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 Opinion and Section 7(a)(4) Conference Report

USACE Unalaska Bay Bar Reduction Project, Iliuliuk Bay, Alaska

NMFS Consultation Number: AKRO-2022-03610

Action Agencies: U.S. Army Corps of Engineers; National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division

Affected Species and Determinations:

ESA-Listed Species	Status	Is the Action Likely to Adversely Affect Species?	Is the Action Likely to Adversely Affect Critical Habitat?	Is the Action Likely To Jeopardize the Species?	Is the Action Likely To Destroy or Adversely Modify Critical Habitat?
Steller Sea Lion, Western DPS (*Eumetopias jubatus)*	Endangered	Yes	No	No	No
Humpback Whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	Yes	No	No	No
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	Yes	No	No	No
Blue whale (*Balaenoptera musculus*)	Endangered	No	N/A	No	N/A
Fin Whale (*Balaenoptera physalus*)	Endangered	No	N/A	No	N/A
North Pacific Right Whale (*Eubalaena japonica*)	Endangered	No	No	No	No
Sperm Whale (*Physeter macrocephalus*)	Endangered	No	N/A	No	N/A
Sei Whale	Endangered	No	N/A	No	N/A

(*Balaenoptera borealis*)					
Gray Whale, Western North Pacific DPS (*Eschrichtius robustus*)	Endangered	No	N/A	No	N/A
Killer Whale, Southern Resident DPS *(Orcinus orca)*	Endangered	No	No	No	No
Sunflower Sea Star (*Pycnopodia helianthoides*)	Proposed-Threatened	No	N/A	No	N/A

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

Jonathan M. Kurland
Regional Administrator

Date: November 16, 2023

Accessibility of this Document

Every effort has been made to make this document accessible to individuals of all abilities and compliant with Section 508 of the Rehabilitation Act. The complexity of this document may make access difficult for some. If you encounter information that you cannot access or use, please email us at Alaska.webmaster@noaa.gov or call us at 907-586-7228 so that we may assist you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TERMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AKR	Alaska Region
BA	Biological Assessment
cm	Centimeter
CFR	Code of Federal Regulations
dB re 1µPa	Decibel referenced to 1 micropascal
District Court	U.S. District Court for the District of Alaska
DPS	Distinct Population Segment
DQA	Data Quality Act
ESCA	Endangered Species Conservation Act
ESA	Endangered Species Act
°F	Fahrenheit
FR	Federal Register
GPS	Global Positioning System
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
IWC	International Whaling Commission
kHz	Kilohertz
km	Kilometer(s)
lb	Pound
L_E	Cumulative Sound Exposure Level
m	Meter(s)
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
µPa	Micropascal
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
Opinion	Biological Opinion
Pa	Pascals

PBF	Physical or Biological Features
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
Rrms	Root Mean Square
RPA	Reasonable and Prudent Alternative
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level
SPL	Sound Pressure Level
SPL_{PK}	Peak Sound Pressure Level
TTS	Temporary Threshold Shift
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Services
WNP	Western North Pacific

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)).

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 without 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. Army Corps of Engineers (USACE) and the National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division (PR1). The USACE proposes to lower an existing bar in Iliuliuk Bay by 16-feet using dredging and if necessary, explosives. Dredged fill will be placed back in the water near the dredging area. PR1 proposes to issue an Incidental Harassment Authorization under the Marine Mammal Protection Act for this work. The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's biological opinion (opinion) on the effects of this proposed project on endangered and threatened species and designated critical habitat.

The opinion and ITS were prepared by NMFS Alaska Region in accordance with section 7(b) of the ESA (16 U.S.C. § 1536(b)), and implementing regulations at 50 CFR part 402.

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

This opinion is based on information provided in the IHA application (USACE 2022), the proposed IHA (88 FR 21630, April 11, 2023), and the submitted Biological Assessment (BA) (USACE 2023). Other sources of information relied upon include consultation communications (emails and virtual meetings), recent consultations completed in the same region, previous monitoring reports, and marine mammal surveys conducted in the Aleutian Islands. A complete record of this consultation is on file at NMFS's Anchorage, Alaska office.

The proposed action involves the dredging and possible blasting of a terminal moraine bar within Iliuliuk Bay, Alaska, which is restricting access to Dutch Harbor.

Figure 1: Picture of Dutch Harbor and Iliuliuk Bay.

This opinion considers the effects of dredging, blasting, and vessel transit, and the associated proposed issuance of an IHA, on the endangered North Pacific right whale (*Eubalaena japonica*), threatened Mexico distinct population segment (DPS) and endangered Western North Pacific (WNP) DPS humpback whale (*Megatera novaeangliae*), endangered blue whale (*Balaenoptera musculus*), endangered fin whale (*Balaenoptera physalus*), endangered sperm whale (*Physeter macrocephalus*), endangered sei whale (*Balaenoptera borealis*), endangered WNP DPS gray whale (*Eschrichtius robustus*), endangered Southern Resident DPS killer whale (*Orcinus orca*), endangered Western DPS Steller sea lion (*Eumetopias jubatus*), proposed-threatened sunflower sea star (*Pycnopodia helianthoides*), and designated critical habitat for the Mexico DPS and WNP DPS humpback whale, Southern Resident DPS killer whale, and Steller sea lion. There is no designated critical habitat for the North Pacific right whale in the action area.

1.2 Consultation History

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

- **November 17, 2022:** NMFS received notification of PR1 contact for consultation
- **December 15, 2022-March 1, 2023:** NMFS, PR1, and USACE had numerous discussions over blasting and dredging isopleths
- **January 24, 2023:** The USACE resubmitted their IHA application with additional details and corrections
- **February 5, 2023:** USACE resubmitted a BA for the project
- **February 27, 2023:** USACE resubmitted their IHA application with corrections
- **February 28, 2023:** USACE resubmitted their IHA application with additional corrections
- **April 11, 2023:** PR1 published the proposed IHA in Federal Register and requested formal consultation
- **May 11, 2023:** NMFS initiated formal consultation
- **June 12, 2023:** NMFS provided recommended mitigation measures for the consultation as well as recommending the addition of WNP DPS gray whales, North Pacific right whales, and sunflower sea stars (proposed listing) to the list of potentially affected species
- **June 13, 2023:** USACE agreed to addition of recommended species, but has questions on recommended mitigation measures
- **June 20, 2023:** USACE agreed to recommended mitigation measures
- **June 21, 2023:** USACE resubmitted their IHA application with updated monitoring/shutdown zones
- **October 5, 2023:** NMFS submitted questions to USACE regarding transit of project-related vessels to the project site and spill prevention and response measures
- **October 5, 2023:** NMFS received response to spill prevention and response question
- **October 11, 2023:** NMFS received an addendum to the BA analyzing transit of project-specific vessels to the project site

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 or upon the high seas. 50 C.F.R. § 402.02.

Dutch Harbor, Alaska, is the only deep draft, year-round, ice-free port along the 1,200-mile (1,931 km) Aleutian Island chain. The harbor is a vital sanctuary for vessels traveling along or near the island chain who need refuge from dangerous weather and/or ocean conditions. However newer, larger, vessels are unable to enter the harbor due to a bar located at the mouth of Iliuliuk Bay that is 42 feet (12.8 m) below the mean lower low water (MLLW) line. The USACE plans to lower the bar's height by 16 feet (4.9 m) using dredging, and if necessary, confined explosives. The bar's expected height after lowering will be 58 feet (17.7 m) below the MLLW line. Dredged-up material will be placed back in the water at a site adjacent to the dredge location.

Once the bar is lowered, the harbor will be able to provide safe access for larger deep-draft vessels. This will not only allow safe delivery of fuel and goods to the Dutch Harbor community, but also increase safety for vessel crews. Currently, a deep-draft vessel cannot enter the port in the event of dangerous conditions at sea. If conditions are bad enough, the crews of these vessels must depart the vessel in open-waters and come over the bar, into the port's protection, on smaller vessels. This increases the risk to crew and potential rescue personnel. There is also an increased risk of damage occurring to the large and smaller vessels from having to be out in potentially dangerous conditions. Additionally, the bar at its current height prevents deep-draft vessels from being able to access the harbor for repairs and complicates medical evacuations. Therefore, lowering the bar will increase safety for all involved in shipping and rescue operations, as well as increasing cargo transportation efficiency.

Geophysical surveys of the action area indicate that the bar is made up of terminal moraine from when Iliuliuk Bay was last glaciated. The survey also indicated the material that makes up the moraine might be highly compacted. In the event that the moraine is too compacted to excavate, or if large boulders are found, blasting will be used to loosen and break up the bar. The USACE estimates that up to 50 percent of the bar might need to be blasted using approximately 1,800 drilled boreholes and up to 24 total blasting events.

The proposed IHA would be effective from November 1, 2023, to October 31, 2024. Within that period in-water work will take 150 to 200 days over 12 months. Confined blasting will occur over a maximum of 24 non-consecutive days. Blasting will only occur if it's needed to break up regolith material that is too large and/or compacted to dredge.

2.1.1 Proposed Activities

2.1.1.1 Dredging and Fill Placement

Dredging will be performed by a clam shell or long-reach excavator (backhoe) from a barge that will be moved around the dredging area using a tugboat. The channel will be dredged with a side slope of 1-vertical/2-horizontal, and an extra two-foot-deep tolerance, meaning that if the excavator is unsure of the depth, they can dig to a maximum of 60 feet (18.3 m) below MLLW. Geotechnical drilling in 2022 indicates that the material to be dredged is dense, consolidated, glacial drift deposit on top of bed rock. The USACE plans to dredge approximately 182,000 cubic yards (139,149 cubic meters) of material from a 600-foot by 600-foot area (183 x 183-m) in the Bay. The dredged material will be placed on a split hopper barge for transport to the adjacent dump site where it will then be placed back in waters that are about 100 feet (30.5 meters) deep.

Dredging will take place for 10 hours a day over 150 to 200 days. Dredge disposal will take place the same days that dredging occurs. As a result, dredge disposal will occur for up to one hour a day over 150-200 days.

2.1.1.2 Blasting

Confined underwater blasting will be used only if dredging is not capable of removing the necessary material. Due to the formation of the bar, it is predicted that 50 percent of the top layer of material that makes up the bar is made of a hard compact crust or contains boulders too large to dredge. In the event that the excavator cannot break through the crust, blasting will be required. The USACE estimates that a maximum of 50 percent of the dredging site will require blasting. However, that is a conservative estimate, and it is possible that less blasting will be needed. In that event, the amount of blasting within the area will be decreased to the minimum amount needed.

