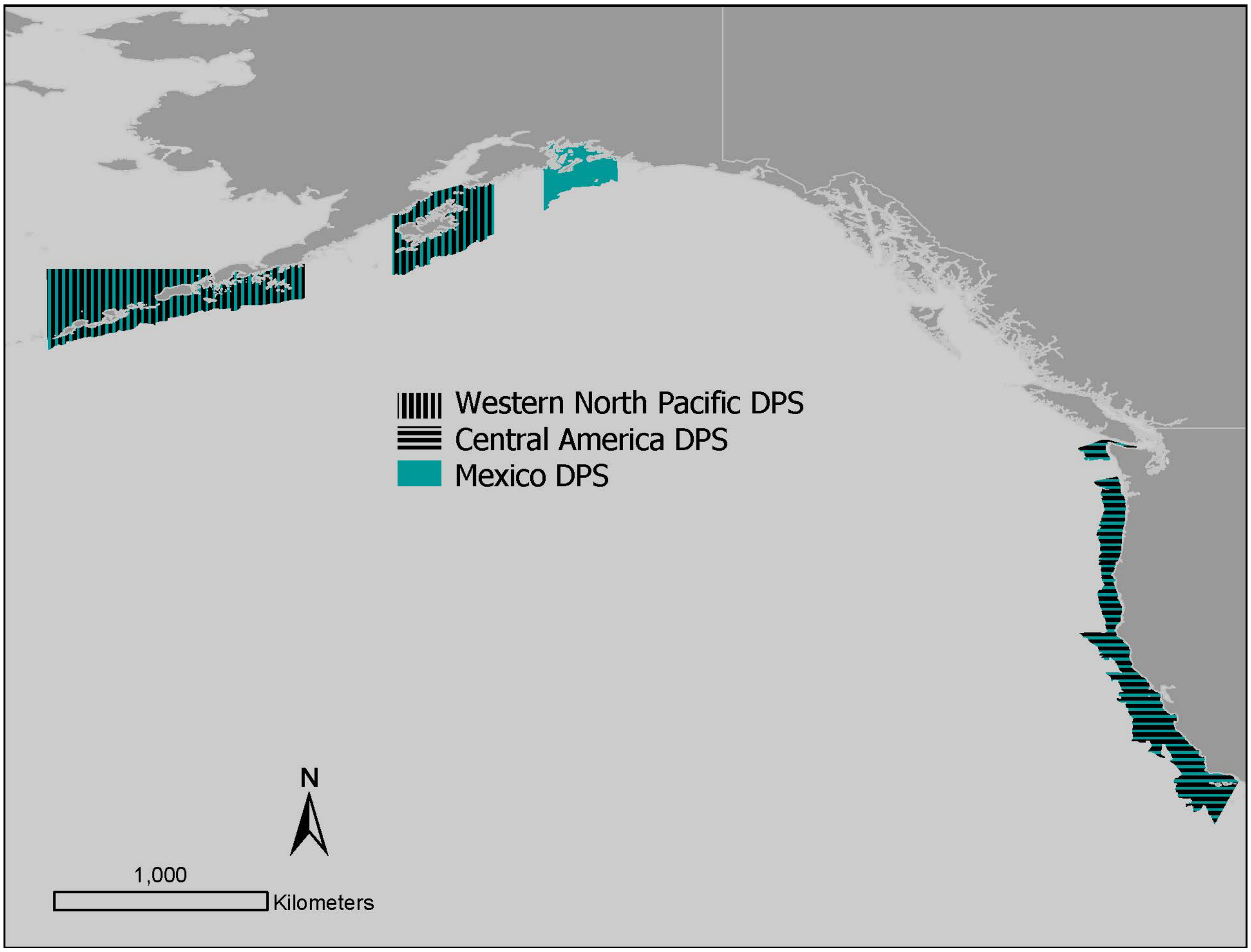

Figure 5. *Map showing designated critical habitat for humpback whales in Alaska and the West Coast of the United States. Critical habitat for the Mexico DPS humpback whale is denoted in turquoise, and occurs in Prince William Sound.*

Therefore, the critical habitats for Steller sea lions and Mexico DPS humpback whales are not considered further in this opinion.

4.2 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, changes in the quality and quantity of ice, changes in ocean acidification, and changes in precipitation patterns, all of which are likely to impact ESA species and habitat. NOAA's climate information portal provides basic background information on these and other measured or expected climate change effects (see https://www.climate.gov). We present an overview of the potential climate change effects on Western DPS Steller sea lions, Mexico DPS humpback whales, sunflower sea stars, and their habitat below.

Global climate change is a threat common to all the species we discuss in this opinion. Because of this commonality, we present an overview here rather than in each of the species-specific narratives that follow. A vast amount of literature is available on climate change and for more detailed information we refer the reader to these websites which provide the latest data and links to the current state of knowledge on the topic in general, and Alaska specifically:

https://www.ipcc.ch/reports/

https://climate.nasa.gov/evidence/

http://nsidc.org/arcticseaicenews/

https://arctic.noaa.gov/Report-Card

Three facets of climate change, increased air temperatures, increased ocean temperatures, and ocean acidification, are presented because they have the most direct impact on ESA-listed species and their prey.

Air temperature

Recording of global temperatures began in 1880, and the last nine years (2014–2022) have ranked as the nine warmest years on record[1]. The yearly temperature for North America has increased at an average rate of 0.23°F since 1910; however, the average rate of increase has doubled since 1981 (0.49°F)[2].

The Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes since 2000. This is due to “Arctic amplification,” a characteristic of the global climate system influenced by changes in sea ice extent, albedo, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors (Serreze and Barry 2011, Richter-Menge et al. 2017, Richter-Menge 2019). The average annual temperature is now 3-4°F warmer than during the early and mid-century (Figure 6). The average annual temperature for Alaska in 2022 was 28.6°F, 2.6°F above the long-term average, ranking 16th warmest in the 98-year record for the state[3]. Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014).

[1] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213 viewed 2/17/2023.
[2] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213 viewed 2/17/2023.
[3] https://www.ncei.noaa.gov/access/monitoring/monthly-report/national/202213 viewed 2/17/2023.

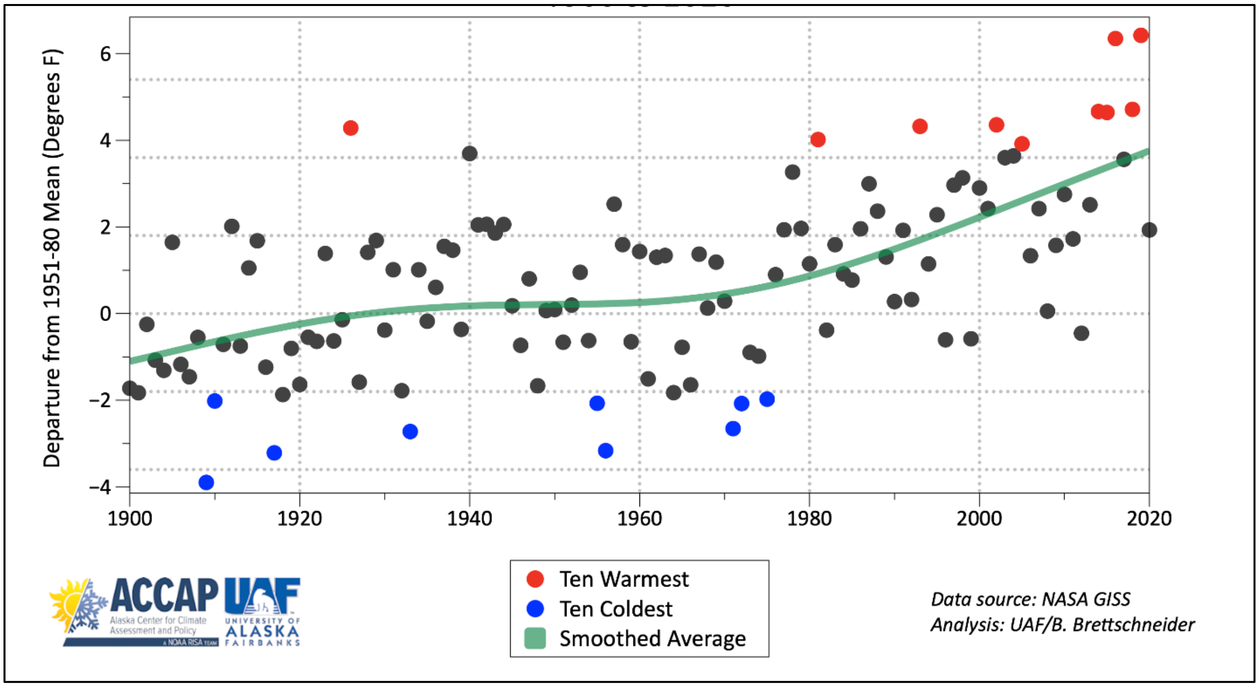

Figure 6. *Alaska annual temperature, 1900 to 2020.*

Marine water temperature

Higher air temperatures have led to higher ocean temperatures. More than 90 percent of the excess heat created by global climate change is stored in the world's oceans, causing increases in ocean temperature (IPCC 2019, Cheng et al. 2020). The four highest annual global ocean heat content, which measures the amount of heat stored in the upper 2000 m (6,561 ft) of the ocean, have all occurred in the last four years (2019–2022), and regions of the North Pacific, North Atlantic, Mediterranean, and southern oceans recorded their highest ocean heat content since the 1950s[4].

The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect is observed throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas (Figure 7). Annual average temperatures have increased by 1.8°C across the contiguous U.S. since the beginning of the 20th century with Alaska warming faster than any other state and twice as fast as the global average since the mid-20th century (Jay et al. 2018). Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) began declining at an accelerated rate and continues to decline at a rate of approximately -2.7 percent per decade (Stroeve et al. 2007, Stroeve and Notz 2018).

[4] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213 viewed 2/17/2023.

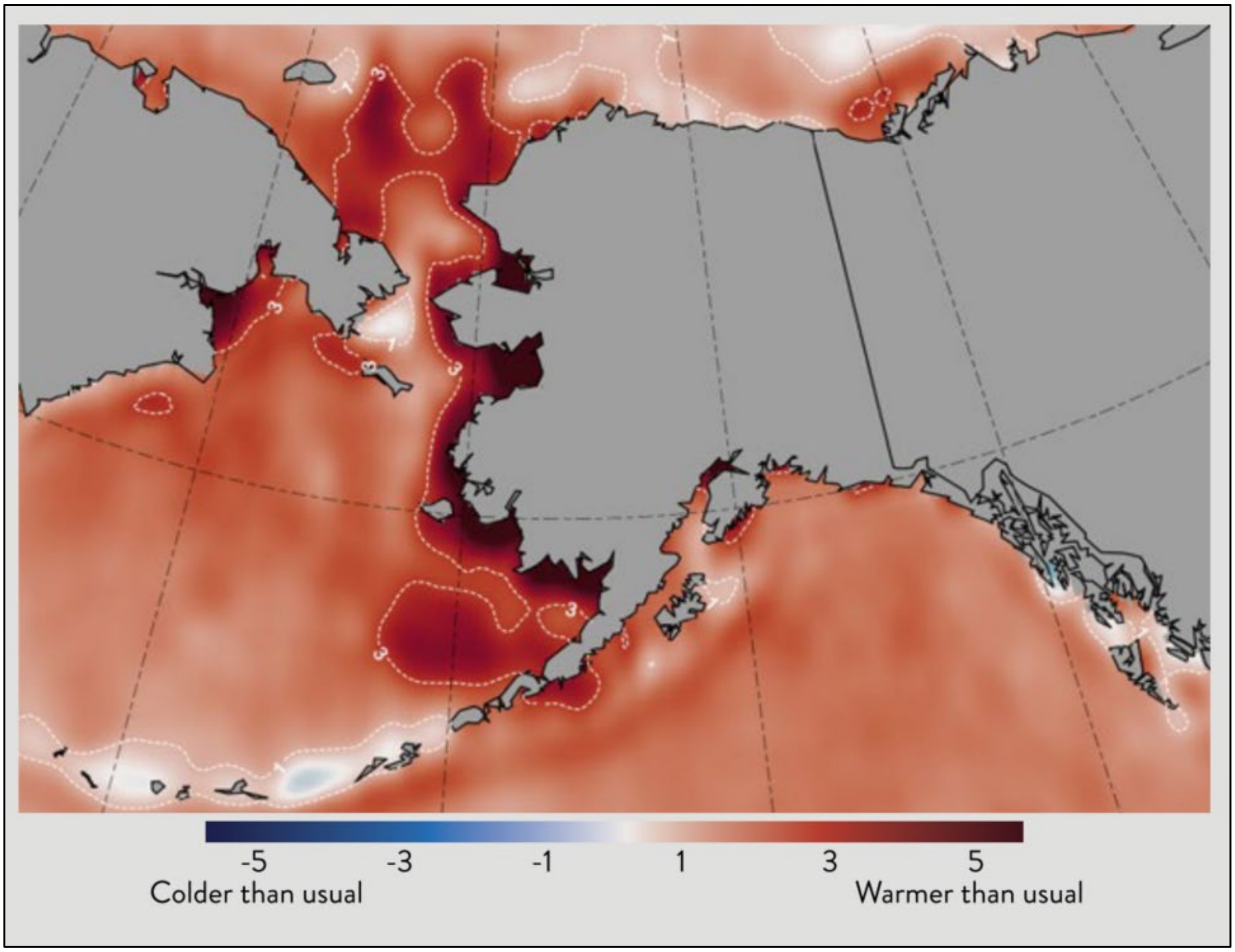

Figure 7. *Alaska summer sea surface temperatures, 2014-2018 (Thoman and Walsh 2019).*

In the Pacific Arctic, with the reduction in the cold-water pool in the northern Bering Sea, largescale northward movements of commercial stocks are underway as previously cold-dominated ecosystems warm and fish move northward to higher latitudes (Grebmeier et al. 2006, Eisner et al. 2020). Not only fish, but plankton, crabs, and, ultimately, sessile invertebrates like clams are affected by these changes in water temperature (Grebmeier et al. 2006, Fedewa et al. 2020).

Another ocean water anomaly is the marine heat wave, a coherent area of extreme warm temperature at the sea surface that persists (Frölicher, Fischer and Gruber 2018). Global warming has led to more frequent heatwaves in most land regions and an increase in the frequency and duration of marine heatwaves (IPCC 2018). Marine heatwaves are a key ecosystem driver and nearly 70 percent of global oceans experienced strong or severe heatwaves in 2016, compared to 30 percent in 2012 (Suryan et al. 2021). The largest recorded marine heat wave occurred in the northeast Pacific Ocean, appearing off the coast of Alaska in the winter of 2013-2014 and extending south to Baja California by the end of 2015 (Frölicher, Fischer and Gruber 2018). The Pacific marine heatwave began to dissipate in mid-2016, but warming re-intensified in late-2018 and persisted into fall 2019 (Suryan et al. 2021). Consequences of this event included an unprecedented harmful algal bloom that extended from the Aleutian Islands to southern California, mass strandings of marine mammals, shifts in the distribution of invertebrates and fish, and shifts in abundance of several fish species (Cavole et al. 2016).

Cetaceans, forage fish (capelin and herring), Steller sea lions, adult cod, chinook and sockeye salmon in the Gulf of Alaska were all impacted by the Pacific marine heatwave (Bond et al. 2015, Peterson, Bond and Robert 2016, Sweeney, Towell and Gelatt 2018). The northeast Pacific marine heat wave is negatively correlated with humpback whale reproduction in Hawaii (Cartwright et al. 2019). Recent largescale declines in sunflower sea star abundance have been linked to Pacific Ocean heatwaves (Lowry 2022).

The 2018 Pacific cod stock assessment[5] estimated that the female spawning biomass of Pacific cod (an important prey species for Steller sea lions) was at its lowest point in the 41-year time series, following three years of poor recruitment and increased natural mortality as a result of the Pacific marine heatwave. The spawning stock biomass dropped below 20 percent of the unfished spawning biomass in 2020; 20 percent is a minimum spawning stock size threshold instituted to help ensure adequate prey availability for the endangered Western DPS of Steller sea lions. The federal Pacific cod fishery in the Gulf of Alaska was closed by regulation to directed Pacific cod fishing in 2020 as a result (Barbeaux, Holsman and Zador 2020). As of 2022, Pacific cod has not recovered from the decline during the 2014-2016 marine heatwave[6].

Ocean Acidification

For 650,000 years or more, the average global atmospheric carbon dioxide (CO2) concentration varied between 180 and 300 parts per million (ppm), but since the beginning of the industrial revolution in the late 1700s, atmospheric CO2 concentrations have been increasing rapidly, primarily due to anthropogenic inputs (Fabry et al. 2008, Lüthi et al. 2008). The world’s oceans have absorbed approximately one-third of the anthropogenic CO2 released, which has buffered the increase in atmospheric CO2 concentrations (Feely et al. 2004, Feely, Doney and Cooley 2009). Despite the oceans’ role as large carbon sinks, the CO2 level continues to rise and is currently at 419 ppm[7].

As the oceans absorb CO2, the buffering capacity and pH of seawater are reduced. This process is referred to as ocean acidification. Ocean acidification reduces the saturation states of certain biologically important calcium carbonate minerals like aragonite and calcite that many organisms use to form and maintain shells (Bates, Mathis and Cooper 2009, Reisdorph and

[5] https://www.fisheries.noaa.gov/alaska/population-assessments/2018-north-pacific-groundfish-stock-assessments accessed 2/17/23.
[6] https://apps-afsc.fisheries.noaa.gov/REFM/docs/2022/GOA-ESR-Brief.pdf accessed 2/17/23.
[7] https://gml.noaa.gov/ccgg/trends/ accessed 2/17/23.

Mathis 2014). When seawater is supersaturated with these minerals, calcification (growth) of shells is favored. Likewise, when the seawater becomes undersaturated, dissolution is favored (Feely, Doney and Cooley 2009).

High latitude oceans have naturally lower saturation states of calcium carbonate minerals than more temperate or tropical waters, making Alaska's oceans more susceptible to the effects of ocean acidification (Fabry et al. 2009, Jiang et al. 2015). Model projections indicated that aragonite undersaturation would start to occur by about 2020 in the Arctic Ocean and by 2050, all of the Arctic will be undersaturated with respect to aragonite (Feely, Doney and Cooley 2009, Qi et al. 2017). Large inputs of low-alkalinity freshwater from glacial runoff and melting sea ice contribute to the problem by reducing the buffering capacity of seawater to changes in pH (Reisdorph and Mathis 2014). As a result, seasonal undersaturation of aragonite was already detected in the Bering Sea at sampling stations near the outflows of the Yukon and Kuskokwim Rivers, and the Chukchi Sea (Fabry et al. 2009).

Models and observations indicate that rapid sea ice loss will increase the uptake of CO2 and exacerbate the problem of aragonite undersaturation in the Arctic (Yamamoto et al. 2012, DeGrandpre et al. 2020).

Undersaturated waters are potentially highly corrosive to any calcifying organism, such as corals, bivalves, crustaceans, echinoderms (including sea stars), and many forms of zooplankton such as copepods and pteropods, and, consequently, may affect Arctic food webs (Fabry et al. 2008, Bates, Mathis and Cooper 2009). Pteropods, which are often considered indicator species for ecosystem health, are prey for many species of carnivorous zooplankton, fishes including salmon, mackerel, herring, and cod, and baleen whales (Orr et al. 2005). Because of their thin shells and dependence on aragonite, under increasingly acidic conditions, pteropods may not be able to grow and maintain shells (Lischka and Riebesell 2012). It is uncertain if these species, which play a large role in supporting many levels of the Alaskan marine food web, will be able to adapt to changing ocean conditions (Fabry et al. 2008, Lischka and Riebesell 2012).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Hinzman et al. 2005, Burek, Gulland and O'Hara 2008, Doney et al. 2012, Huntington et al. 2020). The physical effects on the environment described above have impacted, are impacting, and will continue to impact marine species in a variety of ways (IPCC 2014b), including shifting abundances, changes in distribution, changes in timing of migration, changes in periodic life cycles of species. For example, cetaceans with restricted distributions linked to water temperature may be particularly susceptible to range restriction (Learmonth et al. 2006, Isaac 2009). Macleod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will be put at risk of extinction. Of greatest concern for cetaceans are populations with ranges limited to non-tropical waters, and preferences for shelf habitats (Macleod 2009).

4.3 Status of Listed Species Likely to be Adversely Affected by the Proposed Action

This opinion examines the status of each species that would be adversely affected by the proposed action. Species status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in the definition of "jeopardy" under 50 CFR § 402.02.

For each of the endangered, threatened, and proposed threatened species that occur in the action area and that would be adversely affected by the proposed action, we present a summary of information on the population structure and distribution of the species to provide a foundation for the exposure analyses that appear later in this opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determinations we make later in this opinion. That is, we rely on a species' status and trend to determine whether an action's effects are likely to increase the species' probability of becoming extinct.

4.3.1 Mexico DPS Humpback Whales

Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the Northern Hemisphere and from tropical to near-ice-edge waters in the Southern Hemisphere.

Additional information on humpback whale biology and natural history is available at:

https://www.fisheries.noaa.gov/species/humpback-whale

Humpback Whale 2015 Status Review

Humpback Whale 1991 Recovery Plan

https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock

4.3.1.1 Population Structure and Status

Commercial whaling severely reduced humpback whale numbers from historical levels. 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 conducted a global status review and in 2016 changed the status of humpback whales under the ESA. The globally listed species was divided into 14 DPSs, four of which are endangered, one is threatened, and the remaining nine are not listed under the ESA (81 FR 62260; September 8, 2016).

Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, (Wade 2021) concluded that whales feeding in Alaskan waters belong primarily to the Hawaii DPS (recovered), with small numbers from the WNP DPS (endangered) and Mexico DPS (threatened). There are approximately 1,084 animals in the WNP DPS and 2,913 animals in the Mexico DPS (Wade 2021). The population trend is unknown for both DPSs. The Hawaii DPS is estimated at 11,540 animals, and the annual growth rate is between 5.5 and 6.0 percent. Humpback whales in Southeast Alaska are comprised of approximately 98% Hawaii DPS individuals and 2% Mexico DPS individuals (Table 6).

Table 6. *Estimated proportion of humpback whales from each DPS in the North Pacific Ocean in various feeding areas. Adapted from Wade (2021).*

Summer Feeding Areas	**North Pacific Distinct Population Segments**			
	Western North Pacific DPS (endangered)[1]	**Hawaii DPS (not listed)**	**Mexico DPS (threatened)**	**Central America DPS (endangered)**
Kamchatka	91%	9%	0%	0%
Aleutian Islands / Bering / Chukchi / Beaufort	2%	91%	7%	0%
Gulf of Alaska	1%	89%	11%	0%
Southeast Alaska / Northern BC	0%	98%	2%	0%
Southern BC / WA	0%	69%	25%	6%
OR/CA	0%	0%	58%	42%

Whales from the WNP, Mexico, and Hawaii DPSs overlap on feeding grounds off Alaska, and are not visually distinguishable. All waters off the coast of Alaska may contain ESA-listed humpbacks. Central America DPS humpback whales do not occur in Alaska waters.

The abundance of humpback whales has increased in Southeast Alaska, though a trend for the Southeast Alaska portion of the Mexico DPS cannot be estimated from the data because of differences in methods and areas covered (Muto et al. 2022).

4.3.1.2 Distribution

Humpback whales migrate seasonally between warmer, tropical or sub-tropical waters in winter months (where they reproduce and give birth to calves) and cooler, temperate or sub-Arctic waters in summer months (where they feed). In their summer foraging areas and winter calving areas, humpback whales tend to occupy shallower, coastal waters; during their seasonal migration however, humpback whales disperse widely in deep, pelagic waters and tend to avoid shallower coastal waters (Winn and Reichley 1985).

Humpback whale populations in Southeast Alaska have been steadily increasing in recent decades. Humpback whale abundance has increased by at least an estimated annually 6.8% in the North Pacific in the 39 years following the cessation of commercial whaling in the United States (Calambokidis et al. 2008). The annual rate of increase of humpback whale abundance in Southeast Alaska was estimated to be 10.6% from 1991-2007 (Dahlheim, White and Waite 2009), and recent estimates of abundance for Southeast Alaska and northern British Columbia are between 3,000 and 5,890 humpback whales (Calambokidis et al. 2008, Wade 2021, Muto et al. 2022). As previously mentioned, an estimated 98% of humpback whales in Southeast Alaska are from the Hawaii DPS (not listed) and 2% from the Mexico DPS (threatened) (Wade 2021). We use 2% in this analysis to estimate the percentage of observed humpbacks that are from the Mexico DPS. WNP DPS humpback whales are not expected to occur in Southeast Alaska (Table 6).

Humpback whales are present in Southeast Alaska year round. Most Southeast Alaska humpback whales winter in low latitudes, but there is significant overlap in migratory departures and returns, and documentation of individuals overwintering in Southeast Alaska (Baker et al. 1985, Straley 1990, Moran et al. 2018). Humpback whales forage on fish and euphausieds throughout the summer in Southeast Alaska (Krieger and Wing 1984). Late fall and winter whale habitat in Southeast Alaska appears to correlate with areas that have over-wintering herring such as lower Lynn Canal, where the proposed action would occur (Baker et al. 1985, Straley 1990). In Lynn Canal, peak densities of whales occur in early Fall in preparation for schooling herring (Straley et al. 2018). Schools of euphasiids, herring, and other fish in the action area may provide foraging opportunities for whales.

Fritz Cove and Auke Bay are overwintering locations for herring, which attracts humpback whales. Late season humpback whales are present through February, with an estimated average of 1-5 humpback whales present in Auke Bay and Fritz Cove daily (J. Moran, pers. comm).

4.3.1.3 Threats to the Species

Algal toxins

Harmful algal blooms are a potential stressor for humpback whales. Out of 13 stranded marine mammal species sampled in Alaska, domoic acid was detected in all species examined with humpback whales showing 38% prevalence. Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales (50%) and bowhead whales (32%) (Lefebvre et al. 2016). Domoic acid has caused marine mammal illness and mortality on the West Coast of the United States, and saxitoxin is a known cause of human illness and mortality in Alaska. Both are expected to increase in association with current climate trends (i.e., increasing water temperatures) (Lefebvre et al. 2016).

Entanglement

Humpback whales can be killed or injured in interactions with commercial fishing gear and other entangling materials. A photo analysis study of humpback whales in Southeast Alaska in 2003 and 2004 found at least 53% of individuals showed some kind of scarring from past entanglements (Neilson 2006). The total minimum estimate of the mean annual mortality of all humpback whales incidental to U.S. commercial fisheries for the Central North Pacific stock (CNP: which includes whales from the Hawaii DPS, Mexico DPS, and Western North Pacific DPS) from 2014-2018 is 6.6 humpback whales. This estimate is based on observer data from Alaska (0.2 in federal fisheries + 5.5 in the state-managed Southeast Alaska salmon drift gillnet fishery) and observer data from Hawaii (0.9) (Muto et al. 2022). During the same time period (2014-2018) Marine Mammal Authorization Program (MMAP) fishermen self-reports in which the commercial fishery is confirmed, and reports to the NMFS Alaska Region stranding network, documented an additional mean annual CNP humpback whale mortality rate of 8.4 due to entanglements in recreational fishing gear, subsistence fishing gear, unknown fishing gear, marine debris, and other gear (e.g., mooring line) (Muto et al. 2022). These estimates are based on confirmed reports and are certainly a minimum number of humpback whale mortality and serious injury in Alaska due to entanglement (Muto et al. 2022). Between 2016 and 2020, entanglement of humpback whales (n = 47) was the most frequent human-caused source of mortality and injury in Alaska (Freed 2022).

Ship Strike

Ship strikes and other interactions with vessels occur frequently with humpback whales in Alaska. Neilson et al. (2012) summarized 108 large whale ship strikes in Alaska from 1978 to 2011, 25 of which are known to have resulted in the whale’s death. Eighty-six percent of these reports involved humpback whales. Eighteen humpbacks were confirmed to be struck by vessels in Alaska from 2016 to 2022 (Freed 2022). Most ship strikes of humpback whales in Alaska are reported from Southeast Alaska (Muto et al. 2022).

In 2017, there were eight reported vessel strikes to large whales in Alaska; six confirmed humpback whales, one unknown large whale, and one sperm whale. In 2018, there were nine reported vessel strikes to large whales in Alaska; seven humpback whales, one gray whale, and one fin whale (AKR Stranding Program Vessel Strike database; accessed by S. Wright on June 4, 2020). These reports are a minimum number of whale vessel strikes in Alaska, however, these incidents account for a very small fraction of the total humpback whale range (Laist et al. 2001).

Vessel collisions with humpback whales remain a significant management concern, given the increasing abundance of humpback whales foraging in Alaska, as well as the growing presence of marine traffic in Alaska's coastal waters. Based on these factors, injury and mortality of humpback whales as a result of vessel strike will continue into the future.

Anthropogenic Sound

Elevated levels of sound from anthropogenic sources (e.g., shipping, military sonars, coastal development) are a potential concern for humpback whales in the North Pacific, as well as the growth of the whale watching industry in Hawaii and Alaska (preferred habitats may be abandoned if disturbance levels are too high) (Muto et al. 2022). Abandonment of preferred habitats could lead to decreases in fitness if the whales do not have access to food or resting areas.

4.3.1.4 Reproduction and Growth

Humpback whales in the Northern Hemisphere give birth and presumably mate on low-latitude wintering grounds in January to March. Average sexual maturity of humpback whales in the Northern Hemisphere is between 5-11 years old, and varies between and within populations (Clapham 1992, Robbins 2007, Bettridge et al. 2015). Calving rates are between one and five years in humpback whales in the Northern Hemisphere, although two or three years is most common (Steiger and Calambokidis 2000, Bettridge et al. 2015). Gestation is about 12 months, and calves are likely weaned by the end of their first year (Perry, DeMaster and Silber 1999).

4.3.1.5 Feeding and Prey Selection

Humpback whales tend to feed on summer grounds and not on winter grounds. However, some opportunistic winter feeding has been observed at low latitudes (Perry, DeMaster and Silber 1999). Humpback whales engulf large volumes of water and then filter small crustaceans and fish through their fringed baleen plates.

Humpback whales are relatively generalized in their feeding compared to some other baleen whales. In the Northern Hemisphere, known humpback whale prey includes: euphausiids (krill); copepods; juvenile salmonids; Arctic cod; sardines; capelin; anchovy; herring; walleye pollock; pteropods; and cephalopods (Perry, DeMaster and Silber 1999, Bettridge et al. 2015, Moran et al.

2018). Feeding by humpback whales is observed most of the year in Lynn Canal, including in the action area.

4.3.1.6 Diving and Social Behavior

In Hawaiian waters, humpback whales remain almost exclusively within the 1800 m isobath and usually within water depths less than 182 meters. Maximum diving depths are approximately 170 m (558 ft) (but usually <60 m [197 ft]), with a very deep dive (240 m [787 ft]) recorded off Bermuda (Hamilton, Stone and Martin 1997). Diving behavior varies by season, and average dive times are less than five minutes during the summer, and between 10-15 minutes (and sometimes more than 30 minutes) in winter months (Clapham and Mead 1999). Because most humpback whale prey is likely found above 300 m, most humpback dives are probably relatively shallow.

Humpback whales appear to form small, unstable social groups during the breeding season (Clapham 1996). During the feeding season they form small groups that occasionally aggregate on concentrations of food. Feeding groups are sometimes stable for long periods of time. There is good evidence of some territoriality in feeding (Clapham 1994, Clapham 1996) and calving areas (Tyack 1981).

4.3.1.7 Vocalization and Hearing

As is the case for all large baleen whales, direct information about the hearing abilities of humpback whales is not available. NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, which likely hear frequencies between 7 Hz to 35 kHz (Southall et al. 2007, NMFS 2016). Researchers studying *Mysticete* auditory apparatus morphology hypothesized that large *Mysticetes* have acute infrasonic hearing (Ketten 1997). Baleen whales have inner ears that appear to be specialized for low-frequency hearing.

Humpback whales produce a variety of vocalizations ranging from 20 Hz to 24 kHz (Thompson, Cummings and Ha 1986, Au et al. 2006). On wintering grounds, males sing complex songs that can last up to 20 minutes and may be heard up to 20 miles away (Clapham and Mattila 1990, Cato 1991). Source levels average 155 dB and range from 144 to 174 dB (Thompson, Winn and Perkins. 1979).

Humpback whales produce sounds less frequently in their summer feeding areas. Feeding groups produce distinctive sounds ranging from 20 Hz to 2 kHz, with median durations of 0.2-0.8 seconds and source levels of 175-192 dB (Thompson, Cummings and Ha 1986). These sounds are attractive and appear to rally animals to the feeding activity (D'Vincent, Nilson and Hanna 1985, Sharpe and Dill 1997).

4.3.2 Western DPS Steller Sea Lions

Steller sea lions are the largest of the eared seals (*Otariidae*) and range throughout the North Pacific Ocean from Japan, east to Alaska, and south to central California (Loughlin, Rugh and Fiscus 1984).

Additional information on Steller sea lion biology and natural history is available at:

https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock#pinnipeds---otariids%C2%A0(eared-seals-or-fur-seals-and-sea-lions)

https://www.fisheries.noaa.gov/resource/document/western-distinct-population-segment-steller-sea-lion-5-year-review-summary-and

https://www.fisheries.noaa.gov/resource/document/recovery-plan-steller-sea-lion

https://www.fisheries.noaa.gov/species/steller-sea-lion

4.3.2.1 Population Structure and Status

Historically, Steller sea lion abundance was significantly greater with an estimated worldwide population of 245,000 to 290,000 animals in the late 1970s (Loughlin, Rugh and Fiscus 1984). The Western DPS decreased from an estimated 220,000 to 265,000 animals in the late 1970s to less than 50,000 in 2000 (Muto et al. 2022). Based on counts in 2019, Western DPS Steller sea lions in Alaska are estimated to number 52,932 (Muto et al. 2022). This is considered a minimum estimate because it has not been corrected to account for animals that were at sea during the surveys.

By 1990, the U.S. portion of the population had declined by about 80 percent relative to the 1950s. On April 5, 1990, NMFS issued an emergency interim rule to list the Steller sea lion as threatened (55 FR 12645). On November 26, 1990, NMFS issued the final rule to list Steller sea lions as a threatened species under the ESA (55 FR 49204).

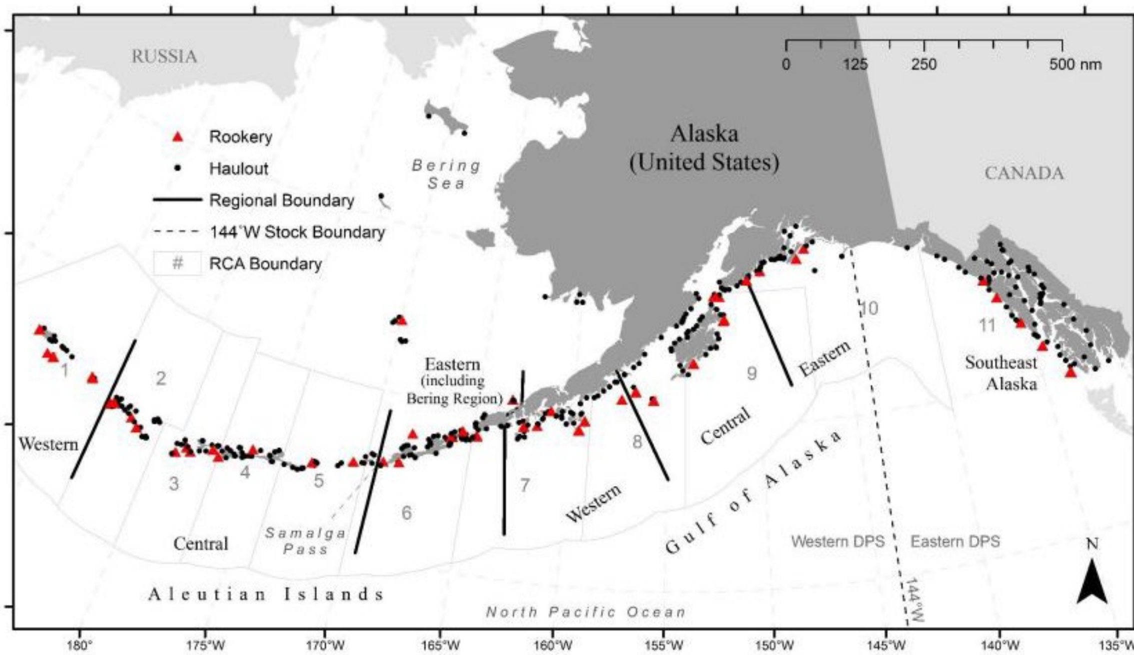

Figure 8. *Map of Alaska showing the NMFS Steller sea lion survey regions, rookery, and haulout locations. The line (144° W) separating primary breeding rookeries of the eastern and western distinct population segments is also shown (Fritz et al. 2016).*

NMFS reclassified Steller sea lions as two distinct population segments under the ESA in 1997 based on demographic and genetic differences—the Western and Eastern DPSs (62 FR 24345). At that time, the Western DPS, which generally occurs from Japan around the Pacific Rim to Cape Suckling in Alaska (144° W) (Figure 8), was listed as endangered due to its continued decline and lack of recovery.