The blasting plan calls for 93.5 lb (42.4 kg) blast charges to be placed inside a lined 3.5-4 inches (8.9-10.2 cm) in diameter borehole and stemmed. Stemming is when the borehole is packed back in with gravel in order to reduce impacts to the water above the blast, which transfers the blasting force into the bar to break up the hard crust or nuisance boulders. Smaller charge sizes may be used at the discretion of the USACE and the contractor. Borehole drilling and charge placement is likely to occur from a jack-up barge that will be moved around the blasting area by a tugboat. Boreholes will be drilled to a maximum depth of 60 feet (18.3 m) below the MLLW; however, they may be drilled shallower if conditions allow. The boreholes will be drilled in a 10-foot by 10-foot (3 x 3-m) grid pattern over up to 50 percent of the 600-foot by 600-foot (183 x 183-m), 360,000 square foot (33,445 m^2) dredging area. As a result, 1,800 boreholes will be required to cover the 180,000 square foot (16,722.5 m^2) area that may require blasting. Boreholes will be blasted in groups of 75 holes with 15 millisecond delays between the charges. The delay helps to limit the overall explosive force perceived at one time, while maintaining the effectiveness of the blast. For safety and due to time restraints, only one 75-hole blast will occur in a day. In order for all 1,800 boreholes to be detonated, 24 non-consecutive blasting days will be required, with one blasting event lasting just over one second each of those 24 days.

Safety restrictions required for blasting impose some limitations on blasting activities and possible mitigation measures available to protect ESA-listed species. The explosives cannot be placed and then left undetonated for longer than 24 hours because after that they become a risk to safety. The charges also cannot be set off at night. Therefore, in the event that charges are set and then an ESA-listed species enters the blasting area, blasting will be delayed as long as possible. However, the charges will be detonated when delaying is no longer possible. All other measures to avoid injury to an ESA-listed species will be utilized, but non-mortality auditory harassment or harm is authorized for blasting in the event that the charges must be set off and an ESA-listed species is within an acoustic harm or harassment zone.

2.1.1.3 Vessel Transits

Up to five project-dedicated tugboats with barges will deploy to the project site from Seattle, Washington, and return there via those routes upon completion of the work (i.e., one round trip for the project). USACE estimates that April would be the earliest timing of vessel departure from Seattle and the vessel would return to Seattle by the end of November. The vessels will transit along standard commercial shipping routes when departing from and returning to Seattle, and will generally travel no more than 8 knots (outside of when the mitigation measures for vessel transit specified in Section 2.1.2 are in effect). The tugs and barges will be kept at the dredge site as much as possible and temporarily moved to a protected area inside the Dutch Harbor spit as needed due to weather. Crew boats will be used to transport workers between the dredge site and docks located inside the Dutch Harbor spit, a distance of less than 1.6 miles (2.6 km), at least twice per day for shift changes; additional trips are likely when other staff need to access the tugs/barges or the shore.

2.1.2 Mitigation Measures

General Mitigation Measures

1. The USACE will inform NMFS of impending in-water activities a minimum of one week prior to the onset of those activities (email information to AKR.section7@noaa.gov).
2. If construction activities will occur outside of the time window specified in this letter, the applicant will notify NMFS of the situation at least 60 days prior to the end of the specified time window to allow for reinitiation of consultation.
3. Consistent with AS 46.06.080, trash will be disposed of in accordance with state law. In addition, the project proponent will ensure that all closed loops (e.g., packing straps, rings, bands) will be cut prior to disposal. In addition, the project proponent will secure all ropes, nets, and other marine mammal entanglement hazards so they cannot enter public waterways.

Spill Prevention

4. All materials will be appropriately managed, containerized, and secured during movement, in accordance with applicable regulations and policies.
5. Spill prevention measures will be in place on barges (drip pans in use under vehicles), spill cleanup equipment will be available on deck (absorbent pads, dry sweep, small absorbent booms, etc.), and equipment will be checked daily for any leaks.

Protected Species Observer (PSO)-Related Measures

6. At least three PSOs will perform PSO duties onsite throughout blasting.
7. One PSOs will perform PSO duties onsite throughout dredging.
8. For each in-water activity, PSOs will monitor all marine waters within the indicated

shutdown zone for that activity (Table 1).

9. PSOs will be positioned such that they will collectively be able to monitor the entirety of each activity's shutdown zones. The proponent will coordinate with NMFS on the placement of PSOs prior to commencing in-water work.

10. Prior to commencing blasting or dredging, PSOs will scan waters within blasting or dredging shutdown zones and confirm no listed species are within the shutdown zones for at least 30 minutes immediately prior to initiation of the in-water activity. If one or more listed species are observed within the corresponding shutdown zones, the in-water activity will not begin until the listed species exit the shutdown zone of their own accord, or the shutdown zones has remained clear of listed species for 30 minutes immediately prior to blasting or dredging. The exception being that if charges have been deployed for nearly 24 hours and must be detonated for safety reasons related to the explosives, and marine mammals appear to be persistently present in the shutdown zone for explosives, charges may be detonated.

11. The on-duty PSOs will continuously monitor the shutdown zones and to the extent practicable, the monitoring zone, during blasting or dredging operations for the presence of listed species.

Table 1. Shutdown, monitoring, and MMPA Level A zones for blasting and dredging. Shutdown zones are derived from MMPA Level B isopleths. For blasting, distances are measured from the outermost points of the grid of charges that make up a blast. For other activities, distances are measured from the sound source.

Species	Activity	Shutdown Zone (m)	Monitoring Zone (m)	Acoustic Harm (Level A) Zone (m)
Humpback whale	Explosives	1,918	2,500	345
	Dredging	300	300	N/A
Steller sea lion	Explosives	250	2,500	92
	Dredging	300	300	N/A
North Pacific Right Whale & Gray Whale	Explosives	1,918	2,500	N/A
	Dredging	300	300	N/A

12. In-water activities will take place only:
    a. between local sunrise and sunset.
    b. when the entire associated shutdown zone is visible (e.g., monitoring effectiveness is not reduced due to rain, fog, snow, haze or other environmental/atmospheric conditions).
13. If visibility degrades such that a PSO can no longer ensure that the shutdown zones remains devoid of listed species during blasting or dredging, the crew will cease in-water work until the entire shutdown zone is visible and the PSO has indicated that the zone has remained devoid of listed species for 30 minutes.
14. If a listed species is observed within a shutdown zone or is otherwise harassed, harmed, injured, or disturbed, PSOs will immediately report that occurrence to NMFS using the contact information specified in Table 2.

<u>Protected Species Observer Requirements</u>

15. PSOs must be independent of the activity contractor (for example, employed by a subcontractor) and have no other assigned tasks during monitoring periods.
16. The action agency or its designated non-federal representative will provide resumes or qualifications of PSO candidates to the NMFS consultation biologist or section 7

coordinator for approval at least one week prior to in-water work. NMFS will provide a brief explanation of lack of approval in instances where an individual is not approved.

17. At least one PSO will have prior experience performing the duties of a PSO during construction activity
18. At least one PSO on the project will complete PSO training prior to deployment (e.g., see https://aisobservers.com/protected-species/new-protected-species-observer-training/). The training will include:
    a. field identification of marine mammals and marine mammal behavior;
    b. ecological information on marine mammals and specifics on the ecology and management concerns of those marine mammals;
    c. ESA and MMPA regulations;
    d. proper equipment use;
    e. methodologies in marine mammal observation and data recording and proper reporting protocols; and
    f. an overview of PSO roles and responsibilities.
19. Where a team of three or more PSOs are required, a lead observer or monitoring coordinator will be designated
20. PSOs will:
    a. have the ability to effectively communicate orally, by radio and in person, with project personnel to provide real-time information on listed species;
    b. be able to collect field observations and record field data accurately and in accordance with project protocols and provide an understandable summary of those observations;
    c. be able to identify protected species that occur in the action area at a distance equal to the outer edge of the shutdown zone;
21. PSOs will work in shifts lasting no longer than 4 hours with at least a 1-hour break from monitoring duties between shifts. PSOs will not perform PSO duties for more than 12 hours in a 24-hour period.
22. PSOs will have the ability and authority to order appropriate mitigation response, including shutdowns, to avoid takes of all listed species.
23. The PSOs will:
    a. communicate in real time with the construction crew
    b. effectively observe the entirety of the shutdown zone

c. identify marine mammals

d. record the date, time, species, and coordinates of all observed marine mammals.

e. have instruments that allow them to estimate geographic coordinates of observed marine mammals

f. possess a legible copy of this BiOp and all appendices

g. possess legible and fillable observations record forms allowing for data entry.

24. Prior to commencing in-water work or at changes in watch, PSOs will establish a point of contact with the construction crew. The PSO will brief the point of contact as to the shutdown procedures if listed species are observed likely to enter or within the shutdown zone, and will request that the point of contact instruct the crew to notify the PSO when a marine mammal is observed. If the point of contact goes "off shift" and delegates his duties, the PSO must be informed and brief the new point of contact.

Dredging/Screeding

25. All vessels involved in dredging, screeding, and underwater excavating operations, including survey vessels, will transit at velocities below 10 knots.

26. Dredging, screeding and underwater excavating activities will shut down whenever a listed marine mammal approaches within 300 m.

27. Following a lapse of dredging/screeding activities of more than 30 minutes, the PSO will authorize resumption of dredging/screeding only after the PSO provides assurance that listed species have not been present within 300 m of the dredging/screeding operation for at least 30 minutes immediately prior to resumption of operations.

Placement of Fill

28. Fill material will consist of rock fill that is free of fine sediments to the extent practical, to reduce suspended materials from entering the water column.

Project-Dedicated Vessels

29. While underway, vessel operators will:

a. maintain a watch for marine mammals at all times while underway;

b. stay at least 91 m (100 yards) away from listed marine mammals, except they will remain at least 460 m (500 yards) from endangered North Pacific right whales;

c. travel at less than 5 knots (9 km/hour) when within 274 m (300 yards) of a whale;

d. avoid changes in direction and speed when within 274 m (300 yards) of a whale, unless doing so is necessary for maritime safety;

e. not position vessel(s) in the path of a whale, and will not cut in front of a whale in a way or at a distance that causes the whale to change direction of travel or behavior (including breathing/surfacing pattern);

f. check the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged;

g. reduce vessel speed to 10 knots or less when weather conditions reduce visibility to 1.6 km (1 mile) or less;

30. Adhere to the Alaska Humpback Whale Approach Regulations when vessels are transiting to and from the project site: (see 50 CFR §§ 216.18, 223.214, and 224.103(b)) (note: these regulations apply to all humpback whales). Specifically, pilot and crew will not:

    a. approach, by any means, including by interception (i.e., placing a vessel in the path of an oncoming humpback whale), within 100 yards of any humpback whale;

    b. cause a vessel or other object to approach within 100 yards of a humpback whale;

    c. disrupt the normal behavior or prior activity of a whale by any other act or omission.

31. If a whale's course and speed are such that it will likely cross in front of a vessel that is underway, or approach within 91 m (100 yards) of the vessel, and if maritime conditions safely allow, the engine will be put in neutral and the whale will be allowed to pass beyond the vessel, except that vessels will remain 460 m (500 yards) from North Pacific right whales.