The Eastern DPS, extending from Cape Suckling (144° W) east to British Columbia and south to California, remained in threatened status. A number of protective measures were implemented to aid recovery (NMFS 2013), and between the 1970s and 2002 the Eastern DPS Steller sea lion population increased on average by 3.1% per year (Pitcher et al. 2007), which is one factor that led to NMFS's decision to delist the Eastern DPS (78 FR 66140; November 4, 2013).

In Alaska, population decline spread and intensified east and west of the eastern Aleutians in the 1980s. Between 1991 and 2000, overall counts of Steller sea lions at trend sites decreased 40%, an average annual decline of 5.4% (Loughlin and York 2000). In the 1990s, counts decreased more at the western (western Aleutians: -65%) and eastern edges (eastern and central GOA: -56% and -42%, respectively) of the U.S. range than they did in the center (range of -24% to -6% from the central Aleutians through the western GOA (Fritz et al. 2008)). The decline continued in the Western DPS until about 2002.

There is evidence that the Western DPS Steller sea lion abundance increased across much of their range between 2002 and 2022. Between 2007 to 2022, Western DPS non-pup and pup counts increased 1.05% and 0.50% per year, respectively (Sweeney 2023). However, there was high variability among regions. Steller sea lions in the western Aleutian Islands region continued to decline, along with pups in the adjacent central Aleutian Islands region. East of Samalga Pass, Aleutian Islands, pup production slowed or plateaued in the early 2010s, with subsequent non-pup numbers plateauing or declining starting in the late 2010s in all region (Sweeney 2023). The 2014-2016 North Pacific marine heatwave (PMH), one of the most severe heatwaves ever recorded, resulted in reduced survival of adult female Steller sea lions in the Gulf of Alaska and reduced survival of adult female and adult male Steller sea lions in Southeast Alaska (Sweeney 2023). While it appears that adult female Steller sea lions in Southeast Alaska maybe have recovered from the effects of the most recent PMH, Steller sea lions in Southeast Alaska may be most vulnerable to changing oceanographic conditions in the future (Hastings et al. 2023).

4.3.2.2 Distribution

Movement of Steller sea lions between the Western DPS and Eastern DPS may affect population dynamics and patterns of underlying genetic variation. Studies have confirmed movement of animals across the 144° W boundary (Fritz et al. 2013, Jemison et al. 2013, Hastings et al. 2020). Western DPS Steller sea lions regularly temporarily cross to the east of the 144° W longitude boundary, and some Western DPS females have given birth at White Sisters and Graves Rocks rookeries, and have likely emigrated permanently (Jemison et al. 2013). The vast majority of these sightings have been in northern Southeast Alaska, north of Frederick Sound.

Within the action area, Steller sea lions are expected to be predominantly from the Eastern DPS; however, Western DPS animals occur there as well. The two closest haulouts at Benjamin Island and Little Island are over 15 miles to the northwest of the proposed project location. These two haulouts are likely the predominant haulouts used by the Steller sea lions that are found transiting into and out of the action area. From 2000-2018, 280 unique branded individuals were documented at the Benjamin Island haulout. Of these, three individuals were from the Western DPS and the remaining 277 were from the Eastern DPS. During the same time period, 105 unique branded individuals were documented at the Little Island haulout. Of these, three individuals were from the Western DPS and the remaining 102 were from the Eastern DPS (pers. comm., L. Jemison, ADF&G). Based on these data, modelling efforts estimate that 1.4% of Steller sea lions observed in the action area will be from the endangered Western DPS animals (Hastings et al. 2020, NMFS 2020).

4.3.2.3 Threats to the Species

Brief descriptions of threats to Steller sea lions follow. More detailed information can be found in the Steller Sea Lion Recovery Plan (available at: https://www.fisheries.noaa.gov/action/notice-final-2008-revised-recovery-plan-steller-sea-lions), and the Stock Assessment Reports (available at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments).

Environmental Variability and Drivers in the Bering Sea and Gulf of Alaska/North Pacific

The Steller Sea Lion Recovery Plan ranks environmental variability as a potentially high threat to recovery of the Western DPS (NMFS 2008). The Bering Sea and Gulf of Alaska (GOA) are subjected to large-scale forcing mechanisms that can lead to basin-wide shifts in the marine ecosystem resulting in significant changes to physical and biological characteristics, including sea surface temperature, salinity, and sea ice extent and amount. Physical forcing affects food availability and can change the structure of trophic relationships by impacting climate conditions that influence reproduction, survival, distribution, and predator-prey relationships at all trophic levels (Wiese, Wiseman Jr and Van Pelt 2012). Populations of Steller sea lions in the GOA and Bering Sea have experienced large fluctuations due to environmental and anthropogenic forcing (Mueter et al. 2009). As we work to understand how these mechanisms affect various trophic levels in the marine ecosystem, we must consider the additional effects of global warming, which are expected to be most significant at northern latitudes (IPCC 2013, Hastings et al. 2023).

Fishing Gear and Marine Debris Entanglement

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked interactions with fishing gear and marine debris as a low threat to the recovery of the Western DPS. Between 2013-2017, 455 Steller sea lions were reported to be killed or seriously injured by entanglement with commercial fisheries gear or marine debris (Delean et al. 2020). Seventy-nine of these reported sea lion serious injuries and mortalities were Western DPS Steller sea lions entangled in the federal groundfish trawl fishery in Alaska, eight entangled in other types of fishery gear, fourteen entangled in marine debris, and four hooked in fishing gear (Delean et al. 2020). In Southeast Alaska and British Columbia, 386 Steller sea lions were observed by researchers over the period 2000-2007 to be entangled in marine debris or having ingested fishing gear (Raum-Suryan, Jemison and Pitcher 2009).

The estimated mean annual mortality and serious injury rate in US commercial fisheries in 2014-2018 is 37 Steller sea lions from the Western DPS (plus 0.8 annually in unknown fisheries). No observers have been assigned to several fisheries that are known to interact with Western DPS Steller sea lions; thus, the estimated mortality and serious injury is likely an underestimate of the actual level (Muto et al. 2022).

Nutritional Stress: Competition with Fisheries

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked competition with fisheries for prey as a potentially high threat to the recovery of the Western DPS. Substantial scientific debate surrounds the question about the impact of potential competition between fisheries and Steller sea lions. Commercial fisheries target several important Steller sea lion prey species including salmon species, Pacific cod, Atka mackerel, pollock, and others. These fisheries could be reducing sea lion prey biomass and quality at regional and/or local spatial and temporal scales such that sea lion survival and reproduction are reduced. Limitations on fishing grounds, duration of fishing season, and monitoring have been established in an effort to prevent Steller sea lion nutritional deficiencies as a result of inadequate prey availability

Subsistence Harvest

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked subsistence harvest as a low threat to the recovery of the Western DPS. The most recent subsistence harvest data were collected by the Alaska Department of Fish and Game through 2008, by the Aleut Community of St. Paul Ecosystem Conservation Office (2014-2018), and by the Aleut Community of St. George Island (2014-2018). The mean annual subsistence take from the Western DPS in Alaska over the 5-year period from 2004 through 2008, combined with the mean harvest over the 2014-2018 period from Saint Paul and St. George, was 209 Steller sea lions/year (Muto et al. 2022).

Illegal Shooting

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked illegal shooting as a low threat to the recovery of the Western DPS. Illegal shooting of sea lions is thought to have been a potentially significant source of mortality prior to the listing of sea lions as threatened under the ESA in 1990. The NMFS Alaska Stranding Program documents Steller sea lions with suspected or confirmed firearm injuries in Southeast Alaska every year.

A significant illegal shooting event occurred in Alaska in 2015. On November 6, 2018, two men were sentenced in federal court for harassing and killing Steller sea lions with shotguns. The sentencing was the result of a federal investigation after over 15 Steller sea lions were found dead along the sand bars at the mouth of Copper River during the 2015 Copper River salmon gillnet season[8].

Mortality and Serious Injury from Research Activities

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked effects from research activities as a low threat to the recovery of the Western DPS. Mortalities may occur incidental to marine mammal research activities authorized under ESA and MMPA permits issued to a variety of government, academic, and other research organizations. Between 2014 and 2018, there were three mortalities (one in 2015 and two in 2016) incidental to research on the Western DPS of Steller sea lions, resulting in a mean annual mortality and serious injury rate of 0.6 from this potential stressor (Muto et al. 2022).

Vessel Disturbance

Vessel traffic, in the form of sea lion research, tourism, and other marine vessel traffic, may

[8] https://www.justice.gov/usao-ak/pr/two-alaska-men-sentenced-harassing-killing-steller-sea-lions-and-obstructing

disrupt sea lion feeding, breeding, or aspects of sea lion behavior. The Steller Sea Lion Recovery Plan (NMFS 2008) ranked disturbance from these sources as a low threat to the recovery of the Western DPS.

Risk of Vessel Strike

NMFS Alaska Region Stranding Program has records of at least four confirmed occurrences of Steller sea lions being struck by vessels in Southeast Alaska; three were near Sitka, one was south of Juneau. Vessel strike is not considered a major threat to the Western DPS Steller sea lion.

Hazardous Materials Spills

The Steller Sea Lion Recovery Plan ranked the threat of toxic substances as medium (NMFS 2008). While there are numerous small hazardous materials spills in Alaska and near Juneau every year, the proponents of the proposed action have developed mitigation measures to lessen the risk of oil spills impacting Steller sea lions as a result of this project.

Metals and Contaminants

Metal and contaminant exposure remains a focus of ongoing investigation. Total mercury concentrations measured in hair samples collected from pups in the western-central Aleutian Islands were detected at levels that cause neurological and reproductive effects in other species (Rea et al. 2013).

Other Stressors

Sharks and killer whales are known natural predators of Steller sea lions. Toxicosis from domoic acid or saxitoxin related to harmful algal blooms is another potential stressor. Domoic acid and saxitoxin have been detected in stranded Steller sea lions in Alaska (2004-2013) (Lefebvre et al. 2016). Of 42 sampled stranded Steller sea lions, 27% tested positive for domoic acid and 10% tested positive for saxitoxin. Although domoic acid and saxitoxin toxicosis have not been documented in marine mammals in Alaska, domoic acid has caused 100s of California sea lions to strand and die annually due to neurologic issues (Lefebvre et al. 2016)

4.3.2.4 Reproduction and Growth

Steller sea lions are colonial breeders. They have a polygynous mating system, in which only a small proportion of the sexually mature males father most of the pups in a given season. Adult males, known as bulls, arrive early on rookeries to establish breeding territories that they defend through the breeding season. Bulls become sexually mature between three and eight years of age, but typically are not large enough to hold territory successfully until nine or 10 years old. A mature male may go without eating for one to two months while he defends his territory. Not all males will successfully hold a breeding territory for one or more breeding seasons.

Females, known as cows, begin to arrive on rookeries in mid-May. Females typically birth their first pup at four to six years of age, usually giving birth to a single pup each year. However, they may not pup every year. Pupping occurs from about mid-May to mid-July and peaks in June. Females usually mate within two weeks after giving birth. Females stay with their pups for a few days after birth before beginning a regular routine of foraging at sea, nursing pups on land, then going back to forage. Female Steller sea lions use smell and distinct vocalizations to recognize and create strong social bonds with their newborn pups. While most pups likely wean before their first birthdays, some pups are nursed for as long as three years.

At birth, pups are about three feet in length and weigh 35 to 50 pounds. Pups have a thick, dark brown to black "lanugo" coat until four to six months old, when they molt to a lighter brown. By the end of their second year, pups are the same color as adults. Males can live to be up to 20 years old, while females can live to be approximately 30 years old.

4.3.2.5 Feeding and Prey Selection

Steller sea lions consume a variety of demersal, semi-demersal, and pelagic prey, indicating a potentially broad spectrum of foraging styles, probably based primarily on availability. Overall, the available data suggest two types of distribution at sea by Steller sea lions: 1) less than 20 km (12 mi) from rookeries and haulout sites for pups, juveniles, and adult females with pups, and 2) much larger areas (greater than 20 km [12 mi]) where these and other Steller sea lions may range to find optimal foraging conditions once they are no longer tied to rookeries and haulout sites for nursing and reproduction. Large seasonal differences in foraging ranges have been observed associated with seasonal movements of prey (Merrick, Chumbley and Byrd 1997).

The seasonal ecology of Steller sea lions in Southeast Alaska has been studied by relating the distribution of sea lions to prey availability (Womble et al. 2005, Womble, Sigler and Willson 2009). Figure 9 depicts a likely seasonal foraging strategy for Steller sea lions in Southeast Alaska. This diagram suggests that seasonally aggregated high-energy prey species, such as eulachon and herring in late spring, and salmon in summer and fall, influence the seasonal distribution of Steller sea lions in some areas of Southeast Alaska. Similarly, the Southeast Alaska Pacific Herring Status Review (NMFS 2014) generalizes that sea lions forage on herring aggregations in winter, on spawning herring and eulachon in spring, and on various other species throughout the year.

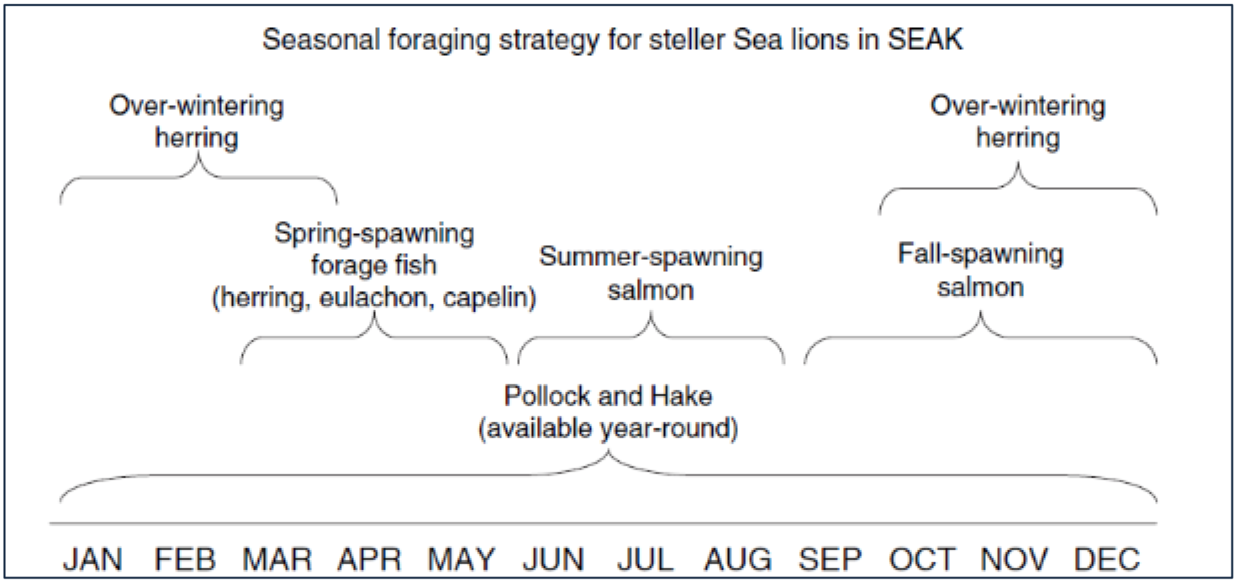

Figure 9. *Diagram of the likely seasonal foraging ecology of Steller sea lions in Southeast Alaska (Womble, Sigler and Willson 2009).*

The action area and surrounding waters contain abundant sources of prey species, which draw Steller sea lions in to forage year round.

4.3.2.6 Diving and Social Behavior

Steller sea lions are very vocal marine mammals. Roaring males often bob their heads up and down when vocalizing. Adult males aggressively defend territories. Steller sea lions gather on haulouts year-round and rookeries during the breeding season and regularly travel as far as 250 miles to forage for seasonal prey. However, females with pups likely forage much closer to their rookery. Diving is generally to depths of 600 feet or less and diving duration is usually two minutes or less.

Steller sea lions are gregarious animals that often travel in large groups of up to 45 individuals (Keple 2002), and rafts of several hundred Steller sea lions are often seen adjacent to haulouts. Individual rookeries and haulouts may be comprised of hundreds of animals. At sea, groups usually consist of females and subadult males as adult males are often solitary.

4.3.2.7 Vocalization and Hearing

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid functional hearing group which has an estimated auditory bandwidth of 60 Hz to 39 kHz in-water, and 75 Hz to 30 kHz on land (Southall et al. 2007, NMFS 2016). Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 to 25 kHz (Kastelein et al. 2005), and in the air between 0.25 to 30 kHz (Mulsow and

Reichmuth 2010). Sound associated with the in-water activities associated with the proposed action is within the hearing range of Steller sea lions.

4.3.3 Sunflower Sea Stars

Sunflower sea stars are one of the largest sea stars in the world, reaching more than 1 meter in diameter and 8 kg in weight (Jewett et al. 2015). They are also one of the fastest species of sea stars, moving up to 1.6 m per minute and are also characterized by having many arms (15-24) (Jewett et al. 2015). The species was proposed to be listed as threatened throughout its range on March 16, 2023 (88 FR 16212) following significant rangewide declines in abundance due to a pandemic likely caused by an unknown pathogen (Lowry 2022). NMFS did not propose to designate critical habitat at this time.

Additional information on sunflower sea star biology and natural history is available at:

https://www.fisheries.noaa.gov/species/sunflower-sea-star

https://www.fisheries.noaa.gov/resource/document/endangered-species-act-status-review-report-sunflower-sea-star

4.3.3.1 Population Structure and Status

Prior to 2013, the global abundance of sunflower sea star was estimated at several billion animals, but from 2013–2017 sea star wasting syndrome (SSWS) reached pandemic levels, killing an estimated 90 percent or more of the population (Lowry 2022). Sunflower sea stars are currently estimated to number approximately 600 million (Lowry 2022). Declines in the northern portion of its range (i.e., Alaska and British Columbia) were less pronounced than in the southern portion, but still exceeded 60 percent. Species-level impacts from SSWS, both during the pandemic and on an ongoing basis, have been identified as the major threat affecting the long-term persistence of the sunflower sea star (Lowry 2022).

Recent counts in some areas of Alaska, including western Prince William Sound, showed a big increase in 2022 (Figure 10) (Coletti et al. 2023). The density of sunflower sea stars in western Prince William Sound in 2022 are similar to what was observed prior to the recent SSWS pandemic (S. Traiger, pers. comm.). In 2022, ADFG conducted sunflower sea star surveys within the proposed action area and extending north of Lincoln Island, and determined density to be 0.0213 individuals/m^2 (ADFG 2023).

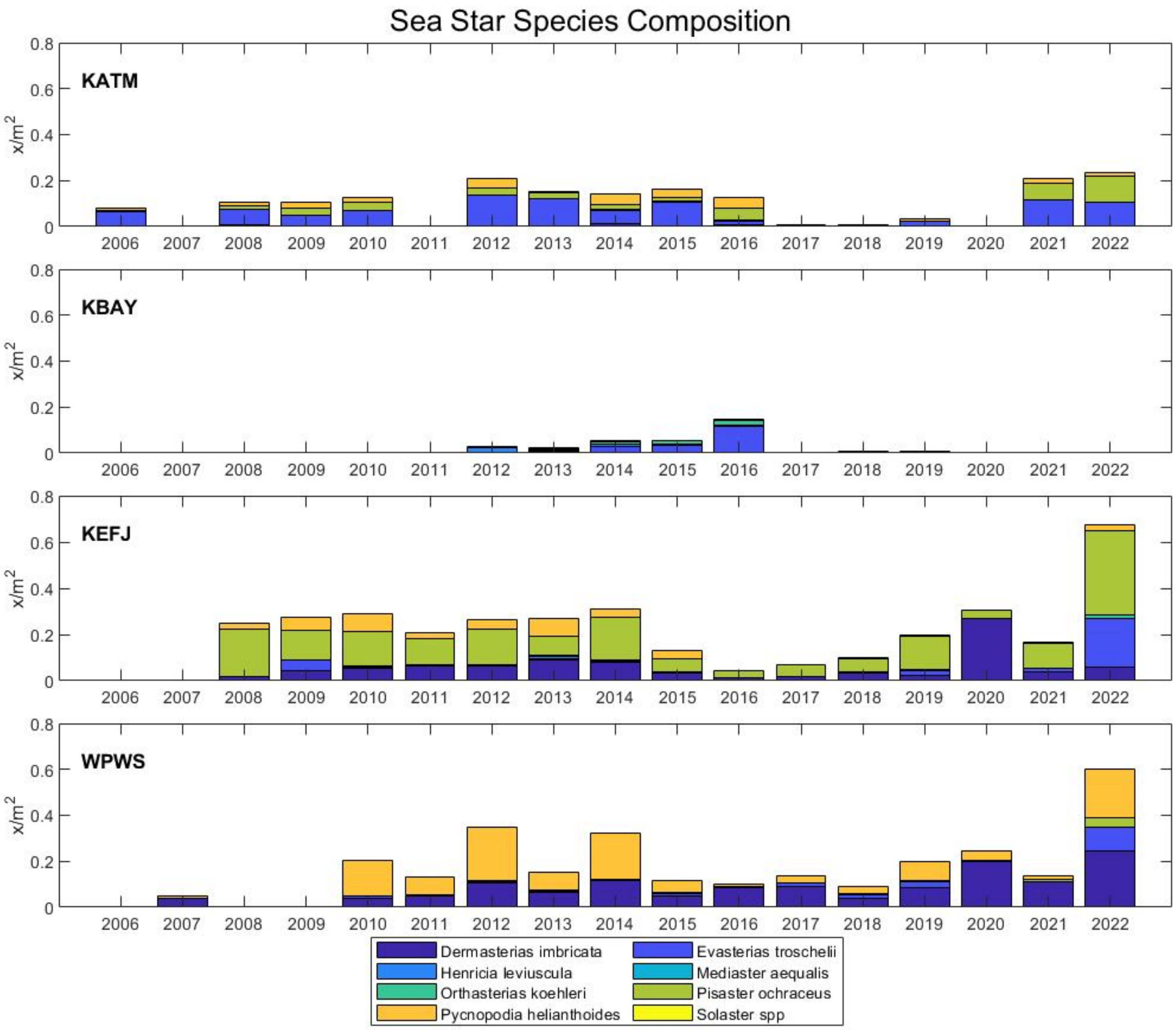

Figure 10. *Sea star densities in Katmai (KATM), Kachemak Bay (KBAY), Kenai Fjords (KEFJ), and western Prince William Sound (WPWS) from 2006-2022. Sunflower sea stars (P. helianthoides) shown in orange. Figure used with permission from the Gulf Watch Alaska 2022 Annual Report (Coletti et al. 2023).*

4.3.3.2 Distribution and Habitat Use

Sunflower sea stars occur in a wide range of intertidal and subtidal habitats from northern Baja California, Mexico, to the central Aleutian Islands, Alaska (Jewett et al. 2015, Gravem et al. 2021, Lowry 2022). It occupies waters from the intertidal to at least 435 m deep, but is most common at depths less than 25 m and rare in waters deeper than 120 m (Lambert 2000, Hemery et al. 2016, Gravem et al. 2021). Sunflower sea stars occur over a broad array of soft-, mixed-, and hard-bottom habitats, and are most abundant in Alaska and British Columbia (Gravem et al. 2021).

They are found along the outer coasts and inside waters, which have complex geophysical features including glacial fjords, sounds, embayments, and tidewater glaciers. Preferring temperate waters, they inhabit kelp forests and rocky intertidal shoals (Shivji et al. 1983, Lowry 2022), and are regularly found in eelgrass meadows as well (Dean and Jewett 2001, Gravem et al. 2021).

4.3.3.3 Threats to the Species

Brief descriptions of threats to sunflower sea stars follow. More detailed information can be found in the draft ESA Status Review report for the species (available at: https://www.noaa.gov/information-technology/endangered-species-act-status-review-report-sunflower-sea-star-pycnopodia-helianthoides-id454).

Sea Star Wasting Syndrome (SSWS)

Sea star wasting syndrome is the primary threat identified to the sunflower sea star in the proposed threatened listing rule (88 FR 16212). Beginning in 2013, SSWS caused ~60-100% declines in locally monitored populations of *P. helianthoides* across its range. The global *P. helianthoides* population declined by an estimated 90.6% due to SSWS (Gravem et al. 2021, Lowry 2022). Recent laboratory studies suggest that *P. helianthoides* die as quickly as 2-4 days after exposure to SSWS (A. Gehman, pers. comm.).

The causative agent of SSWS is currently unknown and various hypotheses regarding transmission dynamics and the lethality of SSWS under diverse physiochemical conditions exist. A number of factors ranging from environmental stressors to the microbiome in sea stars may play a role (Lloyd and Pespeni 2018, Konar et al. 2019, Aquino et al. 2021). Ocean warming has also been linked to SSWS outbreaks, hastening disease progression and severity (Harvell et al. 2019, Aalto et al. 2020).

Bycatch/Overexploitation

Sunflower sea stars are not the object of targeted commercial fisheries historically or currently. Bycatch mortality from trawl and bottom-contact trap/pot fisheries pose a low-level risk now and potentially a higher level of future risk, especially in areas where populations are declining or already at very low levels (Lowry 2022). Recreational harvest of *P. helianthoides* is permitted in British Columbia, Alaska, and California, and is unrestricted in Mexico, but estimates of recreational harvest are not available (Lowry 2022, ADFG 2023). Evidence does not exist for regular human consumption of the species, so all collection is assumed to be for private exhibition, use, or curiosity.

Pollution/Discharge

Impacts that pollutants and contaminants might have on the ecosystems upon which *P. helianthoides* depend, in particular the food that they eat (Lowry 2022), are a concern. Pollutants could potentially weaken the microbiome or immune response of the sunflower sea star, leading to mortality (Aquino et al. 2021, McCracken et al. 2023).

Coastal Development

Impacts to the benthic environment from coastal development activities such as dredging, pile driving, use of heavy equipment, and runoff of pollutants into the marine environment are a potential threat to sunflower sea stars. Sedimentation, erosion, and sea level rise have the potential to produce more widespread impacts, especially in coastal environments near urban development (Lowry 2022). Log booms could create localized habitat destruction as water-soaked bark rains down onto the seafloor in coastal waters, creating anoxic areas (Gravem et al. 2021, Lowry 2022).

4.3.3.4 Reproduction and Growth

Sunflower sea stars are an asteroid species and are broadcast spawners with planktotrophic larval development (Lowry 2022). Most asteroid species have separate sexes (i.e., dioecious), and sexes are externally indistinguishable from one another (Chia and Walker 1991). Broadcast spawning sea stars with planktotrophic development typically release millions of eggs (Strathmann 1987, Chia and Walker 1991, Byrne 2013). A number of environmental factors, such as food availability, seawater temperature, photoperiod, salinity, and the lunar cycle, may control seasonality of asteroid reproductive cycles (Pearse et al. 1986, Chia and Walker 1991).

Typically, sea stars with planktotrophic larval development from the temperate nearshore Northwest Pacific Ocean spawn in late winter or early spring, which serves to provide the best growing conditions for their offspring by synchronizing the presence of their obligate plankton-feeding larvae with the peak of the spring phytoplankton bloom (Menge 1975, Strathmann 1987). Recent research indicates that the reproductive season for female sunflower sea stars begins in November-January and ends in April-May in Washington. Mature sunflower sea star reproductive cells were isolated by a researcher in Southeast Alaska in July 2019 indicating that the reproductive season for females is later in the northern part of the range (Hodin et al. 2021).

Age at first reproduction for sunflower sea stars is estimated to be 4-5 years (Chia and Walker 1991, Gravem et al. 2021). Indications from other asteroids suggest that reproductively viable females can produce at least tens of millions of eggs annually, possibly for several decades. Under appropriate environmental conditions, this represents considerable reproductive and recruitment potential. Sea stars may modify their behavior during spawning in ways that improve the chances of egg fertilization, including aggregating, modifying their positions and postures, and spawning synchronously (Strathmann 1987, Chia and Walker 1991, Dams, Blenkinsopp and Jones 2018), however, it is uncertain if sunflower sea stars aggregate for spawning (Lowry 2022).

There is a relatively short period during which asteroid gametes are viable, and fertilization rates are affected both by viability and contact (the latter is affected by both small- and large-scale water flow patterns). Gametes may be spread quickly by swift currents, expanding the range over which fertilization may occur, or entrained by eddies, resulting in minimal dispersion (Lowry 2022). After fertilization, embryos quickly develop into swimming larvae (Lowry 2022) and have the potential for broad larval dispersal (Gravem et al. 2021). Metamorphosis from the larval to the post-larval form results in the transformation of the bilaterally symmetrical larva into a pentaradially symmetrical juvenile (Chia and Walker 1991, Byrne 2013). Asteroid larvae may respond to a suite of biological, chemical, and/or physical cues that induce metamorphosis from larva to juvenile, and settlement, including the presence of coralline algae, microbial films, and kelp (Metaxas 2013).

No studies have been conducted to establish natural growth rates throughout the lifetime of *P. helianthoides*, due in part to the difficulty of tagging and effectively tracking individuals. Several observations of juvenile growth rates from anecdotal observations and laboratory studies report growth as being between 3 and 8 cm/y, and 2 cm/y for mid-sized individuals (Gravem et al. 2021). In captive rearing of sunflower sea stars, the fastest growing individuals reached 3 cm in diameter in about 9.5 months; juveniles grew slowly for several months after settlement and metamorphosis, but grew faster after they reached about 10 cm in diameter (Hodin et al. 2021). The longevity of *P. helianthoides* in the wild is unknown, as is the age at first reproduction and the period over which a mature individual is capable of reproducing.

4.3.3.5 Diet and Foraging Behavior

Larval and pre-metamorphic *P. helianthoides* are planktonic feeders and no data exist to suggest a prey preference at this stage. The diet of adult *P. helianthoides* generally consists of benthic and mobile epibenthic invertebrates, including sea urchins, barnacles, bivalves, snails, crab, sea cucumbers, and other sea stars (Mauzey, Birkeland and Dayton 1968, Shivji et al. 1983). Sunflower sea stars also scavenge fish, seabirds, and octopus (Shivji et al. 1983), locate their prey by chemosensing, and may show preference for dead or damaged prey (Brewer and Konar 2005).

5 ENVIRONMENTAL BASELINE

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

5.1 Recent Biological Opinions in the Action Area

Two recent biological opinions have been completed for projects in the Auke Bay area. First, major construction with associated blasting and pile driving occurred for the Statter Harbor project (AKRO #2019-03544). The Statter Harbor project began in January 2021 and was completed in late-February 2021. The second recent biological opinion was a modification to the AMHS Ferry Terminal (AKRO #2019-02254). That proposed action also included pile driving and onshore construction, and occurred from January to June 2021.

In addition to the two recent biological opinions, there have also been three recent Letter of Concurrences in or near Auke Bay. First, there was a piling replacement project in Fritz Cove (AKRO #2021-00410). This project removed eight timber pilings and replaced them with eight 16-inch steel pilings during the summer of 2022. The second project was a dock replacement project at the Lindegaard dock in Auke Bay (AKRO #2019-03338). The Lindegaard dock involved the replacement of a single 12-inch diameter piling and was completed in late-2019.

The third Letter of Concurrence recently issued by NMFS near the action area for the proposed action is a cable-laying project for the Sealink project (AKRO #2021-02374). This project includes submarine fiber optic cable laying in Stephen's Passage within the action area to the west of Auke Bay and Fritz Cove. The project includes use of a purpose-built vessel to lay the 2-inch diameter cable along the sea floor and was completed in 2022.

5.2 Marine Vessel Activity

Vessel-based recreational activities, commercial and charter fishing, shipping, whale-watching, and general transportation, including the AMHS ferry, occur within the action area regularly. All of these activities increase ambient in-air and underwater sound and pose risk of vessel collisions with marine mammals. Vessel sound can change the behavior of marine mammals and mask their ability to communicate (Erbe et al. 2019). All of the sources of vessel traffic listed above increase underwater sound and contribute to the risk of vessel-whale collisions.

NMFS provides a voluntary framework for vessel operators to follow a code of conduct to reduce marine mammal interactions including:

- remain at least 100 yards from marine mammals;
- time spent observing individual(s) should be limited to 30 minutes; and
- vessels should leave the vicinity if they observe Steller sea lion behaviors such as these:
    - Increased movements away from the disturbance, hurried entry into the water by many animals, or herd movement towards the water; or
    - Increased vocalization, aggressive behavior by many animals towards the disturbance, or several individuals raising their heads simultaneously.

These guidelines can be viewed at: https://www.fisheries.noaa.gov/topic/marine-life-viewing-guidelines.

There are documented occurrences of Steller sea lions being struck by vessels in Southeast Alaska (see Section 4.2.2.3), and fast moving vessels in the action area have the potential to seriously injure or kill Steller sea lions by striking them. However, reported vessel strikes are uncommon, and the proposed action does not include fast moving vessel activity.

Vessel strikes are a leading cause of mortality in large whales. Neilson et al. (2012) reported the following summary statements about humpback whale and vessel collisions in Southeast Alaska.

- Most vessels that strike whales are less than 49 feet long
- Most collisions occur at speeds over 13 knots
- Most collisions occur between May and September
- Calves and juveniles appear to be at higher risk of collisions than adult whales

Further, the authors used previous locations of whale strikes to produce a kernel density estimation. The high risk areas shown in red in Figure 11 are also popular whale-watching destinations (Neilson et al. 2012). A number of the risk factors listed above occur in the action area, and the action area is within one of the high risk areas in northern Southeast Alaska (Figure 11).