32. Vessels will take reasonable steps to alert other vessels in the vicinity of whale(s).

33. Vessels will not allow lines to remain in the water unless both ends are under tension and affixed to vessels or gear. No materials capable of becoming entangled around marine mammals will be discarded into marine waters.

Vessel Transit, North Pacific Right Whales, and their Critical Habitat

34. Vessels will:

    a. remain at least 460 m (500 yards) from North Pacific right whales.

    b. avoid transiting through designated North Pacific right whale critical habitat if practicable (50 CFR§ 226.215). If traveling through North Pacific right whale critical habitat cannot be avoided, vessels will:

        i. travel through North Pacific right whale critical habitat at 5 knots or less; or at 10 knots or less while PSOs maintain a constant watch for marine mammals from the bridge

ii. maintain a log indicating the time and geographic coordinates at which vessels enter and exit North Pacific right whale critical habitat.

Vessel Transit, Western DPS Steller Sea Lions, and their Critical Habitat.

35. Vessels will not approach within 5.5 km (3 nm) of rookery sites listed in (50 CFR § 224.103(d)).
36. Vessels will not approach within 914 m (3,000 ft) of any Steller sea lion haulout or rookery.

Blasting

37. Charges for blasting will be laid as early as possible in the day to allow for the longest possible delay time should a marine mammal appear within the monitoring zones. Charges for blasting will not be laid if marine mammals are within the Level A pre-clearance zone or appear likely to enter the Level A pre-clearance zone (Table 1).

38. Blasting will only be planned to occur in good visibility conditions, and at least 30 minutes after sunrise and at least one hour prior to sunset.

39. To minimize the potential for an unavoidable exposure, detonation will be initiated as soon as possible after the charges are deployed.

40. If a marine mammal is observed entering or is within the shutdown zones indicated in Table 1, blasting will be delayed until the zones are clear of marine mammals for 30 minutes. This will continue as long as practicable within the constraints of the blasting design, but not beyond sunset on the same day as the charges cannot lay dormant for more than 24 hours.

41. If a detonation occurs when a marine mammal is known to be within the shutdown zone, PSOs will observe the blast area for two hours after the blasting event, or until visibility or safety conditions decline to the point that monitoring is no longer feasible, to determine as much as possible about the behavior and physical status of the marine mammal present during the blasting event.

42. If a detonation occurs when a marine mammal is known to be within the shutdown zones, PSOs will notify the NMFS Alaska Region Protected Resources Division immediately (at akr.prd.section7@noaa.gov, Table 2).

43. If a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized takes are met, is observed approaching or within the monitoring zones (Table 1), a blast must be postponed when doing so is consistent with charge-detonation safety constraints (whereby detonation must occur within 24 hours of charge deployment). Activities must not resume until the animal has been confirmed to have left the area or the animal has not been observed in the

monitoring zone for 30 minutes.

44. Industry blasting best management practices (BMP) to reduce the potential adverse impacts on protected species from in-water noise and overpressure. BMPs include:
    a. using stemming procedures for blasting;
    b. setting off no more than 75 delayed charges in a day;
    c. placing charges a minimum of 4 feet from other charges;
    d. delaying consecutive charges by at least 15 milliseconds;
    e. limiting the weight of delayed charges to no more than 93.5 pounds;
    f. adhering to all federal and state blasting regulations, which include the development and adherence to blasting plans, monitoring, and reporting.

General Data Collection and Reporting

Data Collection

45. PSOs will record observations on data forms or into electronic data sheets.

46. The project proponent will ensure that PSO data will be submitted electronically in a format that can be queried such as a spreadsheet or database (i.e., digital images of data sheets are not sufficient).

47. PSOs will record the following:
    a. the date, shift start time, shift stop time, and PSO identifier;
    b. date and time of each reportable event (e.g., a marine mammal observation, operation shutdown, reason for operation shutdown, change in weather);
    c. weather parameters (e.g., percent cloud cover, percent glare, visibility) and sea state where the Beaufort Wind Force Scale will be used to determine sea-state (https://www.weather.gov/mfl/beaufort);
    d. species, numbers, and, if possible, sex and age class of observed marine mammals, and observation date, time, and location;
    e. the predominant anthropogenic sound-producing activities occurring during each marine mammal observation;
    f. bearing and direction of travel of observed marine mammal(s);
    g. observations of marine mammal behaviors and reactions to anthropogenic sounds and presence;
    h. initial, closest, and last location of marine mammals, including distance from observer to the marine mammal, and minimum distance from the predominant sound-producing activity or activities to marine mammals;
    i. whether the presence of marine mammals necessitated the implementation of

mitigation measures to avoid acoustic impact, and the duration of time that normal operations were affected by the presence of marine mammals;

j. geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates will be recorded in decimal degrees, or similar standard and defined coordinate system).

Data Reporting

48. All observations of North Pacific right whales will be reported to NMFS within 24 hours. These observation reports will include the following information:
    a. date, time, and geographic coordinates of the observation(s);
    b. number of North Pacific right whales observed, including number of adults/juveniles/calves observed, if determinable;
    c. Environmental conditions as they existed during each observation event, including sea conditions, weather conditions, visibility, lighting conditions, and percent ice cover.

49. Observations of humpback whales will be transmitted to AKR.section7@noaa.gov by the end of the calendar year, including:
    a. photographs (especially flukes) and video obtained.
    b. geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates will be recorded in decimal degrees, or similar standard (and defined) coordinate system).
    c. Number of humpback whales observed, including number of adults/juveniles/calves observed (if determinable).
    d. Environmental conditions as they existed during each observation event, including sea conditions, weather conditions, visibility, lighting conditions, and percent ice cover.

Unauthorized Take

50. If a PSO determines an ESA-listed species has been disturbed, harassed, harmed, injured, or killed, the PSO will report the incident to NMFS within one business day. For example, if a listed marine mammal(s) is observed entering a shutdown zone before operations can be shut down, or if the mammal is injured or killed as a direct or indirect result of this action. 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, or a species for which take authorization has been granted but the authorized take amount has been met. These PSO records will include: all information to be provided in the final report (see Mitigation Measures under the *Final Report* heading

below):

a. all information to be provided in the final report (see Mitigation Measures under the *Final Report* heading below):

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; and

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;

h. Photographs or video footage of the animal(s) (if available).

Stranded, Injured, Sick or Dead Marine Mammal (not associated with the project)

50. 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 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), and behavior of live-stranded marine mammals.

Illegal Activities

51. 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 2).

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

Monthly Report

53. Submit interim monthly PSO monitoring reports, including data sheets. These reports will include a summary of marine mammal species and behavioral observations, shutdowns or delays, and work completed.

54. 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 June, 2023 will be submitted by July 15th, 2023.

Final Report

55. A final report will be submitted to NMFS within 90 calendar days of the completion of the project summarizing the data recorded and submitted to AKR.section7@noaa.gov . The report will summarize all in-water activities associated with the proposed action, and results of PSO monitoring conducted during the in-water project activities.
56. The final report will include
    a. summaries of monitoring efforts, including dates and times of construction, dates and times of monitoring, dates and times and duration of shutdowns due to marine mammal presence;
    b. date and time of marine mammal observations, geographic coordinates of marine mammals at their closest approach to the project site, marine mammal species, numbers, age/size/sex categories (if determinable), and group sizes.
    c. number of marine mammals observed (by species) during periods with and without project activities (and other variables that could affect detectability);
    d. observed marine mammal behaviors and movement types versus project activity at time of observation;
    e. numbers of marine mammal observations/individuals seen versus project activity at time of observation
    f. distribution of marine mammals around the action area versus project activity at time of observation.
    g. digital, queryable documents containing PSO observations and records, and digital, queryable reports.

Summary of Agency Contact Information

Table 2: 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

Reports & Data Submittal	AKR.section7@noaa.gov (please include NMFS AKRO tracking number in subject line)
Stranded, Injured, Entangled, or Dead Marine Mammal *(not related to project activities)*	NOAA Fisheries Stranding Hotline (24/7 coverage) 877-925-7773
Oil Spill & Hazardous Materials Response	U.S. Coast Guard National Response Center: 1-800-424-8802 & AKRNMFSspillResponse@noaa.gov
Illegal Activities *(not related to project activities; e.g., feeding, unauthorized harassment, or disturbance to marine mammals)*	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 project is located south of Unalaska Bay which is within the Aleutian Island Chain. The bar that will be lowered is located at the mouth of Iliuliuk Bay (Figure 1), which is itself within the southern section of Unalaska Bay. The communities of Dutch Harbor and Unalaska are approximately 1.75 miles (2.8 km) and 2.5 miles (4 km) to the Southwest of the project site respectively. Amaknak Island surrounds the project site to the northwest and the Island of Unalaska surrounds it to the south and southeast. Iliuliuk Bay and Dutch Harbor are both active marine commercial and industrial areas.

The action area includes: (1) the area in which dredging and blasting, and other in-water work activities will take place (Figure 2), and (2) the ensonified area around blasting, and other in-water work activities associated with the project (Figure 3). The expected vessel transit routes are also considered part of the action area. The project-dedicated tugboats with barges will travel along standard commercial shipping routes to/from Seattle (Figure 4). In addition, crew boats will be used to transport project personnel between the dredging site and docks located inside the Dutch Harbor spit.

The area of the bar that will be lowered is approximately 600 feet by 600 feet (183 x 183 m). A site immediately adjacent to the southeast of the bar will be used as a dumping location for the dredged material. Effects such as increased turbidity or petroleum product spills due to dredging and disposal activities are not expected to expand far from the location being dredged at the time.

Blasting will have an effect on waters outside the project area that will far exceed the area affected by dredging due to underwater sound produced by blasts. The ensonified area will extend 1,918 m (1.2 miles) out from the blast. Therefore, the action area includes waters within 1,918 m of the bar location (Figure 3).