AMHS ferries have incidentally struck whales in the past while transiting Alaska waters. In the past 10 years, three confirmed strikes by AMHS ferries have occurred; a lethal strike to a fin whale near Kodiak in 2018, and two separate humpback whale strikes in Southeast Alaska (Stephen’s Passage, 2015, and Frederick Sound, 2018; AKR Stranding Program Vessel Strike

Database, accessed October 10, 2023). We expect that vessel strikes from AMHS ferries will continue at similar levels in future years, or potentially lower levels if AMHS standard operating procedures are followed to reduce the risk of ship strike.[9]

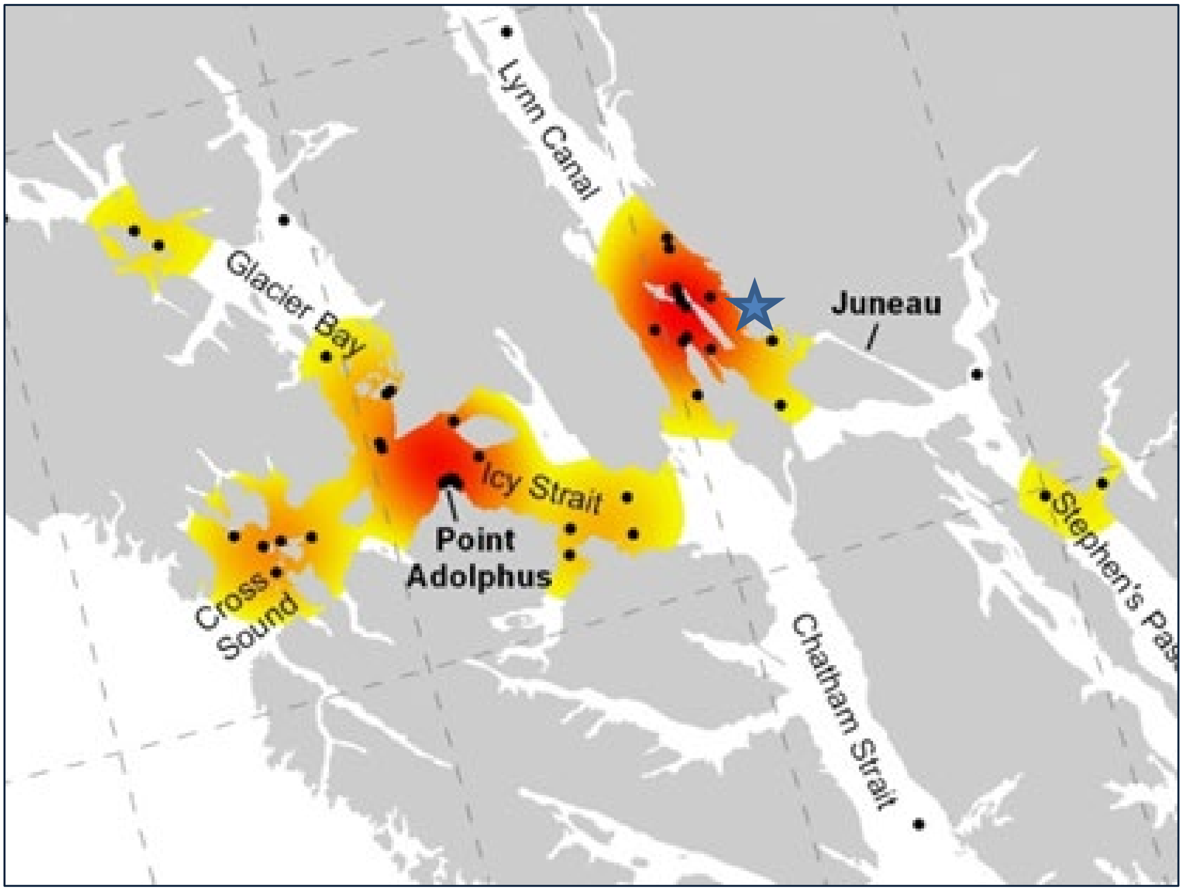

Figure 11. *High risk areas for vessel strike of humpback whales in northern Southeast Alaska (Neilson et al. 2012). Approximate location of the proposed pile driving indicated by the blue star.*

NMFS implemented regulations to minimize harmful interactions between ships and humpback whales in Alaska (see 50 CFR §§ 216.18, 223.214, and 224.103(b)). These regulations require that all vessels:

a. Not approach within 100 yards of a humpback whale, or cause a vessel or other object to approach within 100 yards of a humpback whale;
b. Not place vessel in the path of oncoming humpback whales causing them to surface within 100 yards of vessel;
c. Not disrupt the normal behavior or prior activity of a whale; and

[9] Alaska Marine Highway System Standard Operating Procedures for Whale Avoidance (provided to NMFS via email on September 21, 2023.

d. Operate vessel at a slow, safe speed when near a humpback whale. Safe speed is defined in regulation (see 33 CFR § 83.06).

Since 2011, cruise lines, pilots, NMFS, and National Park Service (NPS) biologists have worked together to produce weekly whale sightings maps to improve situational awareness for cruise ships and state ferries in Southeast Alaska. In 2016, NMFS and NPS launched Whale Alert, a voluntary program that receives and shares real-time whale sightings with controlled access to reduce the risk of ship strike and contribute to whale avoidance.

In addition to these voluntary marine mammal viewing guidelines, many of the marine mammal viewing tour boats voluntarily subscribe to even stricter approach guidelines by participating in the Whale SENSE program.

More information is available at https://whalesense.org/.

These regulations and guidelines all apply within the action area.

5.3 Entanglement Including Fisheries Interactions

Entanglement of pinnipeds and cetaceans in fishing gear and other human-made material is a major threat to their survival worldwide. Other materials also pose entanglement risks including marine debris, mooring lines, anchor lines, and underwater cables. While in many instances marine mammals may be able to disentangle themselves (Jensen et al. 2009), other entanglements result in lethal and sublethal trauma to marine mammals including drowning, injury, reduced foraging, reduced fitness, and increased energy expenditure (van der Hoop, Corkeron and Moore 2017).

Entanglement can include many different gear interaction scenarios, but the following have occurred with humpback whales:

- Gear loosely wrapped around the marine mammal's body that moves or shifts freely with the marine mammal's movement and does not indent the skin can result in disfigurement.
- Gear that encircles any body part and has sufficient tension to either indent the skin or to not shift with marine mammal's movement causes lacerations, partial or complete fin amputation, organ damage, or muscle damage, and interferes with mobility, feeding, and breathing. Chronic tissue damage from lines under pressure can compromise a whale's physiology. Fecal samples from entangled whales had extremely high levels of cortisol, and immune system stress hormone (Rolland et al. 2005). Extended periods of pituitary release of cortisol can exhaust the immune system, making a whale susceptible to disease

and infection.

The NMFS Alaska Marine Mammal Stranding Network database has records of 199 large whale entanglements between 1990 and 2016. Of these, 67% were humpback whales. Most humpbacks get entangled with gear between the beginning of June and the beginning of September, when they are on their nearshore foraging grounds in Alaska waters. Between 1990 and 2016, 29% of humpback entanglements in Alaska with known gear types were with pot gear and 37% with gillnet gear. Longline gear comprised only 1–2% of all recorded humpback fishing gear interactions with known gear. Most confirmed large whale entanglements in Alaska occur in Southeast Alaska. For example, in 2018 of 10 confirmed large whale entanglement reports (nine of which were humpbacks, one was not identified to species), seven occurred in Southeast Alaska. Humpbacks have been reported as entangled in the action area in or near the action area in recent years.

Although the Steller Sea Lion Recovery Plan (NMFS 2008) ranked interactions with fishing gear and marine debris as a low threat to the recovery of the Western DPS, the extent of this threat may not be fully known because some entangled sea lions may be unable to swim to shore once entangled, may die at sea, and may not be available for documentation (Loughlin and Nelson Jr. 1986, Raum-Suryan, Jemison and Pitcher 2009). The main cause of reported human-marine mammal interaction serious injury and mortality in Alaska between 2013-2017 was entanglement/entrapment, and Steller sea lions were the most common species of human-caused mortality and serious injury (Delean et al. 2020). There were 105 cases of serious injury and mortality to Western DPS Steller sea lions from interactions with fishing gear and marine debris, and 350 Eastern DPS Steller sea lion cases. While the bulk of the cases are attributed to the Eastern DPS because they occurred east of 144° W, both Eastern DPS and Western DPS animals are in Southeast Alaska and in the action area, so some cases may have been Western DPS animals. Raum-Suryan et al. (2009) observed a minimum of 386 animals either entangled in marine debris or having ingested fishing gear over the period 2000-2007 in Southeast Alaska and northern British Columbia.

The minimum estimated mortality rate of Western DPS Steller sea lions incidental to all US commercial fisheries (averaged from reports in 2014-2018) is 37 sea lions per year (Muto et al. 2022).

Sunflower sea stars are likely caught in small numbers as bycatch in pot gear in the action area. Most of these are likely returned to the marine environment without serious injury. Handling stress in sea stars, such as returning them to the marine environment, is not well understood, but is not likely to be measurably impacting the species in the action area.

5.4 Collection

Some sunflower sea stars may be collected for curiosity or used as fertilizer by the public in the action area, but these numbers are expected to be small. Sunflower sea stars handled briefly by the public may not result in significant stress if the animals are quickly returned to the marine environment.

5.5 Pollution

A number of intentional and accidental discharges of contaminants pollute the marine waters of Alaska annually. Intentional sources of pollution, including domestic, municipal, and industrial wastewater discharges, are managed and permitted by the Alaska Department of Environmental Conservation. Pollution may also occur from unintentional discharges and spills.

Marine water quality in the action area can be affected by discharges from treated sewer system outflows, vessels operating in marine waters, and sediment runoff from paved surfaces and disturbed areas. Large fuel spills are also possible from large vessel groundings, particularly high fuel capacity ships or barges transporting fuel. Direct exposure of marine mammals to oil or other contaminants spilled into the marine environment could have significant health consequences (Ziccardi et al. 2015, Schwacke et al. 2017, Wright et al. 2022). These events are likely uncommon, and no large scale federalized oil spill responses have occurred in the action area in at least the past decade.

Pollution into the marine environment from runoff, spills, or outfall pipes may compromise the microbiome of sunflower sea stars leading to death, or making them vulnerable to other stressors (Aquino et al. 2021, McCracken et al. 2023). Relative to SSWS, this is a minor threat that is limited in spatial and temporal scope. While runoff occurs within the action area, there is no direct evidence that it is impacting sunflower sea stars.

5.6 Climate Change

As described in detail in Section 4.2, climate change has the potential to impact species abundance, geographic distribution, migration patterns, timing of seasonal activities (IPCC 2014a), and species viability into the future. Climate change is also expected to result in the expansion of low oxygen zones in the marine environment (Gilly et al. 2013). Though predicting the precise consequences of climate change on highly mobile marine species, including those considered in this opinion, is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring. The northeast Pacific marine heat wave is negatively correlated with humpback whale reproduction in Hawaii (Cartwright et al. 2019).

The indirect effects of climate change include changes in the distribution and abundance of prey and the distribution and abundance of competitors or predators. For example, variations in the localized recruitment of herring in or near the action area caused by climate change could change the distribution and localized abundance of humpback whales. Warmer waters favor productivity of some species of forage fish, but the impact on recruitment of important prey fish of humpback whales is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years (NMFS 2008).

The Steller Sea Lion Recovery Plan ranks environmental variability as a potentially high threat to recovery of the Western DPS (NMFS 2008). The Bering Sea and Gulf of Alaska are subjected to large-scale forcing mechanisms that can lead to basin-wide shifts in the marine ecosystem resulting in significant changes to physical and biological characteristics, including sea surface temperature, salinity, and sea ice extent and amount. Physical forcing affects food availability and can change the structure of trophic relationships by impacting climate conditions that influence reproduction, survival, distribution, and predator-prey relationships at all trophic levels in or near the action area. Populations of Steller sea lions in the Gulf of Alaska and Bering Sea have experienced large fluctuations due to environmental and anthropogenic forcing (Mueter et al. 2009). As we work to understand how these mechanisms affect various trophic levels in the marine ecosystem, we must consider the additional effects of global warming, which are expected to be most significant at northern latitudes (Mueter et al. 2009, IPCC 2013).

The effects of climate change to the marine ecosystems of the Gulf of Alaska, including Lynn Canal and Auke Bay, and how they are affecting and may continue to 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). The 2014-2016 North Pacific marine heatwave (PMH) resulted in reduced survival of adult female Steller sea lions in the Gulf of Alaska and reduced survival of adult female and adult male Steller sea lions in Southeast Alaska (Sweeney 2023). It appears that adult female Steller sea lions in Southeast Alaska may have recovered from the effects of the most recent PMH (Hastings et al. 2023).

Climate change is expected to lead to warming ocean temperatures, more extreme fluctuations in ocean temperatures, and more storm events. These characteristics may exacerbate SSWS events in sunflower sea stars, or result in marine habitat or ecological shifts that negatively affect the species (Lowry 2022). Warming ocean temperatures, extreme fluctuations in ocean temperature, harmful algal blooms, ocean acidification, and low dissolved oxygen events, all byproducts of anthropogenic climate change, could impose direct and indirect stress on *P. helianthoides* and increase their vulnerability over the coming decades. There is uncertainty regarding causal links between climate change and impacts to *P. helianthoides*, and the scale over which these potential impacts are taking place. For example, local temperature-related stress, low dissolved oxygen events, and harmful algal blooms may be buffered by the refuge that a broad geographic and depth range provides to this species.

5.7 Competition for Prey

Competition for prey between humans fishing commercially or recreationally and humpback whales and Steller sea lions may exist in some areas in Alaska. In the action area, humans recreationally fish for species that are also prey for humpback whales or Steller sea lions, including herring, salmon, and halibut. Commercial salmon trolling is also possible in the action area, but effort is not large. A nearby salmon hatchery (Douglas Island Pink and Chum) significantly supplements salmon returns to the action area providing an increased prey base for Steller sea lions.

5.8 Sea Star Wasting Syndrome

A SSWS pandemic occurred across the range of the sunflower sea star from 2013-2017. SSWS is known to occur in sunflower sea stars and other species at smaller geographic and temporal scales, and is expected to occur in the future. But the magnitude of future outbreaks is unknown. The pathogen that caused the 2013-2017 is unknown. As stated above, SSWS is the factor of greatest concern for the species throughout its range, including in the action area.

5.9 Environmental Baseline Summary

Overall, Mexico DPS humpback whales and sunflower sea stars in the action area appear to be increasing in population size – or, at least, their population sizes do not appear to be declining – despite their continued exposure to the direct and indirect effects of the activities discussed in the Environmental Baseline. Similarly, it appears that adult female Steller sea lions may have recovered from the effects of the most recent PMH (Hastings et al. 2023), and are not declining as a result of their continued exposure to the direct and indirect effects of the activities discussed in the Environmental Baseline

6 EFFECTS OF THE ACTION

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

This opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data are not available. In analyzing the effects of the action, NMFS aims to minimize the likelihood of false negative conclusions (in other words, minimizing the conclusion that adverse effects are not likely when such effects are, in fact, likely to occur).

We organize our effects analysis using a stressor identification – exposure – response – risk assessment framework for the proposed activities.

We conclude this section with an *Integration and Synthesis of Effects* that integrates information presented in the *Status of the Species* and *Environmental Baseline* sections of this Opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species.

NMFS identified and addressed all potential stressors; and considered all consequences of the proposed action, individually and cumulatively, in developing the analysis and conclusions in this opinion regarding the effects of the proposed action on ESA-listed species and designated critical habitat.

6.1 Project Stressors

Stressors are any physical, chemical, or biological phenomenon that can induce an adverse response. The effects section starts with identification of the stressors produced by the constituent parts of the proposed action.

Based on our review of the Biological Assessment; the IHA application; the proposed notice for issuing the IHA; personal communications with PR1, the responsible entity, and others; and other available literature as referenced in this opinion, our analysis recognizes that the AMHS East Terminal proposed construction action may cause these primary stressors:

1. in-water and in-air sound fields produced by impulsive sound sources such as impact pile driving;
2. in-water and in-air sound fields produced by non-impulsive sound sources such as vibratory pile driving, and vessel sound;
3. risk of vessels striking marine mammals;
4. risk of entangling whales in equipment lines;
5. seafloor disturbance and contact of pilings with sea star during pile driving; and
6. removal of sunflower sea stars from the water via piling removal and subsequent relocation of individuals.

Most of the analysis and discussion of effects to Western DPS Steller sea lions and Mexico DPS humpback whales from this action will focus on exposure to in-water impulsive and non-impulsive sound sources because these stressors will likely have the most direct and far-reaching impacts on those two listed species. The analysis and discussion of effects to sunflower sea stars will focus on impacts to the substrate and to individuals resulting from the pile driving and pile removal.

6.1.1 Minor Stressors ESA-listed/Proposed Species

Based on a review of available information, we determined the following stressors may occur, but are likely to have improbable or minimal effects on ESA-listed and proposed species.

6.1.1.1 In-air sound

NMFS uses the following threshold for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance (as defined under Section 3(18)(A)(ii) of the MMPA):

- 100 dB re 20μPa$_{rms}$ for non-harbor seal pinnipeds

While Western DPS Steller sea lions may be exposed to in-air sound from the pile driving activities, a standard sound attenuation model suggests that sound generated from impact pile driving would attenuate to the 100db rms criterion within 158 feet from the pile, and in-air sound from vibratory driving would fall below 100 db rms threshold altogether (ADOT&PF 2017). Since 100 dB is below the level that could harm Steller sea lions, this in-air sound impact is expected to be minimal. The Benjamin Island Steller sea lion haulout is over 15 miles from the proposed construction activity, and any Western DPS Steller sea lions exposed to the in-air sound of the project would only be exposed after swimming into the action area. Any Western DPS Steller sea lion close enough to the sound source to be considered a 'take' from in-air sound associated with pile driving would already have been accounted for by in-water take or avoided due to the proposed mitigation measures, such as shutdown zones and soft-start ramp-up. Thus, any effects from in-air sound on Western DPS Steller sea lions is likely minimal.

6.1.1.2 Vessel strike and sound

The possibility of vessel strike associated directly with the proposed action is extremely unlikely. Vessel operations for construction occur at relatively low speed limits (5 knots). Vessels at the construction site will be moving very slowly. The use of slow-moving tugboats and barges associated with construction of the project is not expected to measurably affect ESA-listed species.

Although the water near the AMHS ferry terminal in Auke Bay has high volumes of vessel traffic, the likelihood of a vessel strike as a result of the proposed action is low. The project will occur during the winter to spring during a time with relatively low marine mammal densities near the AMHS ferry terminal. Additionally, mitigation measures are in place to reduce the risk of ship strike (e.g., marine mammal avoidance measures). Any marine mammal exposure to vessel sound associated with the proposed action will be minimal due to the mitigation measures and timing of the project. All vessels will be required to observe the Alaska humpback whale approach regulations (100 yards), which will further reduce the likelihood of interactions. Vessel use associated with the proposed construction activity will be low risk for vessel strike due to the low speeds and implementation of avoidance measures.

AMHS ferries have struck humpback whales in Southeast Alaska in the past as described above in the Environmental Baseline. It is possible that strikes involving ferries that use the Auke Bay East Terminal will occur in the future, but based on the very low number of total strikes in the past relative to total transits, and low proportion of ESA-listed humpback whales in Southeast Alaska, the likelihood of a vessel strike of an ESA-listed humpback whale is extremely unlikely. Vessel activity is not expected to increase as a result of the proposed action.

Although risk of vessel strike has not been identified as a significant concern for Steller sea lions (Loughlin and York 2000), the Recovery Plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated (e.g., near rookeries or haulouts) (NMFS 2008). Since 2000, there have been four reported vessel strikes of Steller sea lions within Southeast Alaska.

In general, the overlap in space and time of project-related vessels with humpback whales and Steller sea lions is highly unlikely because 1) vessel traffic associated with the proposed action will be minimal, and 2) the timing of operations is during a period of relative low Steller sea lion and humpback whale density in Auke Bay. In addition, NMFS's regulations for approaching humpback whales require that vessels not approach within 100 yards. AMHS also employs the mitigation measures and guidelines listed above, which will further reduce the risk of ship strike during operations of ferries using the Auke Bay East Terminal. All of these factors limit the risk of strike and minimize vessel sound near marine mammals. We conclude the probability of strike occurring during construction or indirectly during operations is extremely unlikely and therefore effects are highly improbable. We anticipate minimal low-level exposure of short-term duration to listed humpback whales and Steller sea lions from vessel sound related to this action. If whales or sea lions are exposed and do respond, they may exhibit slight deflection from the sound source and engage in short-duration avoidance behavior, short-term vigilance behavior, or experience short-term masking of communication, but these behaviors are not likely to result in adverse consequences.

6.1.1.3 Risk of entanglement

A small number of anchor, towing, and moorage lines will be put in the water column as part of the work associated with the proposed action. There is a precedent for humpback whales becoming entangled in anchor and mooring in Southeast Alaska near the action area, particularly when the lines are novel, or new to the whales. However, due to the timing of this project, mitigation measures, in-water sound associated with the project that will let the whales and sea lions know there is new activity occurring in the area, and the small number of lines associated with the project, the risk of entanglement is low and effects are thus extremely unlikely.

6.1.1.4 In-water sound on sea stars

While there is a paucity of literature on the effects of loud underwater sounds on sunflower sea stars, there are a few studies that look at the effects of loud sounds on other echinoderms. We don't know whether sunflower sea stars possess underwater vibration receptors that could be affected by loud sounds. However, we do know that they possess no gas bladder, as most fish do. With no gas bladder, the number of ways a sunflower sea star could be affected by acoustic sonar surveying is limited. Continuous loud sound exposure (>140 dB) can cause echinoderms such as sea urchins to have increased levels of stress related hormones (Moriyasu et al. 2004). However, there is no information about whether the increase in these hormones have any impact on the behavior or survival of echinoderms. Furthermore, there are currently no studies that suggest sea stars, or more specifically sunflower sea stars, have this response. Therefore, we conclude that, based on the best available information that we have, adverse effects from the sounds generated by pile driving on sunflower sea stars will be insignificant.

6.1.1.5 Disturbance to seafloor and contact of pilings

During pile installation and removal, a temporary and localized increase in turbidity and sedimentation near the seafloor is possible in the immediate area surrounding each pile. The pounding and extraction will generate some sedimentation and turbidity.

Local currents and tidal action will minimize sediments in the water column. Any potential water quality exceedances would likely be temporary and highly localized. The local tides and currents are expected to disperse suspended sediments from pile driving to near background levels in a few hours. Therefore, the impact from increased turbidity levels would be negligible to humpback whales, Steller sea lions, and sunflower sea stars, and would not cause a noticeable disruption of behavioral patterns. Therefore, we conclude that the effects from sedimentation are so small that they are not measurable.

6.1.2 Major Stressors on ESA-listed/Proposed Species

The following stressors are likely to adversely affect Mexico DPS humpback whales and Western DPS Steller sea lions: underwater sound from both impact (impulsive) and vibratory (non-impulsive) pile driving and removal. The following stressors are likely to adversely affect sunflower sea stars: the physical driving and removal of pilings, including seafloor disturbance, contact of a piling with a sea star, and temporary removal of sea stars from the water. These stressors will be analyzed below in the *Exposure Analysis.*

6.1.2.1 Acoustic thresholds

As discussed in Section 2, *Description of the Proposed Action*, ADOT intends to conduct construction activities that would introduce acoustic disturbance.

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871, 1872; January 11, 2005). NMFS developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent threshold shifts (PTS; Level A harassment) and temporary threshold shifts (TTS), also known as permanent or temporary hearing loss (83 FR 28824; June 21, 2018: 81 FR 51693; August 4, 2016) (Table 7). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). 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}
- non-impulsive sound: 120 dB re 1μPa_{rms}

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 USC § 1362(18)(A)(i)) (NMFS 2018). These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (L_E) and peak sound level (PK) for impulsive sounds and L_E for non-impulsive sounds (Table 7). Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS 2018). The generalized hearing range for each hearing group is in Table 8.

Table 7. *PTS onset acoustic thresholds for Level A (harm/injury) take (NMFS 2018).*

Hearing Group	**PTS Onset Acoustic Thresholds*** **(Received Level)**	
	Impulsive	**Non-impulsive**
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB

[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.

Hearing Group	PTS Onset Acoustic Thresholds* (Received Level)	
	Impulsive	**Non-impulsive**
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of $1\mu Pa^2 s$. The subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Level A harassment radii can be calculated using the optional user spreadsheet[12] associated with NMFS Acoustic Guidance, or through modeling.

The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment];

[12] The Optional User Spreadsheet can be downloaded from the following website: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 USC § 1362(18)(A)).

While the ESA does not define "harass," NMFS issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). Exposure to sound capable of causing Level A or Level B harassment under the MMPA often, but not always, constitutes take under the ESA.

For purposes of this consultation, any exposure to Level A or Level B disturbance sound thresholds under the MMPA constitutes an incidental "take" under the ESA and must be authorized by the ITS (Section 10 of this opinion) (except that take is not prohibited for proposed threatened species or for threatened species that do not have ESA section 4(d) regulations). As described below, we expect that exposures to listed marine mammals from sound associated with the proposed action may result in disturbance and potential injury. Due to the use of mitigation measures discussed in detail in Section 2.1.2 above, particularly the protective shutdown zones, no marine mammal mortalities or permanent impairment to hearing are anticipated, and it is extremely unlikely that TTS will occur.

Table 8. *Underwater marine mammal hearing groups (NMFS 2018).*

Hearing Group	**ESA-listed Marine Mammals In the Project Area**	**Generalized Hearing Range[1]**
Low-frequency (LF) cetaceans *(baleen whales)*	Mexico DPS humpback whales	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans *(dolphins, toothed whales, beaked whales)*	None	150 Hz to 160 kHz
High-frequency (HF) cetaceans *(true porpoises)*	None	275 Hz to 160 kHz
Phocid pinnipeds (PW) *(true seals)*	None	50 Hz to 86 kHz
Otariid pinnipeds (OW) *(sea lions and fur seals)*	Western DPS Steller sea lions	60 Hz to 39 kHz
[1]Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 db threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).		

6.1.2.2 Disturbance to seafloor and contact of pilings

During pile installation and removal, new permanent and temporary pilings will come in contact with the benthic environment prior to being driven. In addition, marine invertebrates, such as mussels and barnacles, have likely settled and grown on the pilings that will be removed as part of the action. These are prey items for sunflower sea stars, and it is possible that a few individual sea stars will be attracted to the pilings in pursuit of prey prior to piling removal.

Activities impacting the benthic environment due to pile driving and removal may interact with sunflower sea stars on the sea floor or on the pilings that will be removed. Pilings could potentially come in contact with sunflower sea stars, or they could be brought to the surface on pilings when the pilings are removed from the water. We can calculate the estimated number of sunflower sea stars that could be removed from the water or impacted by pilings based on the estimated density of sea stars and number of pilings removed and driven.

6.2 Exposure Analysis

As discussed in the *Approach to the Assessment* section of this opinion, exposure analyses are designed to identify the listed species that are likely to co-occur with these effects in space and time and 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 an action's effects, and the populations or subpopulations those individuals represent.

As discussed in Section 2.1.2 above, ADOT and PR1 proposed mitigation measures as part of the proposed action that should avoid or minimize exposure of Mexico DPS humpback whales, Western DPS Steller sea lions, and sunflower sea stars to one or more stressors from the proposed action. For example, the monitoring zones shown in Table 3 enable PSOs to be aware of and communicate the presence of marine mammals in the action area outside the shutdown zone and prepare for a potential cessation of activity should an animal approach the shutdown zone. During pile driving, the shutdown zone will be monitored for a minimum of 30 minutes prior to in-water activity. If a marine mammal is observed within the shutdown zone, in-water activity will be delayed until the zone is clear of marine mammals.

6.2.1 Exposure to in-water sound from pile driving activities

Mexico DPS humpback whales and Western DPS Steller sea lions may be present within the waters of the action area during the time that the in-water work is being conducted and could be exposed to temporarily elevated underwater sound levels resulting in harassment.

Temporarily elevated underwater sound during pile driving activities (including vibratory pile driving and impact pile driving) has the potential to result in Level B (behavioral) harassment of marine mammals. Level A harassment (resulting in injury) of humpback whales and Steller sea lions is not expected to occur as a result of the proposed in-water activities because shutdown zones will be implemented (Table 3), as well as other mitigation measures, which will reduce the potential for exposure to levels of underwater sound above the injury threshold established by NMFS.

For this analysis we estimated take by considering: 1) acoustic thresholds above which the best available science indicates listed marine mammals will be behaviorally harassed or incur some degree of hearing impairment; 2) the area that will be ensonified above these levels in a day; 3) the expected density or occurrence of listed marine mammals within these ensonified areas; and 4) the number of days of activities.

<u>Calculating the ensonified area</u>

This section describes the operational and environmental parameters of the activity that allow NMFS to estimate the area ensonified above the acoustic thresholds.

When the NMFS Technical Guidance (NMFS 2016) was initially published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, NMFS developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. Because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates to some degree. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available. For stationary sources, the NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would not incur PTS.

The practical spreading model was used to generate the Level B harassment zones for piling driving and removal activities. Practical spreading, a form of transmission loss, is described in detail below.

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

$$TL = B * \log10(R_1/R_2), \text{ where}$$

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

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

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source (20*log[range]). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10*log[range]). A practical spreading value of 15 is often used under conditions where water increases with depth as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions.

Vibratory Pile Driving

For vibratory pile driving we determined a source level of 166 dB (RMS SPL) at 10m was most appropriate for 30-inch diameter pilings. The most similar known measurements of sound levels for vibratory pile installation of 30-inch steel piles are from the US Navy Proxy Sound Source Study for projects in Puget Sound (Navy 2015). The same study was used for sound source levels for vibratory pile driving of 24-inch pilings (161 dB, RMS SPL, at 10m) and 18-inch pilings (20-inch proxy, 161 dB, RMS SPL, at 10m) (Navy 2015).

Impact Pile Driving

For impact pile driving, NMFS uses the standard proxy source level of 190 dB RMS at 10m for 30-inch pilings and 24-inch pilings, and 185 dB RMS for 20-inch pilings. For this analysis, ADOT used more conservative values to ensure protective measures were inclusive of the estimated harm and harassment zones. ADOT determined a source level of 195 dB (RMS SPL) at 10m from the US Navy Proxy Sound Source Study for Projects in Puget Sound was most appropriate (Navy 2015). The sound source levels for 24-inch diameter pile installation (193 dB, RMS SPL, at 10m) and 18-inch diameter pile installation (20-inch proxy, 187 db, RMS SPL, at 10m) were from the California Department of Transportation's Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish (CALTRANS 2020). No more than two 30-inch diameter pilings will be driven per day using the impact hammer. In all cases we used a propagation loss coefficient of 15 logR as most appropriate for these stationary, in-shore sources.

6.2.1.1 Distances to Harm and Harassment Sound Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed or experience TTS (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Inputs used in the User Spreadsheet and Multi-species Pile Driving Calculator tool are shown in Table 2, along with the resulting Level A (harm/injury) and Level B (harassment) isopleths. Using the practical spreading loss model, underwater sound from non-impulsive sound sources (vibratory pile driving and removal) will fall below the behavioral effects threshold of 120 dB rms for marine mammals at a maximum radial distance of 11.66 km, and below the 160 dB rms for impulsive sound sources (impact pile driving) at 2.2 km for the biggest (30-inch diameter) pilings. Thus, the Level B harassment zones are established (Table 2) for each of these sound sources. Beyond these distances, NMFS anticipates no significant disruption to the behavior of listed marine mammals.

Harassment (Level B)

Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic sound exposure is also informed to varying degrees by other factors related to the source (e.g., frequency, predictability, duty cycle), the environment (e.g., bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context), which can be difficult to predict (Southall et al. 2007, Ellison et al. 2012). Based on the available science and the practical need to use a threshold that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic sound above received levels of 120 dB re 1 μPa rms for non-impulsive (e.g., vibratory pile-driving, vessel sound) and above 160 dB re 1 μPa rms for non-explosive impulsive (e.g., impact pile-driving) or intermittent sources.

ADOT's proposed construction activity for the AMHS East Terminal Improvements includes the use of non-impulsive (vibratory pile driving) and impulsive (impact pile driving) sources, and therefore the 120 and 160 dB re 1 μPa rms thresholds for Level B behavioral harassment are applicable.

Harm (Level A)

NMFS's Revised Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2018) identifies dual criteria to assess auditory injury (Level A) to five different marine mammal groups based on hearing sensitivity as a result of exposure to sound from two different types of sources (impulsive or non-impulsive). ADOT's proposed activity includes the use of non-impulsive (vibratory pile driving) and impulsive (impact pile driving) sources. The Level A thresholds for the onset of PTS are provided in Table 2 and are applicable here (2,513 m for humpback whales and 98 m for Steller sea lions).

6.2.2 Estimating species occurrence

Information about the presence, density, or group dynamics of marine mammals informs the take calculations in Section 10. Reliable, consistent densities are not available for Stephen's Passage, Auke Bay, and Fritz Cove. Generalized densities for the North Pacific would not be applicable given the high variability in occurrence and density at specific inlets and harbors. Therefore, we used information about presence, group size, and dive durations to derive take estimates.

Whale researchers, resource managers, and whale watching guides track the presence of individual humpback whales in the Juneau area by unique fluke patterns (Krieger and Wing 1986, Teerlink 2017). Based on fluke photographs taken between 2006 and 2014, 179 individual humpback whales were identified from the Juneau area (Teerlink 2017). Surveys in Lynn Canal, near the action area, from September 15-October 14, 2007 and 2008, observed 55 humpback whales; 30 whales were unique in 2007, and 22 were unique in 2008 (Straley et al. 2018). During winter, researchers have documented 1 to 19 individual humpback whales per month in waters close to the project area, including Lynn Canal (Moran et al. 2018, Straley et al. 2018). Humpback whale group size in Southeast Alaska generally ranges from one to four individuals (Dahlheim, White and Waite 2009).

Based on these local surveys and known numbers of humpback whales in and near the action area in past years, we estimate that up to eight humpback whales will be exposed to underwater sound each day. Up to 61 days of in-water pile driving and removal will occur, so the total number of exposures of humpback whales to received sound levels capable of causing harassment is 488 (8 x 61 = 488). The proportion of these exposures that are expected to be incurred by threatened Mexico DPS humpback whales is 2% (Table 6) (Wade 2021). This results in 9.76 exposures of ESA-listed whales (2% of 488), which we will round up to 10 for our exposure estimate.

Based on monitoring reports for the Auke Bay Ferry Terminal and Statter Harbor projects in 2019 and 2021, we estimate that groups of up to 50 Steller sea lions per day could be exposed to underwater sound associated with the pile driving and removal within Auke Bay from the AMHS East Terminal Improvements project. Up to 50 Steller sea lions per day for 61 days of pile driving equates to an estimated 3,050 exposures of Steller sea lions in the Auke Bay area. However, the ensonified area for the project action extends into Fritz Cove, a known winter foraging area for Steller sea lions (K. Raum-Suryan, pers. comm.). Based on the action area size being nearly double the area in Auke Bay, we increased the number of estimated takes to 6,100 Steller sea lions. Given that an estimated 1.4% of Steller sea lions in Lynn Canal are from the endangered Western DPS (Hastings et al. 2020), 85.4 of the total exposures are expected to be Western DPS Steller sea lions. For the purposes of authorizing take of individual animals, we rounded this up to 86 harassment takes during the course of the proposed action.

Due to the estimated density of sunflower sea stars in Auke Bay (0.0213 animals/m^2) (ADFG 2023), and ADOT's survey and monitoring plan for the species (mitigation measure 9), we have determined the likelihood of a piling coming into contact with a sunflower sea star on the sea floor is small. Based on the area of the footprint of the pilings being driven and the estimated density of sunflower sea stars in the area, we estimate that pilings may come into contact with 0.4569 sunflower sea stars (rounded up to one individual, given the uncertainty surrounding our density estimate for this area) (Table 9). Surveys conducted by ADOT throughout the proposed action will provide information about the actual density of sunflower sea stars. Based on best available information, we estimate that up to one sunflower sea star may be harmed or killed by the proposed action when pilings are being driven.

Table 9. *Estimated overlap of pilings being driven as part of the proposed action with sunflower sea stars on the sea floor at the east terminal site in Auke Bay.*

Pile Size	Number of Pilings	Individual Pile Area (m^2)	Total Pile Area (m^2)
30-inch	20	0.45604	9.1208
24-inch permanent	8	0.29186	2.33488
18-inch	4	0.16417	0.65668
24-inch temporary	32	0.29186	9.33952
			21.45188
		Total Pile Area summed (m^2)	0.0213
		Estimated sunflower sea star density (ind/m^2)	
		Estimated sunflower sea stars taken	**0.456925044**

There is a chance that sunflower sea stars could occur on several of the pilings that are removed from the ocean as part of the proposed action. The project includes the removal of 47 existing pilings. A survey conducted by ADOT on October 5, 2023, found three sunflower sea stars on one piling that will be removed as part of the proposed action, and five sunflower sea stars on a second piling. Based on that survey, and that some sunflower sea stars may detach from pilings prior to the piling being taken from the water, we estimate than an average of three sunflower sea stars per piling will be taken out of the water with each piling. Forty-seven pilings will be removed from the water as part of the proposed action, for a total exposure estimate of 141 sunflower sea stars from pilings removals. The proposed action includes a plan to gently relocate any sunflower sea stars taken out of the water as a result of this project back into the nearby ocean. The total exposure estimate is 142 sunflower sea stars: 141 from piling removal operations, and one from pile driving.

6.3 Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particularly stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

6.3.1 Responses to major sound sources

Loud underwater sound can result in physical effects on the marine environment that can affect marine organisms. Based on our effects analysis in Section 6.1.1.4, we do not expect significant responses from sunflower sea stars. Possible responses by Mexico DPS humpback whales and Western DPS Steller sea lions to the impulsive and non-impulsive sound produced by the impact and vibratory pile driving and removal include:

- Physical Responses
    - Temporary or permanent hearing impairment (threshold shifts)
    - Non-auditory physiological effects
- Behavioral Responses
    - Auditory interference (masking)
    - Tolerance or habituation
    - Change in dive, respiration, or feeding behavior
    - Change in vocalizations
    - Avoidance or displacement
    - Vigilance
    - Startle or fleeing

As described in the *Exposure Analysis*, Mexico DPS humpback whales and Western DPS Steller sea lions are expected to occur in the action area and are expected to overlap with sound associated with pile installation and removal activities. We assume that some individuals are likely to be exposed and respond to these impulsive and non-impulsive sound sources.

Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and other factors. The potential effects of underwater sound from sound sources can potentially result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson et al. 1995, Nowacek et al. 2007, Southall et al. 2007). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for sound within an animal's hearing range.