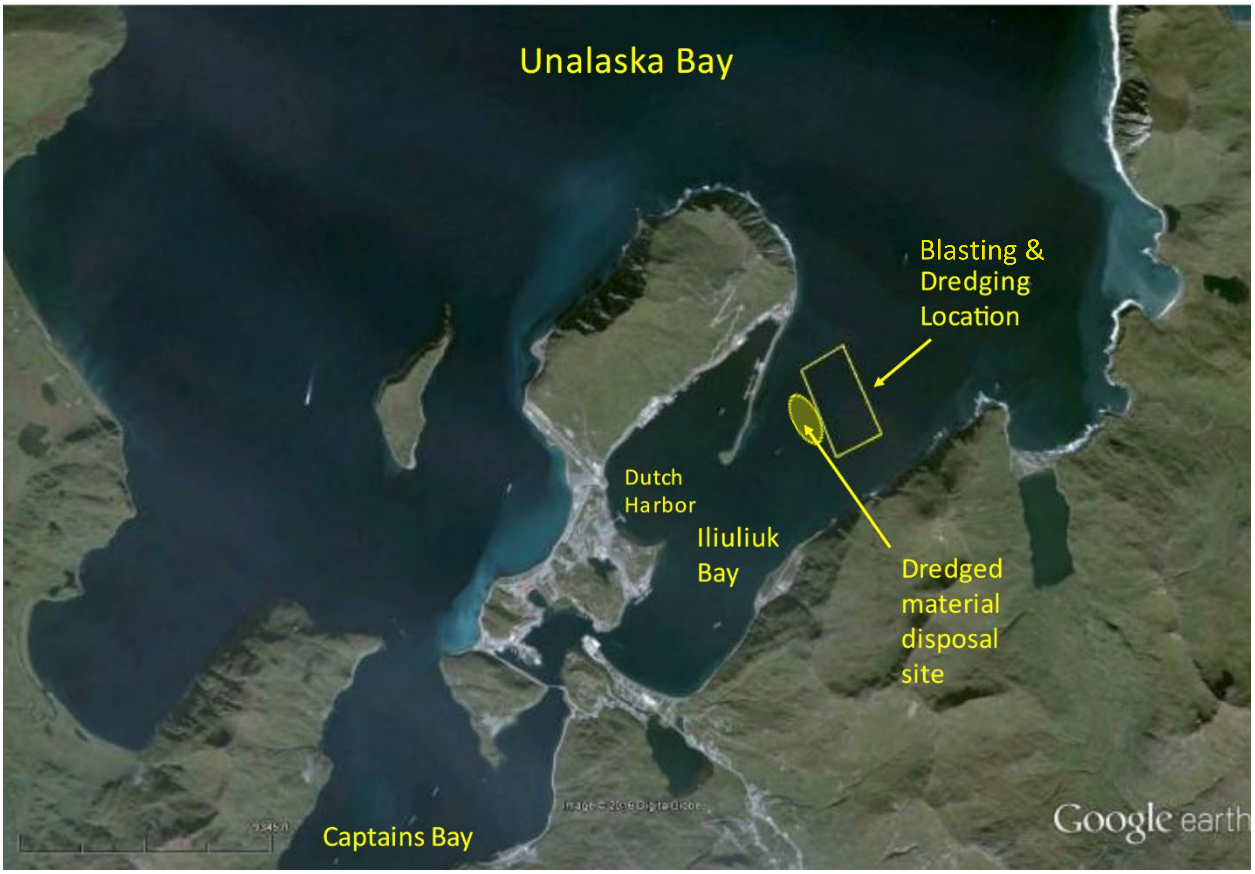

Figure 2: Dutch Harbor with dredging and disposal sites. If blasting occurs, it will be within the dredging area.

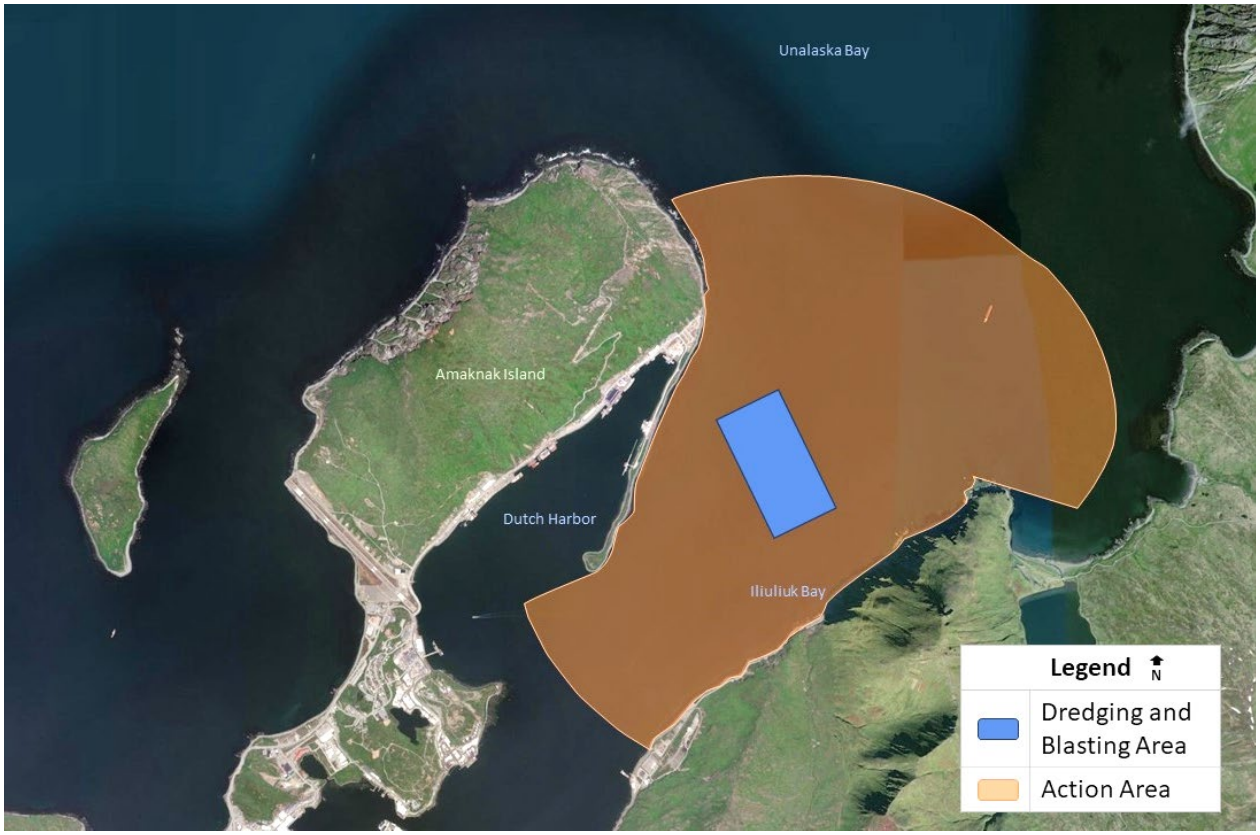

Figure 3: Approximation of ensonified action area for blasting (Created by NOAA biologist). The action area also includes the transit routes of crew boats between the dredging and blasting area and docks located on the inside of the Dutch Harbor spit, and the route of project barges between Seattle, Washington, and Dutch Harbor.

Figure 4: Approximate range of potential vessel routes for project barges between Seattle and the Iliuliuk Bay project site (a broad area is identified for assessment purposes, as exact routes depend on the contractor and determinations of the vessel captains).

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 3, 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).

Designation(s) of critical habitat prior to 2016 use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (81 FR 7414; February 11, 2016) replaced these terms with the term 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, our use of the term PBF also applies to Primary Constituent Elements and essential features.

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 range-wide 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 range-wide 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*; anticipated 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 action. 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 gender 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 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 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 a reasonable and prudent alternative (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 habitats specified in Table 3.

Table 3: Listing status and critical habitat designation for species considered in this opinion.

Species	Status	Listing	Critical Habitat
North Pacific Right Whale *(Eubalaena japonica)*	Endangered	NMFS 2008, 73 FR 12024	NMFS 2008, 73 FR 19000 None in the action area
Humpback Whale, Mexico DPS *(Megaptera novaeangliae)*	Threatened	NMFS 2016, 81 FR 62260	NMFS 2021 86 FR 21082
Humpback Whale, Western North Pacific DPS *(Megaptera novaeangliae)*	Endangered	NMFS 2016, 81 FR 62260	NMFS 2021 86 FR 21082
Blue whale (*Balaenoptera musculus*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Fin Whale (*Balaneoptera physalus*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Sperm Whale (*Physeter macrocephalus*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Sei whale (*Balaenoptera borealis*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Gray whale, Western North Pacific DPS (*Eschrichtius robustus*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Killer whale, Southern Resident DPS (*Orcinus orca*)	Endangered	NMFS 2015, 80 FR 7380	NMFS 2021, 71 FR 69054
Steller Sea Lion, Western DPS *(Eumetopias jubatus)*	Endangered	NMFS 1997, 62 FR 24345	NMFS 1993, 58 FR 45269
Sunflower sea star *(Pycnopodia helianthoides)*	Proposed Threatened Listing	NMFS 2023, 88 FR 16212	Not designated

There is no designated critical habitat for the North Pacific right whale in the action area, and the nearest critical habitat is located in the Bering Sea more than 128 km (79 miles) to the north of the ensonified action area for blasting activities. Therefore, North Pacific right whale critical habitat will not be discussed further.

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

As described in the Approach to the Assessment section of this opinion, NMFS uses two criteria to identify those endangered or threatened species or critical habitats 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 the proposed activities and a listed species or designated critical habitat.

The second criterion is the probability of a response given exposure. For endangered or threatened species, we consider the susceptibility of the species that may be exposed. For example, species exposed to vessel sound that are not likely to exhibit physical, physiological, or behavioral responses given that exposure (at the combination of sound pressure levels and distances associated with an exposure), are unlikely adversely affected by the exposure. We determine that an action would not likely adversely affect an animal if one could not meaningfully measure or detect the effects, or if the effects are extremely unlikely to occur.

In addition, if proposed activities are not likely to destroy or adversely modify critical habitat, further analysis is not required.

We applied these criteria to the species and critical habitats listed above and determined that the following species and designated critical habitats are not likely to be adversely affected by the proposed action: North Pacific right whale, blue whale, fin whale, sperm whale, sei whale, WNP DPS gray whale, Southern Resident DPS killer whale, sunflower sea star, and critical habitat for the Mexico DPS and WNP DPS humpback whale, Southern Resident DPS killer whale, and Steller sea lion. Below we discuss our rationale for those determinations.

4.1.1 North Pacific Right Whale, Blue Whale, Fin Whale, Sperm Whale, Sei Whale, Western North Pacific DPS Gray Whale, and Southern Resident DPS Killer Whale

4.1.1.1 Dredging and Blasting Activities

North Pacific Right Whale

North Pacific right whales are primarily found in coastal or shelf waters but sometimes travel into deeper waters. Analysis of acoustic underwater recordings shows that these whales remain in the southeastern Bering Sea from May through December (no right whale calls were detected from January to April) with peak call detection in September (Munger et al. 2008; Stafford and Mellinger 2009; Muto et al. 2018). The majority of the sightings of North Pacific right whales reported in the southeast Bering Sea in recent decades have been located within the area designated as critical habitat for this species (Young et al. 2023). North Pacific right whales have been acoustically detected in all months except October in Unimak Pass, supporting the idea that this pass is used by right whales entering and leaving the Bering Sea, and possibly during seasonal migration to unknown overwintering areas (Wright et al. 2018). In addition, North Pacific right whale calls have been detected in Umnak Pass (Clapham et al. 2012).