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

The effects of pile installation and removal on marine mammals are dependent on several factors, including the type and depth of the animal; the pile size and type, and the intensity and duration of the in-water sound; the substrate; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving and removal activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the frequency, received level, and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment.

6.3.1.1 Physical Responses

We do not anticipate physical responses (threshold shifts or non-auditory physiological effects) from protected species exposed to sound sources associated with the proposed action.

6.3.1.2 Behavioral Responses

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

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel (24-hour) cycle. Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall et al. 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall et al. 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Auditory Masking

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

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

For the pile driving and removal sound generated from the proposed construction activities, sound will consist of low frequency impulsive and non-impulsive sound depending on if they are using an impact or vibratory hammer. Lower frequency anthropogenic sounds are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey sound. This could affect communication signals used by low frequency mysticetes when they occur near the sound band and thus reduce the communication space of animals (Clark et al. 2009) and cause increased stress levels (Foote, Osborne and Hoelzel 2004, Holt et al. 2009). However, marine mammals are thought to be able to compensate for masking to a degree by adjusting their acoustic behavior by shifting call frequencies, and/or increasing call volume and vocalization rates. For example, humpback whales were shown to alter their calling behavior in response to cruise ships and other vessel activity in Glacier Bay, including increasing the volume of their calls, and reducing their overall calling (Fournet et al. 2018). In addition, the sound localization abilities of marine mammals suggest that, if signal and sound come from different directions, masking would not be as severe as the usual types of masking studies might suggest (Richardson et al. 1995).

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

Sound from pile driving and removal activity is relatively short-term. It is possible that pile driving and removal sound resulting from this proposed action may mask acoustic signals important to western DPS Steller sea lions and Mexico DPS humpback whales, but the short-term duration, limited affected area, and pauses between operations would limit the impacts from masking. Any masking event that could rise to Level B harassment under the MMPA is included within the zones of behavioral harassment estimated in Table 2 which have been taken into account in the exposure analysis.

Toleration

Toleration can occur when an animal's response to a stimulus appears to wane with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003). Animals are most likely to tolerate sounds that are predictable and unvarying. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995, NRC 2003, Wartzok et al. 2003), tolerating the stimuli. Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Schlundt et al. 2000). Observed responses of wild marine mammals to loud, intermittent sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Richardson et al. 1995).

This information indicates marine mammal tolerance or avoidance of underwater sounds. We expect that some humpback whales and Steller sea lions exposed to low frequency underwater sounds from construction activities in the action area may tolerate construction sound and show no apparent response, while others may depart the action area temporarily. More information is needed in order to determine if toleration is occurring over time as animals experience repeated exposures.

Change in dive, respiration, or feeding behavior

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (Lusseau and Bejder 2007). This highlights the importance of assessing the context of the acoustic effects alongside the estimated received levels. Severity of effects from a response to an acoustic stimuli can likely vary based on the context in which the stimuli was received, particularly if it occurred during a biologically sensitive temporal or spatial point in the life history of the animal. There are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

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

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

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

Based on this analysis, we expect Mexico DPS humpback whales and Western DPS Steller sea lions to continue foraging in the face of moderate levels of disturbance. For example, humpback whales, which only feed during part of the year and must satisfy their annual energetic needs during the foraging season, may continue foraging in the face of disturbance in the action area. Similarly, a humpback cow accompanied by her calf is less likely to flee or abandon an area at the cost of her calf's survival. We also expect that these animals could resume foraging close by if the in-water sound associated with the proposed action causes them to avoid the action area. The proposed action is not expected to result in Western DPS Steller sea lions moving to a different haulout, but could cause them to temporarily move to different foraging areas near the action area. It is likely some change in dive, respiration, or feeding behavior of Western DPS Steller sea lions and Mexico DPS humpback whales may occur in the action area, but we do not expect much change in these behaviors. Any change in behavior that could rise to Level B harassment under the MMPA is included within the zones of behavioral harassment estimated in Table 2, and have been taken into account in the exposure analysis.

Change in vocalizations

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, roaring, and singing. Changes in vocalization behavior in response to anthropogenic sound can occur for any of these modes and may result from a need to compete with an increase in background sound or may reflect increased vigilance or a startle response. In some cases, animals may cease sound production during production of aversive signals (Bowles et al. 1994).

In addition to these behavioral responses, whales alter their vocal communications when exposed to anthropogenic sounds. Communication is an important component of the daily activity of animals and ultimately contributes to their survival and reproductive success. Animals communicate to find food, acquire mates, assess other members of their species, evade predators, and defend resources. Human activities that impair an animal's ability to communicate effectively might have significant effects on the survival and reproductive performance of animals experiencing the impairment.

At the same time, most animals that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-sound ratio, active space, and recognition of their vocalizations in the face of temporary changes in background sound. For example, blue whales stopped vocalizing and feeding, and moved out of an area in response to simulated mid-frequency military sonar (Goldbogen et al. 2013). Humpback whales were observed to call louder and less often in Glacier Bay in response to cruise ship and other vessel sound (Fournet et al. 2018). Humpback whales have also been observed to increase the length of their songs in the presence of potentially masking signals (Miller et al. 2000, Fristrup, Hatch and Clark 2003). Change in humpback vocalization may happen within the action area, but to a minimal extent due to the short duration of the project. Steller sea lions vocalize more often on terrestrial haulouts rather than in the water, which is where they will be exposed to sound from the proposed action. We do not expect that the proposed action will significantly alter Steller sea lion vocalizations.

Avoidance or displacement

Avoidance is the displacement of an individual from an area or migration path because of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson et al. 1995). Whales are known to move away from preferred migratory routes and feeding and calving areas in order to avoid sound from seismic surveys (Weller et al. 2002, Quakenbush et al. 2012). Avoidance may be short-term, with animals returning to the area once the sound has ceased (Bowles et al. 1994). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (Blackwell, Lawson and Williams 2004).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (e.g., directed movement, rate of travel). Pinnipeds will evacuate terrestrial sites in a hurried flight response due to human disturbance (Lewis and Mathews 2000), potentially leading to injury, and certainly resulting in harassment. The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (England et al. 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Avoidance is one of many behavioral responses whales and Steller sea lions exhibit when exposed to pile driving sound. Evasive behavior to escape exposure or continued exposure to a sound that is painful, noxious, or that they perceive as threatening, is another potential response. We assume this behavior would be accompanied by acute stress physiology; increased vigilance, which would alter their time budget (that is, during the time they are vigilant, they are not engaged in other behavior); and continued pre-disturbance behavior with the physiological consequences of continued exposure. Avoidance behavior is expected to occur with the Steller sea lions and humpback whales in the action area. Any avoidance that could rise to Level B harassment under the MMPA is included within the zones of behavioral harassment estimated in Table 2, and have been taken into account in the exposure analysis.

Vigilance

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of energy (i.e., when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). In addition, chronic disturbance can cause population declines through decreased individual fitness (e.g., decline in body condition) and subsequent reduction in reproductive success, survival, or both (New et al. 2014). We expect that some humpback whales and Steller sea lions will demonstrate vigilance in response to the in-water work of the proposed action. This behavior will enable the animals to determine if the sound could be a threat. Any change in behavior that could rise to Level B harassment under the MMPA is included within the zones of behavioral harassment estimated in Table 2, and have been taken into account in the exposure analysis.

Humpback whales and Steller sea lions have the potential to exhibit each of these behavioral responses (auditory interference (masking); tolerance; change in dive, respiration, or feeding behavior; change in vocalizations; avoidance or displacement; increased vigilance) due to project activities in the action area. However, the relatively short duration and sporadic nature of the in-water work and implementation of mitigation measures will reduce the likelihood of chronic or long-term effects.

Startling

A startle response is a short behavior in reaction to an unexpected, sudden, or threatening stimuli. In whales or pinnipeds, this behavior could be lifting the head up quickly or changing direction sharply in order to better assess the stimuli. A startle response can be a precursor to a more significant, longer duration change in behavior, such as fleeing by moving quickly deeper or away. Due to the mitigation measures, including ramp up procedures for pile driving, we do not anticipate this behavior to occur frequently in response to the proposed action.

6.3.2 Expected Effects on Habitat

The proposed activities at the project area would not result in permanent negative impacts to habitats used directly by marine mammals and sea stars, but may have potential short-term impacts to food sources, such as forage fish and marine invertebrates, and may affect acoustic habitat. Steller sea lions, humpback whales, and sunflower sea stars likely occur in the action area year round depending on food availability. While humpback whales, Steller sea lions, and sunflower sea stars feed in Stephen’s Passage and the action area, this is a small portion of their overall feeding area. The small portion of the area affected by the construction and construction sound, in conjunction with the short temporal scale of construction activity, make it unlikely the effects of the construction will significantly alter the foraging habitat of humpback whales, Steller sea lions, or sunflower sea stars in Southeast Alaska. Therefore, the main impact issues associated with the proposed action would be temporarily elevated sound levels and the associated direct effects on marine mammals, and the brief removal of sunflower sea stars from the marine environment, as discussed previously in this document. The primary potential acoustic impacts to marine mammal habitat are associated with elevated sound levels produced by pile installation and removal.

Short-term turbidity increases would likely occur during in-water construction work, including pile driving and removal. The physical resuspension of sediments could produce localized turbidity plumes that could last from a few minutes to several hours. In general, turbidity associated with pile installation and removal is expected to be localized to about a 25 ft radius around the pile. Because of the relatively small work area, any increase in turbidity would be limited to the immediate vicinity of the project site. There is little potential for pinnipeds or cetaceans to be exposed to increased turbidity during construction operations. A small number of sunflower sea stars may be exposed to turbidity for a short amount of time.

Considering local currents, tidal action, and implementation of mitigation measures, any potential water quality exceedances would likely be temporary and highly localized. The local tides and currents would disperse suspended sediments from pile driving and removal operations at a moderate to rapid rate depending on tidal stage.

6.3.3 In-water Construction Effects on Potential Prey

Construction activities would produce non-impulsive (i.e., vibratory pile driving and removal) and impulsive (impact pile driving) sounds. Fish react to especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of impulsive sounds such as pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (Scholik and Yan 2001, Popper and Hastings 2009). Sound pulses at received levels of 160 dB may cause subtle changes in fish behavior. Sound pressure levels (SPLs) of 180 dB may cause noticeable changes in behavior (Pearson, Skalski and Malme 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality.

The most likely impact to fish from pile driving activities in the action area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution, and behavior is expected. In general, impacts to humpback whale and Steller sea lion prey species are expected to be minor and temporary due to the short timeframe for the project.

The acoustic characteristics of the construction are not expected to affect marine invertebrate prey of sunflower sea stars (Moriyasu et al. 2004). Sessile sunflower sea star prey could be damaged during piling removal and pile driving. However, these impacts would be highly localized and temporary. The new pilings would provide surfaces for larval marine invertebrates, such as barnacles and mussels, to settle on, leading to new habitat and prey for sunflower sea stars in the near future.

6.3.4 Effects on Potential Fish Foraging Habitat

The area likely impacted by the project is relatively small compared to the available habitat in Auke Bay, Stephen’s Passage, and Southeast Alaska. Avoidance by fish of the immediate area due to the temporary loss of this foraging habitat is possible. The duration of fish avoidance of this area after construction activity stops is unknown, but a rapid return to normal recruitment, distribution, and behavior is expected. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity in Lynn Canal.

Given the short daily duration of sound associated with individual construction activities and the relatively small areas being affected, the proposed action is not likely to have a permanent, adverse effect on any fish habitat, or populations of fish species. In addition, consideration was given in the design of the dock and float to provide barrier-free movement to fish, in order to reduce potential impacts. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

6.3.5 Responses to Benthic Disturbance and Piling Removal

This section focuses on the potential impacts of pilings coming into contact with sunflower sea stars on the sea floor when being driven or removed. We have determined that the chance of a piling coming in contact with a sunflower sea star on the sea floor is small due to the small footprint of the pilings being driven and the low density of sunflower sea stars. It is possible, based on the estimated density of sunflower sea stars and total number of pilings being driven, that pilings may come in contact with up to one sunflower sea star. That contact could result in significant harm resulting in mortality of that individual.

Sunflower sea stars may cling to the sides of existing pilings in order to forage on marine invertebrates that have settled and grown on that habitat. Sunflower sea star prey, such as mussels, barnacles, and other invertebrates thickly coat some of the existing pilings. It is possible that sunflower sea stars could be removed from the marine environment as part of the project’s piling removal procedures.

Sunflower sea stars that are removed from the marine environment for some period of time may desiccate and die. The length of time until death will vary depending on a number of environmental variables including temperature and sunlight exposure. Pilings removed from the water for the proposed action will be placed in a nearby asphalt lot. Because there is no chance for a sunflower sea star to physically return itself to the marine environment, ADOT is proposing to intervene to relocate any sunflower sea stars that are removed from the marine environment during piling removal procedures.

ADOT has proposed as part of their action to immediately carefully remove any sunflower sea stars discovered on pilings that are pulled from the water, and return them back into the marine environment within minutes of the inadvertent removal. This proposed mitigation measure will certainly benefit the individuals that were incidentally removed from the water and will greatly increase their chance of survival. Without this intervention, the sunflower sea stars would almost certainly die. We determine that incidental removal from the water via removed pilings is likely to adversely affect several sunflower sea stars, but due to the proposed plan to return sea stars immediately back to the marine environment, the effects will not rise to the level of harm.

7 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 pursuant to section 7 of the ESA.

Climate change, as well as some continuing and future non-Federal activities expected to contribute to climate change, are reasonably certain to occur within the action area. However, it is difficult if not impossible to distinguish between the action area’s future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the Status of the Species (Section 4) and Environmental Baseline (Section 5).

Commercial boat-based whale watching is typically a private activity that occurs in the action area during the late-Spring to early-Fall months. The overlap of whale watching vessels with this construction activity may be minimal due to timing. In future years, we anticipate that commercial boat-based whale watching activity will continue to occur in the action area. Peak numbers of whale watching boats does not appear to limit humpback whale recovery, as indicated by continued increases in whale abundance.

There are currently no other known or expected state or private activities reasonably certain to occur in the action area that may affect listed species and are not subject to section 7 consultation. 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 5 of this opinion), and we expect those activities discussed to be on-going with similar intensity. For example, we expect fisheries, sound, pollutants and discharges, and marine vessel activity will continue into the future. While the proposed project is designed to maintain or improve the existing ferry terminal, it is not expected to result in a major increase in marine traffic in the action area.

8 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step of NMFS's assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both the survival or recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) result in the adverse modification or destruction of critical habitat as measured through potential reductions in the value of designated critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species (Section 4).

As we discussed in the Approach to the Assessment section (Section 3) of this opinion, we begin our risk analyses by asking whether the probable physical, physiological, behavioral, or social responses of endangered or threatened species are likely to reduce the fitness of endangered or threatened individuals or the growth, annual survival or reproductive success, or lifetime reproductive success of those individuals.

As part of our risk analyses, we identified and addressed all potential stressors and considered all consequences of exposing listed or proposed listed species to all the stressors associated with the proposed action, individually and cumulatively, given that the individuals in the action area for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range.

8.1 Western DPS Steller Sea Lion Risk Analysis

The Steller Sea Lion Recovery Plan (NMFS 2008) lists recovery criteria that should be accomplished in order to downlist the Western DPS from endangered to threatened and to delist the Western DPS. More details and exact specifications can be found in the plan, but these criteria generally include an increased population size, requirements that any two adjacent sub-regions cannot be declining significantly, reducing the threats to sea lion foraging habitat, reducing intentional killing and overexploitation, and others. Western DPS Steller sea lion response from the proposed activities will not impede progress towards these recovery criteria due to the low expected level of harassment, expected lack of injury or mortality, and lack of significant effects to habitat.

Effects to sea lions from exposure to in-air sound, vessel sound from transit, disturbance to the seafloor, potential for vessel strike, and potential for entanglement are likely to be negligible due to the small marginal increase in such stressors relative to the environmental baseline, mitigation measures in place to reduce approach distances, and the transitory and short term nature of the vessels and construction activities. Adverse effects from vessel strike are very unlikely because only a few additional vessels will be introduced due to the proposed action and therefore interactions are expected to be infrequent.

In-water noise from pile-driving could affect Western DPS Steller sea lions. Steller sea lion probable responses to this project (pile driving and removal) after implementation of the mitigation measures in Section 2.1.2 include startle reactions or short-term behavioral modifications, such as those listed in Section 6.3.1.1. These reactions and behavioral changes are expected to subside quickly when the exposures cease. The primary mechanism by which these behavioral changes could affect the fitness of individual animals is through the animals' energy budget, time budget, or both (see Section 6.3.1.1). The individual and cumulative energy costs of the behavioral responses are not likely to appreciably reduce the energy budgets of affected Steller sea lions. Their probable exposure to sound sources is not likely to reduce their fitness because project-related sound is relatively short-term, in a limited affected area, and pauses between operations.

Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July. The endangered Western DPS Steller sea lion population is not currently declining in the eastern portion of their range, closest to the action area. NMFS does not expect any effects from this action on the reproductive success of Steller sea lions. As a result, the probable responses to this project are not likely to reduce the current or expected future reproductive success of Western DPS Steller sea lions or reduce the rates at which they grow, mature, or become reproductively active.

Commercial fishing likely affects prey availability throughout much of the Western DPS's range, and causes a small number of direct mortalities each year. Predation by sharks and killer whales occurs, but is not considered a significant threat to this DPS. Subsistence hunting occurs at fairly low levels for this DPS. Illegal shooting is also a continuing threat, but significant numbers of illegally shot sea lions have not been recently detected in the action area. Ship strikes do not seem to be a significant concern for this species due to its maneuverability and agility in water. Climate change will likely continue to indirectly affect Steller sea lions through changes in prey availability. Despite exposure to construction activities and ferry and vessel operations for decades in Southeast Alaska, and continued climate change impacts, the currently stability in the number of Western DPS Steller sea lions suggests that the stress regime these sea lions are exposed to is not leading to a decline in their numbers, particularly in Southeast Alaska.

Therefore, exposures associated with the proposed action are not likely to reduce the abundance, reproduction rates, or growth rates (or significantly increase variance in one or more of these rates) of the populations those individuals represent. While a single individual may be exposed multiple times during the project, the short duration of sound generation and the implementation of mitigation measures to reduce exposure to high levels of sound reduce the likelihood that exposure would cause a behavioral response that may affect vital functions, or cause TTS or PTS. Cumulative effects of future state or private activities in the action area are likely to affect Steller sea lions at a level comparable to present. The current and recent population trends for Western DPS Steller sea lions indicate that these levels of activity are not hindering population growth.