Though we do not expect North Pacific right whales will occur in the area affected by USACE's dredging or blasting activities, it is possible they may, given the location of the project in the very southeastern edge of the Bering Sea. Therefore, there is potential that a member of the species could be at-risk for vessel strike, exposure to small oil spills, and exposure to sound levels in exceedance of the acoustic thresholds that NMFS uses for underwater sounds that cause behavioral disturbance (see Section 6.1.2.1 of this opinion). However, it is extremely unlikely that North Pacific right whales will be exposed to any of the stressors associated with the dredging and blasting activities for the following reasons:

- Currently it is estimated that there are less than 500 North Pacific right whales remaining, and the estimated abundance of the eastern stock that visits Alaskan waters is 31 whales, with a minimum population estimate of 26 whales (Muto et al. 2022). The rarity of the whales makes it highly unlikely that a right whale will occur in the area affected by the USACE's dredging and blasting activities.
- North Pacific right whale acoustic detections and sightings in the southeastern Bering Sea in recent decades have been primarily located within or near the designated critical habitat and Unimak/Umnak Pass (Young et al. 2023), areas located far from the project action area, further decreasing the chance of a right whale being in the vicinity of the dredging and blasting activities associated with the proposed action.
- Implementation of the proposed mitigation measures prevents project vessels from coming within 500 yards (460 m) of a North Pacific right whale, traveling over 5 knots when within 300 yards (274 m) of a right whale, making unnecessary changes in speed and direction when within 300 yards (274 m) of a right whale, and putting the vessel in the path of a whale.
- Implementation of a 300-m (328-yard) shutdown zone around the dredging vessel when dredging activities are taking place will prevent whales from encountering adverse effects from dredging.
- The USACE has assured NMFS via email that if a North Pacific right whale is spotted in the action area, no blasting would occur until the animal has left the shutdown zone.

For these reasons, we conclude the probability of an ESA-listed North Pacific right whale being in the action area and being exposed to adverse effects from dredging or blasting-related activities is very low, and thus adverse effects to North Pacific right whales are extremely unlikely to occur. Additionally, critical habitat is over 75 miles (127.5 km) north of project action area, meaning no designated critical habitat for the North Pacific right whale falls within the action area. Therefore, we conclude that the adverse effects from dredging and blasting related activities on North Pacific right whales are discountable.

Western North Pacific DPS Gray Whale

WNP DPS gray whales spend all or part of their lives in the waters of the Western North Pacific Ocean off the coast of East Asia, or the Russian Far East, including southern and southeastern Kamchatka (NMFS 2023). Recent studies support a trans-Pacific migration for some WNP DPS gray whales during the winter to areas off Canada, the U.S. West Coast, and Mexico (Weller et al. 2012; Lang et al. 2014; Mate et al. 2015; Urbán et al. 2019). The specific trans-Pacific migration route and timing of this migration are unknown, making it very difficult to predict when and where these whales might pass through the Aleutian Island chain or along the coast of Alaska. However, given that a relatively small number of western gray whales (approximately 139 animals, 48% of the population; Cooke 2020) make the trans-Pacific migration, there is a low likelihood that a gray whale from the WNP DPS will be encountered in Alaskan waters along the Aleutian Islands.

Though we do not expect WNP DPS gray whales will occur in the action area, it is possible they may, given the location of the project within the Aleutian Island chain and in shallow waters. Therefore, it is possible the species will be at-risk for vessel strike, exposure to small oil spills, and exposure to sound levels in exceedance of the acoustic thresholds that NMFS uses for underwater sounds that cause behavioral disturbance (see Section 6.1.2.1 of this opinion). However, it is extremely unlikely that WNP DPS gray whales will be exposed to any of the stressors associated with the dredging and blasting activities for the following reasons:

- Given the small number of WNP DPS gray whales that migrate through the Aleutian Islands, it is highly unlikely that any ESA-listed gray whale will pass through the chain in the vicinity of the action area, further decreasing the chance of the a gray whale being present in the action area.
- Implementation of the proposed mitigation measures prevents project vessels from coming within 100 yards (91 m) of a gray whale, and putting the vessel in the path of a whale.
- Project proponents will implement a 300-m (328-yard) shutdown zone around the dredging vessel when dredging activities are taking place which will prevent whales from encountering adverse effects from dredging.

For these reasons, we conclude the probability of an ESA listed gray whale being exposed to adverse effects from dredging or blasting-related activities is very low, and thus adverse effects to Western North Pacific DPS gray whales are extremely unlikely to occur as a result of this action.

4.1.1.2 Vessel Traffic

Project-dedicated barges will deploy to the Iliuliuk Bay project site from Seattle and return to Seattle upon completion of the dredging and blasting activities. The area of the proposed routes (Figure 4) overlaps with the ranges of the North Pacific right whale, blue whale, fin whale, sperm whale, sei whale, WNP DPS gray whale, and Southern Resident DPS killer whale, and these species may be encountered during transit. All barges will generally be towed at a speed of no more than 8 knots. Project barges will have a short-term presence along the transit routes between Seattle and the project site. Potential effects from project vessel traffic on these ESA-listed species includes auditory and visual disturbance and vessel strike.

Mitigation measures (Section 2.1.2) will be implemented to minimize or avoid auditory and visual disturbance and potential vessel collisions with marine mammals along the barge routes to/from Seattle. These mitigation measures include, but are not limited to, maintaining a vigilant watch aboard vessels for listed marine mammals and avoiding potential interactions with whales by implementing a five-knot speed restriction when within 300 yards of observed whales. Project vessels will also be maneuvered to keep at least 500 yards away from any observed North Pacific right whales, 100 yards from other marine mammals, and avoid approaching whales in a manner that causes them to change direction or separate from other whales in their group.

Although some marine mammals could receive sound levels in exceedance of the acoustic threshold of 120 dB from the project vessels or be disturbed by the visual presence of barges and tugs, disturbances rising to the level of harassment are extremely unlikely to occur.

NMFS has interpreted the term “harass” under the ESA to mean “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). While listed marine mammals will likely be exposed to acoustic stressors from barging activities, the nature of the exposure (primarily vessel noise) will be low-frequency, with much of the acoustic energy emitted by project vessels at frequencies below the best hearing ranges of many large baleen whales. In addition, because vessels will be in transit, the duration of the exposure to ship noise will be brief. The project vessels will emit continuous sound while in transit, which will alert marine mammals before the received sound level exceeds 120 dB. Therefore, a startle response is not expected. Rather, slight deflection and avoidance are expected to be common responses in those instances where there is any response at all. The implementation of mitigation measures is expected to further reduce the number of times marine mammals react to transiting vessels.

The factors discussed above, when considered as a whole, make it extremely unlikely that the transiting project barges will elicit behavioral responses from, or have adverse effects on North Pacific right whales, blue whales, fin whales, sperm whales, sei whales, WNP DPS gray whales, and Southern Resident DPS killer whales that rise to the level of harassment under the ESA (Wieting 2016). We expect any effects to listed species to have little consequence and not to significantly disrupt normal behavioral patterns.

Vessel strike is an ongoing source of mortality for large cetaceans (Vanderlaan and Taggart 2007; Schoeman et al. 2020) and vessel speed is a principal factor in whether a strike results in death (Laist et al. 2001; Vanderlaan and Taggart 2007). From 1978 to 2011, 108 whale-vessel collisions were recorded in Alaska; humpback whales were the most frequent victims, accounting for 86 percent of all reported collisions (Neilson et al. 2012). The majority of reported vessel strikes occurred in Southeast Alaska, where vessel traffic is much greater (Neilson et al. 2012).

Twenty-six large whale-vessel strikes were reported between 2016 and 2020 in Alaska: 18 humpback, 3 fin, 2 sperm, and 3 unidentified whales (Freed et al. 2022). There have been no reported strikes of blue whales, sei whales, or North Pacific right whales in Alaska since 1978; however, the reported unidentified whale strikes could potentially include these species (Neilson et al. 2012; Delean et al. 2020; Freed et al. 2022; Young et al. 2023, NMFS Alaska Regional Office Stranding Database accessed July 2023). As discussed in Section 4.1.1.1, a relatively small number of western gray whales (approximately 139 animals, 48% of the population; Cooke 2020) make a trans-Pacific migration during the winter to areas off Canada, the U.S. West Coast, and Mexico, and there is therefore a low likelihood that a gray whale from the WNP DPS will be encountered during the barge transits to/from Seattle. Southern Resident DPS killer whale L98 was killed during a vessel interaction in 2006 and J34 was found dead in 2016 with injuries consistent with those incurred during a vessel strike (Carretta et al. 2023).

The probability of strike events depends on the frequency, speed, and route of the marine vessels, and the distribution and density of marine mammals in the area, as well as other factors. With the low number of barge trips to/from Seattle, transitory nature of project-related barge transit, slow transit speeds, implementation of the mitigation measures, and the low occurrence of these whale species over the majority of the route, we conclude the probability of a project vessel striking a North Pacific right whale, blue whale, fin whale, sperm whale, sei whale, WNP DPS gray whale, or Southern Resident DPS killer whale, is extremely low and any adverse effects due to such strikes are extremely unlikely to occur.

In summary, we conclude that project-specific vessel transit associated with the proposed action is not likely to adversely affect North Pacific right whales, blue whales, fin whales, sperm whales, sei whales, WNP DPS gray whales, or Southern Resident DPS killer whales.

4.1.2 Southern Resident DPS Killer Whale Critical Habitat

NMFS published a final rule to designate critical habitat for Southern Resident DPS killer whales on November 29, 2006 (71 FR 69054). On August 2, 2021, NMFS published a revision to that rule designating six additional coastal areas along the U.S. West Coast (86 FR 41668). The newly designated critical habitat areas are expected to be outside of the vessel transit portion of the action area. The following PBFs were identified as essential to the conservation of the Southern Resident DPS killer whale:

1. Water quality to support growth and development
2. Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth
3. Passage conditions to allow for migration, resting, and foraging

Projected-specific barges will pass through critical habitat for Southern Resident DPS killer whales during transit to/from Seattle.

Project vessels have the potential for unauthorized spills. However, a large spill is unlikely and a small spill would likely disperse quickly due to tide-induced turbulence and mixing. We expect no toxins to be released into the environment that would be of a quantity to impact water quality. Vessel passage on the surface of the water is not expected to disrupt or disturb any of the primary prey species and prey resource quality will not be diminished. The sound and presence of project vessels could cause killer whales to avoid or abandon certain areas; however, the duration of exposure to the vessels and associated noise will be brief and temporary, lasting on the order of minutes. The impact of project-specific vessel transit on Southern Resident DPS killer whale passage is very unlikely. Limited project-specific vessel transit through this highly industrialized waterway will not negatively affect the essential features of designated critical habitat. Therefore, we conclude that the proposed action is not likely to adversely affect critical habitat for Southern Resident DPS killer whales.

4.1.3 Mexico DPS and Western North Pacific DPS Humpback Whale Critical Habitat and Western DPS Steller Sea Lion Critical Habitat

Critical habitat for Mexico DPS and WNP DPS humpback whales was designated May 21, 2021 (86 FR 21082, April 21, 2021; Figure 5). Critical habitat for the Western North Pacific DPS includes areas in the eastern Aleutian Islands, the Shumagin Islands, and around Kodiak Island, and for the Mexico DPS includes those same areas plus the Prince William Sound area. The PBF identified as essential to the conservation of both DPSs is prey of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth. The humpback whales' diet is dominated by euaphausiids and small pelagic fishes, which is reflected in the list of key prey species included in the regulatory definition of the prey PBF for each DPS.

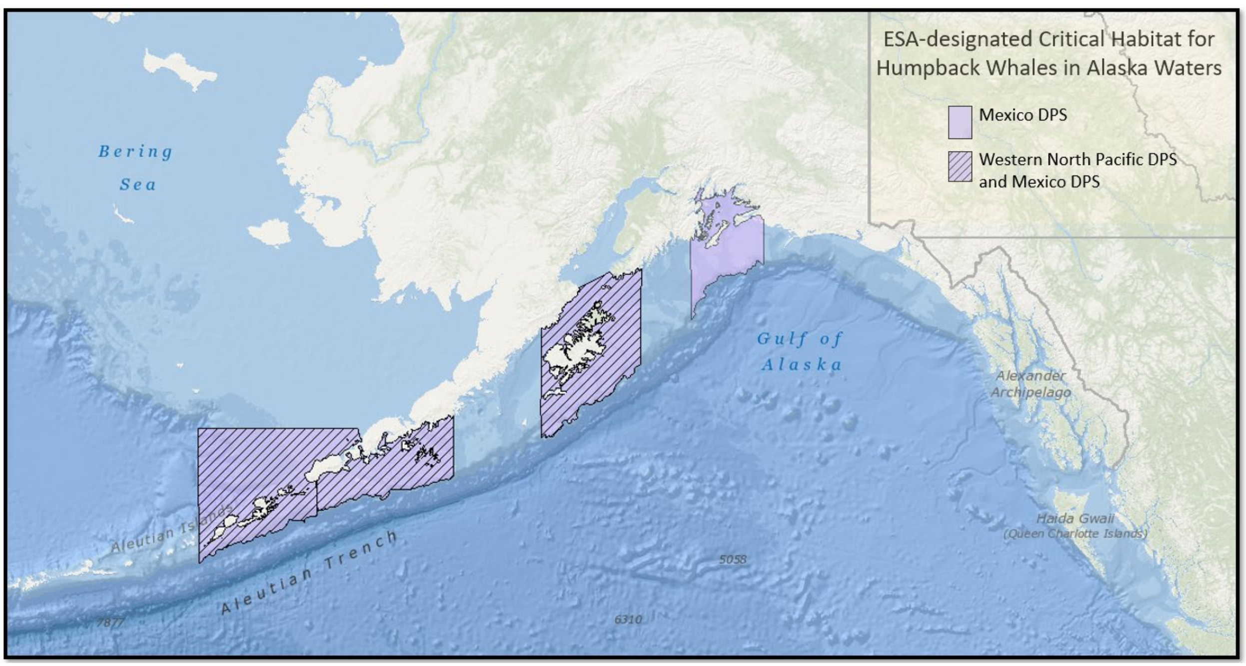

Figure 5: Critical habitat for Mexico DPS and Western North Pacific DPS humpback whales in waters off Alaska (Source: NOAA).

NMFS designated for Steller sea lions on August 27, 1993 (58 FR 45269; Figure 6). In Alaska, designated critical habitat includes the following areas as described at 50 CFR § 226.202.

1. Terrestrial zones that extend 3,000 feet (0.9 km) landward from each major haulout and major rookery in Alaska.
2. Air zones that extend 3,000 feet (0.9 km) above the terrestrial zone of each major haulout and major rookery in Alaska.
3. Aquatic zones that extend 3,000 feet (0.9 km) seaward of each major haulout and major rookery in Alaska that is east of 144° W longitude.
4. Aquatic zones that extend 20 nm (37 km) seaward of each major haulout and major rookery in Alaska that is west of 144° W longitude.
5. Three special aquatic foraging areas: the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area, as specified at 50 CFR § 226.202(c).

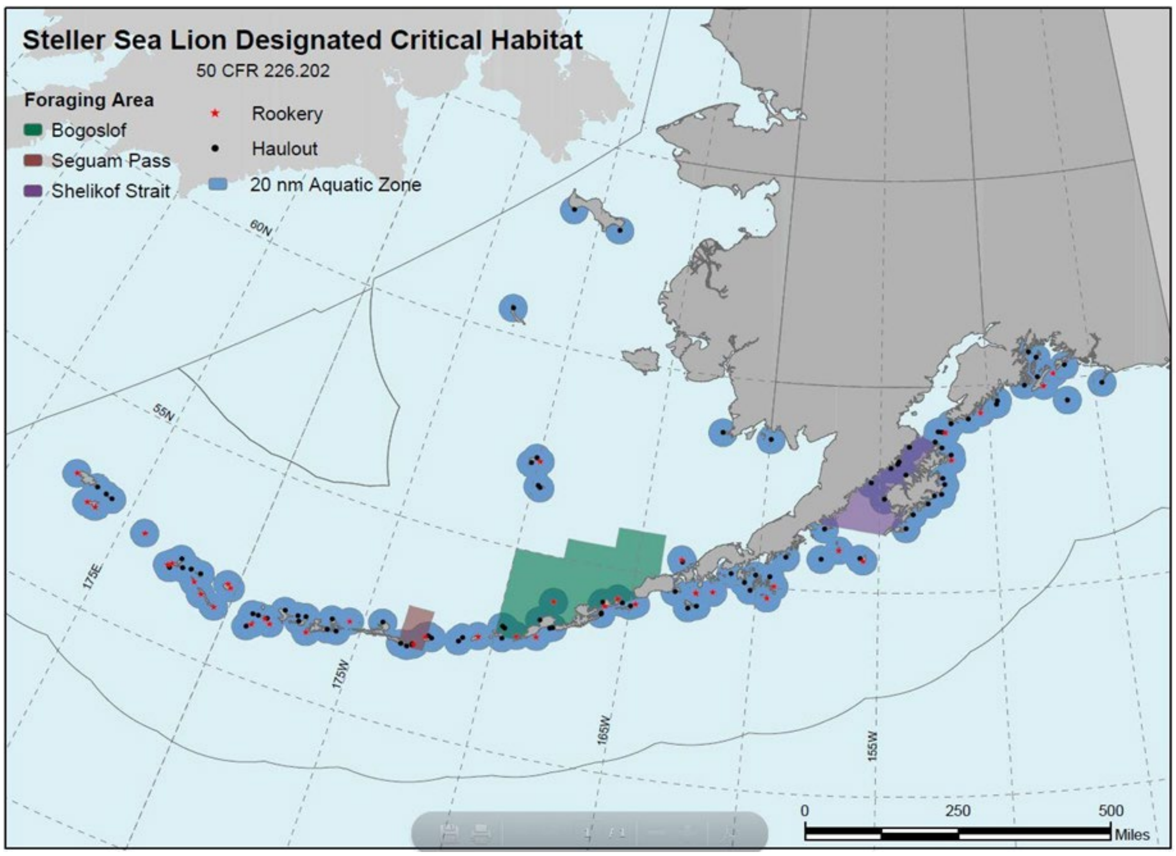

Figure 6: Designated Steller sea lion critical habitat in Alaska. (Source NOAA).

Project barges will pass through critical habitat for Mexico DPS and WNP DPS humpback whales, and Steller sea lions during transit to/from Seattle. In addition, the project barges, tugboats, and crew boats, will be present during the in-water work of the proposed action.

Specific mitigation measures are in place to protect Steller sea lion critical habitat from vessel disturbance (Section 2.1.2). In addition, we expect the project barges will be traveling in normal shipping lanes when in transit to/from Seattle and that Steller sea lions at haulouts or rookeries near those shipping lanes are accustomed to shipping traffic. The passage of a vessel on the surface of the water is not expected to disrupt or disturb any of the primary prey species which Steller sea lions depend upon and, therefore, the quality of their prey resources will not be diminished. Likewise, we do not expect that the passage of a vessel on the surface of the water will have a measureable effect on aggregations of humpback whale prey species. The eddies or wake of the vessels across the surface of the water may cause temporary mixing or displacement of a relatively small number of zooplankton but we do not expect that this disturbance would affect the prey distribution or abundance in a meaningful or measurable way. Project vessels have the potential for unauthorized spills. However, a large spill is unlikely and a small spill would likely disperse quickly due to tide-induced turbulence and mixing. We expect no toxins to be released into the environment that would be of a quantity to impact water quality. For these reasons we conclude that there is no aspect of the passage of the project vessels over or near critical habitat that will negatively impact the essential features of Steller sea lion critical habitat, or critical habitat for Mexico DPS and WNP DPS humpback whales.

The dredge site is located within critical habitat for both Mexico DPS and WNP DPS humpback whales, and Steller sea lions. There are three major Steller sea lion haulouts and one major rookery within 20 nautical miles of the dredge site. The major haulouts include Old Man Rocks and Unalaska/Cape Sedanka (approximately 15 nm southeast straight-line distance from the project site) and Akutan/Lava Reef (approximately 19 nm (35 km) northeast straight-line distance from the project area). The closest rookery is Akutan/Cape Morgan (approximately 19 nm (35 km) east straight-line distance from the project area). Another major rookery is located approximately 19 nm (35 km) from the project location (straight line distance over mountains) at Akutan/Lava Reef. As of 2014, the number of adult Steller sea lions using these sites was: 1,129 (Akutan/Cape Morgran rookery); 182 (Akutan/Lava Reef haulout); 15 (Old Man Rocks haulout); and 0 (Unalaska/Cape Sedanka haulout) (NMFS, 2021). The dredging and blasting site is also located within the Bogoslof special aquatic foraging area.

While the total seafloor area likely to be impacted by the project is 40,000 square yards (33,445 m^2, 8.26 acres, 3.34 ha) this area is less than 0.04 percent of the available 33.4 square miles (85 km^2) of habitat just within Iliuliuk and Unalaska Bays, and is an infinitesimally tiny fraction of extant habitat in Alaska. The action area for the proposed bar lowering project is highly influenced by anthropogenic activities and is likely not heavily used by marine mammals for foraging. Additionally, the total seafloor area that would be affected by dredging, and potentially blasting, is a small area compared to the vast foraging habitat available to marine mammals within the area.

The proposed action will have temporary impacts on water quality (increases in turbidity levels) and on prey species distribution.