As a result of all of the above factors, this project is not likely to appreciably reduce Western DPS Steller sea lions' likelihood of surviving or recovering in the wild.

8.2 Mexico DPS Humpback Whale Risk Analysis

Our consideration of probable exposures and responses of ESA-listed whales to construction activities associated with the proposed action is designed to help us assess whether those activities are likely to increase the extinction risks or jeopardize the continued existence of Mexico DPS humpback whales.

Effects from exposure to in-air sound, vessel sound from transit, disturbance to the seafloor, potential for vessel strike, and potential for entanglement are likely to be negligible due to the small marginal increase in such stressors relative to the environmental baseline, mitigation measures in place to reduce approach distances, and the transitory and short-term nature of vessels and construction activities. Adverse effects from vessel strike are very unlikely because only a few additional vessels will be introduced for the proposed action, the vessels will be operating at slow speeds or will be stationary, and therefore interactions are expected to be infrequent.

In-water noise from pile driving could affect Mexico DPS humpback whales. Humpback whales' probable response to the in-water sound of pile driving associated with the proposed action includes short-term behavioral modification such as those listed in Section 6.3.1.1. These reactions and behavioral changes are expected to subside quickly when the exposures cease. The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animals' energy budget, time budget, or both (the two are related because foraging requires time). Large whales such as humpbacks have the ability to store substantial amounts of energy, which enables them to survive for months on stored energy during migration and while in their wintering areas, and their feeding strategy allows them to acquire energy at high rates. The individual and cumulative energy costs of the behavioral responses discussed are not likely to reduce the energy budgets of humpback whales, and their probable exposure to sound sources is not likely to reduce their fitness due to the short duration of the project and implementation of the proposed mitigation measures.

As discussed in the *Description of the Action* and *Status of the Species* sections, this action does not overlap in space or time with humpback whale breeding. Some Mexico DPS humpback whales feed in Southeast Alaska and migrate to Mexican waters for breeding and calving in winter months. As a result, the probable responses to the proposed action are not likely to reduce the current or expected future reproductive success of Mexico DPS humpback whales or reduce the rates at which they grow, mature, or become reproductively active. Sound from the proposed action could discourage Mexico DPS whales from feeding in the action area during some construction activities, but any such effects would be brief and the affected whales would likely find other comparable foraging opportunities in the vicinity. Although climate change has the potential to impact humpback whales through reduced prey abundance or availability, the rapidly increasing numbers of humpback whales in Southeast Alaska suggest that climate change is not negating population growth.

Therefore, these exposures are not likely to reduce the abundance, reproduction rates, or growth rates (or significantly increase variance in one or more of these rates) of the populations those individuals represent. The short duration of sound generation and implementation of mitigation measures to reduce exposure to high levels of sound reduce the likelihood that exposure would cause a behavioral response that may affect vital functions, or cause TTS or PTS. Cumulative effects of future state or private activities in the action area are likely to affect humpback whales at a level comparable to present.

The strongest evidence supporting the conclusion that the proposed action will likely have minimal impact on Mexico DPS humpback whales is the estimated annual growth rate of the humpback whale populations in the North Pacific (5-7%). While there is no accurate estimate of the maximum productivity rate for humpback whales, it is assumed to be 7% (Muto et al. 2022). Despite exposure to pile driving operations for decades, humpback whale entanglements in fishing gear and other marine debris, serious injuries and mortalities caused by vessel strike, climate change, and marine vessel activity, this increase in the number of listed whales suggests that the stress regime these whales are exposed to has not prevented them from increasing their numbers.

As a result of all the above factors, this project is not likely to appreciably reduce Mexico DPS humpback whales' likelihood of surviving or recovering in the wild.

8.3 Sunflower Sea Star Risk Analysis

Our consideration of probable exposures and responses of proposed threatened sunflower sea stars to construction activities associated with the proposed action is designed to help us assess whether those activities are likely to increase the extinction risk or jeopardize the continued existence of the species.

Effects from exposure to in-air sound, in-water sound, entanglement, and vessel use are likely negligible due to the lack of expected responses from sea stars to these potential stressors. Effects from disturbance to the benthic environment and pilings where sunflower sea stars may be located are expected to occur within a small footprint relative to the entire range of the species. We estimate that one sunflower sea star could be killed due to the potential for a piling to crush an individual when being driven.

We also expect that up to 141 sunflower sea stars could be incidentally removed from the marine environment while attached to pilings that are removed as part of the proposed action. However, ADOT is proposing to carefully handle and relocate animals that are incidentally taken from the marine environment, and place them back into the ocean. The handling of sunflower sea stars is part of a planned relocation effort described in the mitigation measures section above that will benefit the individuals that are taken from the water relative to the animals being left in a lot onshore.

The primary threat to sunflower sea stars identified in the draft Status Review Report (Lowry 2022) and proposed rule to list the sunflower sea star as threatened (88 FR 16212; March 16, 2023), is sea star wasting syndrome (SSWS). Based on our analysis of the action description provided to NMFS by ADOT, no aspect of the proposed action should increase the prevalence of SSWS in sunflower sea stars. While it is unknown whether handling stress could increase the vulnerability of sea stars to SSWS, the relocation plan proposed by ADOT should result in minimal handling of a few individuals. Handling of the few individuals is beneficial relative to leaving them on land and will result in the sea stars being returned to the marine environment instead of dying onshore.

The geographic scope of this project is small relative to the entire range of the species. The duration of the project is short (approximately four months). Habitat and prey impacts for the sunflower sea star are extremely small. The effects from the proposed action on sunflower sea stars are not likely to reduce the reproduction rates or growth rates of sunflower sea stars. Due to the limited geographic and temporal scope of the project, we do not expect significant increases in vulnerability of sunflower sea stars to a SSWS pandemic as a result of the proposed action. The number of individuals that will be affected is very small relative to the estimated population of sunflower sea stars (over 600 million) (Lowry 2022). Based on evidence of recent recruitment and localized abundance increases in sunflower sea stars, the current coastal construction regime and other cumulative effects in Alaska do not appear to be limiting sunflower sea star recovery. Despite exposure to coastal development (as described in past section 7 consultations), climate change, and other human activities such as fishing, densities of sunflower sea stars in the action area and other parts of Southeast Alaska are robust (ADFG 2023). The uncertainty associated with the recent pandemic caused by an unknown pathogen is the primary threat to sunflower sea stars, and the proposed action is extremely unlikely to increase the threat of SSWS.

9 CONCLUSION

After reviewing the current status of the listed or proposed-listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological and conference opinion that the proposed action is not likely to jeopardize the continued existence of Western DPS Steller sea lions (*Eumetopias jubatus*), Mexico DPS humpback whales (*Megaptera novaeangliae*), or proposed sunflower sea stars (*Pycnopodia helianthoides*).

With respect to Steller sea lion and Mexico DPS humpback whale critical habitat, all potential effects from the action are either highly improbable or immeasurably small, and therefore the proposed action is not likely to destroy or adversely modify designated Steller sea lion or Mexico DPS humpback whale critical habitat.

10 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a 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 (16 USC § 1532(19)). "Incidental take" is defined as take that results from, but is not the purpose of, carrying out an otherwise lawful activity (50 CFR § 402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 U.S.C. § 1362(18)(A)). For this consultation, ADOT and PR1 expect that any take of Steller sea lions and humpback whales will be by Level B harassment only. No Level A takes of Western DPS Steller sea lions or Mexico DPS humpback whales are contemplated or authorized. ADOT anticipates that up to one sunflower sea star may be killed by pile driving operations, and up to 141 individuals will be relocated from removed pilings back into the marine environment.

The ESA does not prohibit the take of threatened species unless special regulations have been promulgated, pursuant to ESA section 4(d), to promote the conservation of the species. Federal regulations promulgated pursuant to section 4(d) of the ESA extend the section 9 prohibitions to the take of Mexico DPS humpback whales (50 CFR § 223.213). ESA section 4(d) rules are not being proposed for the sunflower sea star at this time; therefore, ESA section 9 take prohibitions might not apply to this species. This ITS includes numeric limits on the take of sunflower sea stars because specific amounts of take were analyzed in our jeopardy analysis. These numeric limits provide guidance to the action agency on its requirement to re-initiate consultation if the amount of take estimated in the jeopardy analysis of this biological opinion is exceeded. This ITS includes reasonable and prudent measures and terms and conditions designed to minimize and monitor take of this proposed-threatened species.

Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to an otherwise lawful 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 an ITS.

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the taking must first be authorized by section 101(a)(5) of the MMPA. **Accordingly, the terms of this ITS 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 ITS is inoperative.

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. ADOT and PR1 have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, ADOT and PR1 must monitor and report the progress of the action and its impact on the species as specified in the ITS (50 CFR § 402.14(i)(3)). If ADOT or PR1 (1) fail to require the authorization holder to adhere to the terms and conditions of the ITS through enforceable terms that are added to the authorization, and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

10.1 Amount or Extent of Take

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or use a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14 (i)(1): see also 80 FR 26832; May 11, 2015).

10.1.1 Western DPS Steller Sea Lions

Based on the distances to Level A (injury) and Level B (harassment) sound thresholds calculated in Section 6.2.1.1, and the estimate of marine mammal occurrence calculated in Section 6.2.2 of the *Exposure Analysis* for the proposed activities, we expect a maximum of 86 Western DPS Steller sea lions may be behaviorally harassed by sound from pile driving and removal activities.

Based on monitoring reports for the Auke Bay Ferry Terminal and Statter Harbor projects in 2019 and 2021, it is estimated that groups of up to 50 Steller sea lions (from the Eastern or Western DPS) per day could be exposed to underwater sound associated with the pile driving and removal within Auke Bay from the AMHS East Terminal Improvements project. Up to 50 Steller sea lions per day for 61 days of pile driving equates to an estimated 3,050 exposures of Steller sea lions in the Auke Bay area. However, the ensonified area for the project action extends into Fritz Cove, a known winter foraging area for Steller sea lions (K. Raum-Suryan, pers. comm.). Based on the action area size being nearly double the area in Auke Bay, we increased the number of estimated takes to 6,100 Steller sea lions. Given that an estimated 1.4% of Steller sea lions in Lynn Canal are from the endangered Western DPS (Hastings et al. 2020), 85.4 of the total exposures are expected to be Western DPS Steller sea lions. For the purposes of authorizing take of individual animals, we rounded this up to 86 harassment takes during the course of the proposed action. We are reasonably certain these takes will occur.

10.1.2 Mexico DPS Humpback Whales

Based on the distances to Level A (harm) and Level B (harassment) sound thresholds calculated in Section 6.2.1.1, and the estimate of marine mammal occurrence calculated in Section 6.2.2 of the *Exposure Analysis* for the proposed activities, we expect a maximum of 10 Mexico DPS humpback whales may be behaviorally harassed by sound from pile driving and removal activities.

Based on humpback whale fluke identification and population estimates near Juneau (Krieger and Wing 1986, Teerlink 2017, Straley et al. 2018) and Dahlheim et al. (2009), we estimate that up to eight humpback whales will be exposed to underwater sound each day. Up to 61 days of in-water activity will occur, so the total number of humpback whales expected to be exposed to harassment level sound is 488. The proportion of these whales that are expected to be from the threatened Mexico DPS is 2% (Table 6) (Wade 2021). This proportion results in 9.76 ESA-listed whales (2% of 488), which we will round up to 10 for our estimate of harassment takes. We are reasonably certain these takes will occur.

10.1.3 Sunflower Sea Stars

Based on the estimated density of sunflower sea stars in the action area, the number of pilings being driven, and the surface area of the pilings that will come in contact with the sea floor, we estimate that up to one sunflower sea star (rounded up from 0.4569) may be crushed by a piling (Table 9).

In addition, based on the number of pilings that will be removed (47), and the assumption that up to three sunflower sea stars may be present on the piling when it is removed, we estimate that up to 141 individuals may be removed from the marine environment as a result of this proposed action. ADOT is proposing to gently carry the sunflower sea stars from the removed pilings and replace them immediately in the ocean close to the site. This relocation is beneficial relative to the animals being left in a concrete lot. Although there may be some handling stress resulting from this relocation plan, we anticipate it will be minor. We are reasonably certain that up to 141 sunflower sea stars will be relocated, resulting in harassment take of these individuals. We expect that the relocations will not result in harm or mortality to the individual sea stars. Therefore, we expected a total combined take of 142 sunflower sea stars; 141 harassment takes, and one lethal take.

10.2 Effect of the Take

The only takes authorized for ESA-listed marine mammals during the proposed action are takes by acoustic harassment. No serious injuries or mortalities of marine mammals are expected or authorized as part of this proposed action. This consultation has assumed that exposure to major sound sources might disrupt one or more behavioral patterns that are essential to an individual animal’s life history. However, any behavioral responses of these whales and pinnipeds to major sound sources and any associated disruptions are not expected to affect the reproduction, survival, or recovery of these species.

Only one sunflower sea star mortality is expected as a result of the proposed action assuming full implementation of the mitigation measures. This is an incredibly small number relative the entire population size. In addition, take prohibitions have not been proposed for this species at this point.

In Section 9 of this opinion, NMFS determined that the level of expected take, coupled with other effects of the proposed action, is not likely to result in jeopardy to Mexico DPS humpback whales, Western DPS Steller sea lions, or sunflower sea stars.

10.3 Reasonable and Prudent Measures (RPMs)

“Reasonable and prudent measures” are those actions necessary or appropriate to minimize the impacts of the amount or extent of incidental take. (50 CFR § 402.02). Failure to comply with the RPMs (and the terms and conditions that implements them) may invalidate the take exemption and result in unauthorized take.

RPMs are distinct from the mitigation measures that are included in the proposed action (described in Section 2.1.2). We presume that the mitigation measures will be implemented as described in this opinion. The failure to do so will constitute a change to the action that may require reinitiation of consultation pursuant to 50 CFR § 402.16.

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of Mexico DPS humpback whales, Western DPS Steller sea lions, and sunflower sea stars (if listed) resulting from the proposed action.

1. ADOT and PR1 must implement a monitoring program that includes all items described in the mitigation measures section of this opinion (Section 2.1.2) and allows NMFS AKR to evaluate the exposure estimates contained in this opinion and that underlie this ITS.
2. ADOT and PR1 must submit a final report to NMFS AKR that evaluates the mitigation measures and the results of the monitoring program.

10.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, ADOT and PR1 must comply with the following terms and conditions, which implement the RPMs described above and the mitigation measures set forth in Section 2.1.2 of this opinion. ADOT and PR1 have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR § 402.14(i)(3)).

Any taking that is in compliance with these terms and conditions is not prohibited under the ESA (50 CFR § 402.14(i)(5)). As such, partial compliance with these terms and conditions may invalidate this take exemption and result in unauthorized, prohibited take under the ESA. These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

To carry out RPM #1, ADOT, NMFS PR1, or their authorization holder must undertake the following:

A. The monitoring zones must be fully observed by qualified, NMFS-approved PSOs during all in-water work in order to document observed incidents of harassment as described in the mitigation measures associated with this action.
B. If take of Steller sea lions, humpback whales, or sunflower sea stars approaches the number of takes authorized in the ITS, ADOT will notify NMFS by email, attn: Sadie.Wright@noaa.gov (Table 4), and discuss the need for reinitiation of consultation.

To carry out RPM #2, ADOT, NMFS PR1, or their authorization holder must undertake the following:

A. Adhere to all monitoring and reporting requirements as detailed in the IHA issued by NMFS under section 101(a)(5) of the MMPA.

B. Adhere to all monitoring and reporting requirements in the PSMMP or revisions described in this biological opinion.
C. Submit a project specific report within 90 days of the conclusion of the project that analyzes and summarizes interactions with sunflower sea stars, humpback whales, and Steller sea lions during this project to the Protected Resources Division, NMFS by email (Table 4). This report must contain the following information:
   - Date and time that monitored activity begins or ends;
   - Construction activities occurring during each observation period;
   - Weather parameters (e.g., percent cover, visibility);
   - Water conditions (e.g., sea state, tide state);
   - Species, numbers, and, if possible, sex and age class of marine mammals and size of sunflower sea stars;
   - Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from construction activity;
   - Distance from construction activities to marine mammals and distance from the marine mammals to the observation point; and
   - Locations of all marine mammal and sunflower sea star observations.

11 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR § 402.02). For this project, NMFS AKR recommends:

1. ADOT should ensure that the entities responsible for conducting the sunflower sea star surveys have practice and expertise with the methodology they use to conduct the survey, prior to conducting the actual surveys. In addition, ADOT should invite PRD biologists to the site when a sunflower sea star survey is being conducted or the equipment to do the survey is being tested, to enable PRD to better understand the efficacy of the selected methods and equipment.
2. ADOT should publish, or make widely available, a report detailing the methodology used and results of the sunflower sea star surveys conducted as part of this proposed action. Those findings will aid other action agencies and future projects in developing protocols for future surveys, and will increase general understanding of sunflower sea star movements and densities, particularly in the Juneau area.

3. ADOT should continue to provide innovative outreach on their ferries and in their public facilities informing the public about Alaskan wildlife including marine mammals and sea stars. PRD can contribute information and suggestions.
4. All project vessel crews and ferry crews should participate in the WhaleAlert program to report real-time sightings of whales while transiting in the waters of Southeast Alaska and to minimize the risk of vessel strikes. More information is available at: https://www.fisheries.noaa.gov/resource/tool-app/whale-alert

In order to keep NMFS's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, ADOT and NMFS PR1 should notify NMFS of any conservation recommendations they implement in their final action.

12 REINITIATION OF CONSULTATION

As provided in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately (50 CFR § 402.14(i)(4)).

The taking of Mexico DPS humpback whales and Western DPS Steller sea lions will be by incidental harassment only. The taking of those two marine mammal species by serious injury or death is prohibited and will result in the modification, suspension, or revocation of the ITS.

13 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

13.1 Utility

This document records the results of an interagency consultation. The information presented in this document is useful to NMFS, ADOT, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website: https://www.fisheries.noaa.gov/alaska/consultations/section-7-biological-opinions-issued-alaska-region

The format and name adhere to conventional standards for style.

13.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

13.3 Objectivity

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the *References* section. The analyses in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

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