Blasting, dredging, and fill dumping may cause temporary and localized turbidity through sediment disturbance. According to USACE (2019), sediments from the Iliuliuk Bar are not annotated in the Alaska Department of Environmental Conservation (ADEC) catalog of contaminated sites. Sediments released into the water column by dredging activities would most closely resemble the sediments of the surrounding areas and would not be harmful to adjacent benthic habitats (USACE 2019). Turbidity plumes during bar lowering activities will be localized around the dredging site, blasting area, and dumping site. These activities will not take place simultaneously, limiting the amount of sediment stirred up at any given time. We expect increased turbidity from dredging activities to be highly localized; within a few tens of meters of the dredge area, and to increase turbidity in an infinitesimally small (<0.0001%) proportion of the 168 km^2 of habitat within Iliuliuk and Unalaska Bays. Dumping of dredged material and blasting are likely to cause larger sediment plumes than dredging. However, these activities will take place in limited duration, with fill dumping taking place for less than an hour a day, and blasting occurring only once per day. The periodic nature of the two activities will provide an abundance of time for sediment to disperse and settle within the area before the activity occurs again. Additionally, local currents and tidal forces will minimize the amount of time (tens of minutes) it takes for sediment plumes to disperse.

Local strong currents are expected to disperse any additional suspended sediments produced by project activities at moderate to rapid rates depending on tidal stage. Due to temporary, localized, and low levels of turbidity increases, it is not expected that turbidity would result in adverse effects to the prey resources of Mexico DPS humpback whales, WNP DPS humpback whales, or Western DPS Steller sea lions.

Dredging and blasting activities will produce non-impulsive (i.e., dredging and borehole drilling) and impulsive (i.e., blasting) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of blasting on fish, although many focus on physical injury (e.g., Kolden and Aimone-Martin 2013; Aimone-Martin and Kolden 2019). Impulsive sounds 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 et al. 1992; Skalski et al. 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality.

The most likely impact to fish from blasting and dredging activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after a blasting event or after dredging ceases is unknown, but a rapid return to normal recruitment, distribution, and behavior is expected. In general, impacts to marine mammal prey species are expected to be minor and temporary given the small area of blasting or dredging relative to known feeding areas of listed marine mammals. We expect fish will be capable of moving away from project activities to avoid exposure to noise. 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. For blasting we expect the area in which stress, injury, temporary threshold shifts (TTS), or changes in balance of prey species may occur will be limited to a few hundred meters directly around the blasting area. For dredging we expect the area in which stress, injury, TTS, or changes in balance of prey species may occur will be limited to a few tens of meters directly around the dredging area. We consider potential adverse impacts to prey resources from the dredging and blasting activities in the action area to be immeasurably small.

Studies on euphausiids and copepods, two of the more abundant and biologically important groups of zooplankton, have documented some sensitivity of zooplankton to sound (Chu et al. 1996; Wiese 1996); however, any effects of blasting and dredging activities on zooplankton would be expected to be restricted to the area within a few feet or meters of the project and would likely be sub-lethal.

While previous studies concluded that crustaceans (such as zooplankton) are not particularly sensitive to sound produced by even louder impulsive sounds such as seismic operations (Wiese 1996), a recent study provides evidence that seismic surveys may cause significant mortality (McCauley et al. 2017). However, seismic surveys are significantly louder and lower frequency than the sound sources associated with this project and are not directly comparable.

No appreciable adverse impact on zooplankton populations will occur due in part to large reproductive capacities and naturally high levels of predation and mortality of these populations. Any mortality or impacts on zooplankton as a result of construction operations is immaterial as compared to the naturally occurring reproductive and mortality rates of these species.

In summary, the size of the area that will be affected by dredging and potential blasting to deepen the bar at the entrance to Iliuliuk Bay is very small relative to the available habitat for humpback whales and Steller sea lions in Iliuliuk and Unalaska Bays and the total amount of critical habitat available for these species. Given the numbers of fish and other prey species in the vicinity, and the localized and short-term nature of effects on fish and invertebrate prey species, the proposed action is not expected to have measurable effects on the quality, distribution, or abundance of humpback whale or Steller sea lion prey resources.

4.1.4 Sunflower Sea Star

On August 18, 2021, the Center for Biological Diversity petitioned NMFS to list the sunflower sea star (*Pycnopodia helianthoides*) under the ESA. NMFS determined that the proposed action may be warranted (86 FR 73230, December 27, 2021) and began a full status review to evaluate overall extinction risk for the species. On March 16, 2023, NMFS published a proposed rule to list the sunflower sea star as a threatened species (88 FR 16212). NMFS has not proposed to designate critical habitat for the sunflower sea star.

The sunflower sea star occupies waters from the intertidal to at least 435 m (475.7 yards) 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 from the Aleutian Islands to Baja California, Mexico, but are most abundant in waters off eastern Alaska and British Columbia (Gravem et al. 2021).

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 et al. 2022). Declines in the northern portion of its range 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 et al. 2022).

The most current survey of Unalaska's coastline indicated the sunflower sea stars were very rare and only seen at one location on the very southern coast of the island. No sunflower sea stars were found in Unalaska Bay or correspondingly Iliuliuk Bay[1]. As a result, we do not expect sunflower sea stars to be within the action area, therefore they will not be considered further.

4.2 Climate Change

The listed marine mammals we consider in this opinion live in the ocean and depend on the ocean for nearly every aspect of their life history. Factors which affect the ocean, like temperature and pH, can have direct and indirect impacts on marine mammals and the resources they depend upon. Global climate change may affect all the species we consider in this opinion, but it is expected to affect them differently. Because it is a shared threat, we present this narrative here rather than in each of the species-specific narratives that follow. First, we provide background on the physical effects climate change has caused on a broad scale; then we focus on changes that have occurred in Alaska. Next, we provide an overview of how these physical changes translate to biological effects.

4.2.1 Physical Effects

4.2.1.1 Air Temperature

There is consensus throughout the scientific community that atmospheric temperatures are increasing, and will continue to increase, for at least the next several decades (Intergovernmental Panel on Climate Change (IPCC) 2001; Oreskes 2004). The IPCC estimated that since the mid-1800s, average global land and sea surface temperature has increased by 0.85°C (±0.2°C), with most of the change occurring since 1976 (IPCC 2019). This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000).

[1] Alaska Shore Station Database, https://alaskafisheries.noaa.gov/mapping/sz/index.html?tab=ss&layout=h2

Continued emission of greenhouse gases is expected to cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems (IPCC 2019). Data show that 2019 was the second warmest year in the 140-year record, and global land and ocean surface temperatures departed +0.95°C (+1.71°F) from average[1]. The five warmest years in the 1880–2019 record have all occurred since 2015, with nine of the 10 warmest years having occurred since 2005. July, 2019, was Earth's hottest month on record (Blunden and Arndt 2020).

The impacts of climate change are especially pronounced at high latitudes. Since 2000, the Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes because of "Arctic amplification," a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, albedo, black carbon, and many other factors (Serreze and Barry 2011; Richter-Menge et al. 2017). Across Alaska, average air temperatures have been increasing, and the average annual temperature is now 1.65-2.2°C (3-4°F) warmer than during the early and mid-century (Thoman and Walsh 2019). Winter temperatures have increased by 3.3°C (6°F) (Chapin et al. 2014) and the snow season is shortening (Thoman and Walsh 2019). Alaska had its warmest year on record in 2019, with a statewide average temperature of 32.2°F, 6.2°F above the long-term average. This surpassed the previous record of 31.9°F in 2016. The four warmest years on record for Alaska have occurred in the past 9 years.

4.2.1.2 Ocean Heat

Higher air temperatures have led to higher ocean temperatures. More than 90% 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 upper ocean heat content, which measures the amount of heat stored in the upper 2,000 m (6,561 feet) of the ocean, was the highest on record in 2019 by a wide margin, and is the warmest in recorded human history (Cheng et al. 2020). The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect can be seen throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas (Figure 7) (Thoman and Walsh 2019).

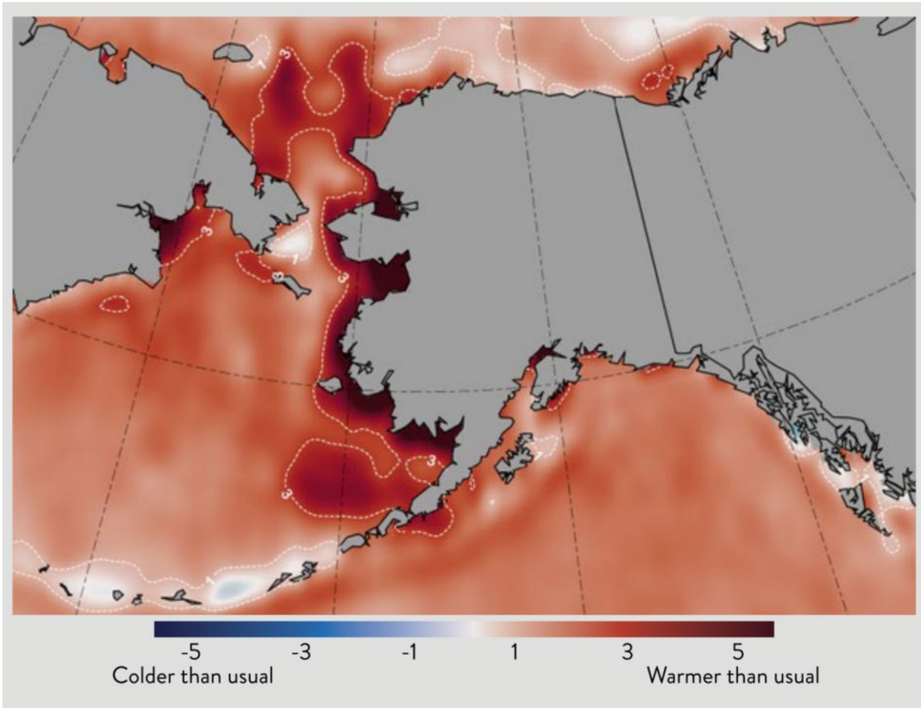

Figure 7: Arctic summer sea surface temperatures, 2019 (Thoman and Walsh 2019).

Warmer ocean water affects sea ice formation and melt. In the first decade of the 21 century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) declined at a considerably accelerated rate and continues to decline (Stroeve et al. 2007; Stroeve and Notz 2018) (Figure 8). Approximately three-quarters of summer Arctic sea ice volume has been lost since the 1980s (IPCC 2013). In addition, old ice (> 4 years old), which is thicker and more resilient to melting than young ice, constituted 33% of the ice pack in 1985, but by March 2019, it represented only 1.2% of the ice pack in the Arctic Ocean (Perovich et al. 2019). Overland (2020) suggests that the loss of the thicker older ice makes the Arctic ecosystem less resilient. Both the maximum sea ice extent (March) and the minimum (September) have consistently been decreasing, although the summer minimums are more pronounced (Perovich et al. 2019) (Figure 8). The minimum Arctic sea ice extent in 2019 was effectively tied with 2007 and 2016 for second lowest, only behind 2012, which is the record minimum.

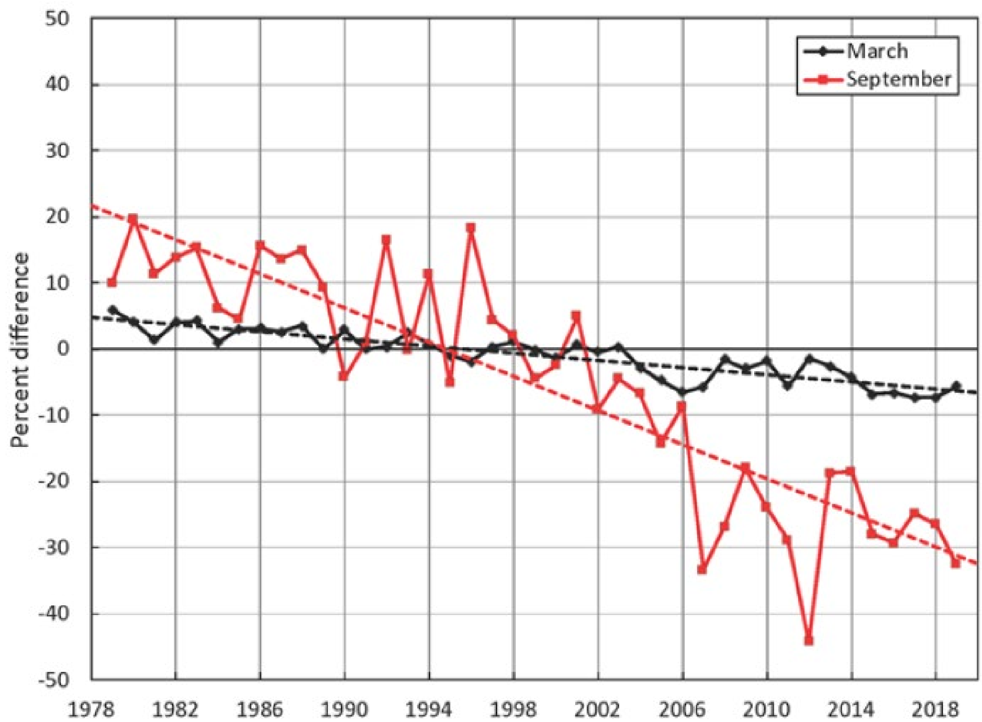

Figure 8: Arctic ice extent declines in September (red) and in March (black). The value for each year is the difference in percent in ice extent relative to the mean values for 1981-2010. Both trends are significant at the 99% confidence level. The slopes of the lines indicate losses of -2.7 for the maximum ice extent and -12.9 percent for the minimum ice extent, per decade.

Wang and Overland (2009) estimated that the Arctic will become essentially ice-free (i.e., sea ice extent will be less than 1 million km^2) during the summer between the years 2021 and 2043 and modeling with the new generation climate models provides independent support of an ice-free Arctic in mid-century or earlier (Notz and Stroeve 2016; Guarino et al. 2020; SIMIP Community

2020). Notz and Stroeve (2016) found that sea-ice loss directly follows anthropogenic CO_2 emissions and suggest that there is a loss of approximately 3 m^2 of September Arctic sea ice per metric ton of CO_2 emission. Under the Paris Agreement, emissions scenarios are pursued that would stabilize the global mean temperature at 1.5–2.0 °C above pre-industrial levels. If the climate were to stabilize at plus 1.5 °C, Sigmond et al. (2018) project that Arctic ice-free conditions would occur once every forty years. On the other hand, if temperatures rose to plus 2.0 °C, ice-free conditions would occur once every five years. These and other researchers conclude that any measures taken to mitigate CO_2 emissions would directly slow the ongoing loss of Arctic summer sea ice (Sigmond et al. 2018; Stroeve and Notz 2018). Once the entire Arctic Ocean becomes a seasonal ice zone, its ecosystem will change fundamentally as sea ice is the key forcing factor in polar oceans (Wassmann et al. 2011).

Related to the loss of sea ice is the northward shift and near loss of the cold-water pool in the eastern Bering Sea. Winter sea ice creates a pool of cold (<2ºC) bottom water that is protected from summer mixing by a thermocline (Mueter and Litzow 2008). With the reduction in winter sea ice, the cold-water pool has shrunk (Figure 9). Many temperate species, especially groundfish, are intolerant of the low temperatures so the extent of sea ice determines the boundary between arctic and subarctic seafloor communities and demersal versus pelagic fish communities (Grebmeier et al. 2006). In the Pacific Arctic, large scale, northward movements of commercial stocks are underway as previously cold-dominated ecosystems warm and fish move northward to higher latitude, relatively cooler environments (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).

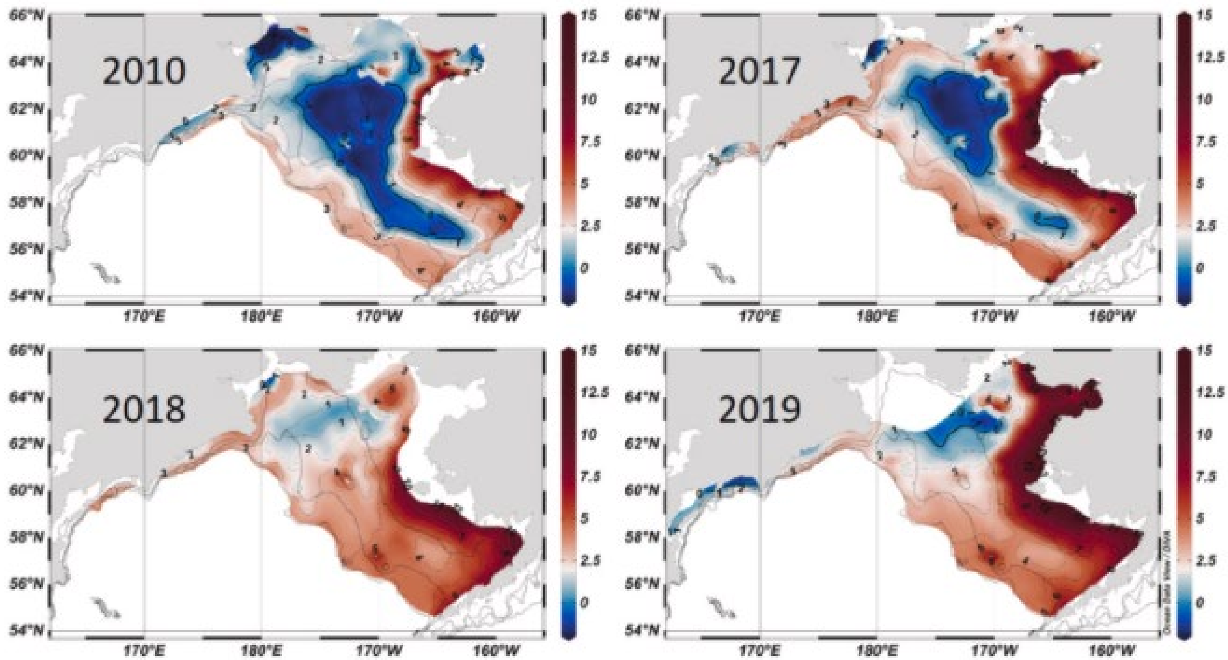

Figure 9: Bottom temperatures from summer oceanographic surveys. Graphic display of the shrinkage of the cold pool over time. From Eisner et al. (2020).

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). The 2018 Pacific cod stock assessment estimated that the female spawning biomass of Pacific cod is 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 blob. It is thought that marine mammals in the Gulf of Alaska were also likely impacted by the low prey availability associated with warm ocean temperatures that occurred (Bond et al. 2015; Peterson et al. 2016; Sweeney et al. 2018).

Another ocean water anomaly is described as a marine heat wave. These are described as a coherent area of extreme warm temperature at the sea surface that persists (Frölicher et al. 2018). The largest recorded marine heat wave occurred in the northeast Pacific Ocean from 2013-2015 (Frölicher et al. 2018). It was called "the blob". The blob first appeared off the coast of Alaska in the winter of 2013-2014 and by the end of 2015 it stretched from Alaska to Baja California.

4.2.1.3 Ocean Acidification

For 650,000 years or more, the average global atmospheric carbon dioxide (CO_2) concentration varied between 180 and 300 parts per million (ppm), but since the beginning of the industrial revolution in the late 1700s, atmospheric CO_2 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 CO_2 released, which has buffered the increase in atmospheric CO_2 concentrations (Feely et al. 2004; Feely et al. 2009). Despite the oceans' role as large carbon sinks, the CO_2 level continues to rise and is currently over 410 ppm.

As the oceans absorb CO_2, the pH of seawater is 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 et al. 2009; Reisdorph and Mathis 2014). When seawater is supersaturated with these minerals, calcification (growth) of shells is favored. Likewise, when the sea water becomes undersaturated, dissolution is favored (Feely et al. 2009).

High latitude (colder) 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 et al. 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 CO_2 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 and many forms of zooplankton such as copepods and pteropods, and consequently may affect Arctic food webs (Fabry et al. 2008; Bates et al. 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, may be able to adapt to changing ocean condition(Fabry et al. 2008; Lischka and Riebesell 2012).

4.2.2 Biological Effects

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; 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 2014), such as: Shifting abundances, changes in distribution, changes in timing of migration, changes in periodic life cycles of species.

Climate change is likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2009). For species that rely primarily on sea ice for major parts of their life history, we expect that the loss of sea-ice would negatively impact those species' ability to thrive. Consequently, we expect the future population viability of at least some ESA-listed species to be affected with global warming.

Changes in ocean surface temperature may impact species migrations, range, prey abundance, and overall habitat quality. For ESA-listed species that undertake long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperature regimes, the timing of migration can change. For example, cetaceans with restricted distributions linked to cooler water temperatures may be particularly exposed 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 are cetaceans with ranges limited to non-tropical waters, and preferences for shelf habitats (Macleod 2009).

4.3 Status of Listed Species and Critical Habitat Likely to be Adversely Affected by the Action

This opinion examines the status of each species and critical habitat that is likely to 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 50 CFR § 402.02.

For each species, 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 and Western North Pacific DPS Humpback Whale

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

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

https://media.fisheries.noaa.gov/2021-12/Guidance-Humpbacks-Alaska.pdf

4.3.1.1 Population Structure and Status

In 1970, the humpback whale was listed as endangered worldwide, under the Endangered Species Conservation Act (ESCA) of 1969 (35 FR 18319; December 2, 1970), primarily due to overharvest by commercial whalers. Congress replaced the ESCA with the ESA in 1973 and humpback whales continued to be listed as endangered, and were considered "depleted" under the MMPA.

Following the cessation of commercial whaling, humpback whale numbers increased. NMFS conducted a global status review (Bettridge et al. 2015) and published a final rule on September 8, 2016 (81 FR 62260) recognizing 14 DPSs. Four of these were designated as endangered and one as threatened, with the remaining nine not warranting ESA listing status.

Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, (Wade 2021) concluded that humpback 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 the Aleutian Islands are comprised of approximately 91 percent Hawaii DPS individuals, 7 percent Mexico DPS individuals, and 2 percent WNP DPS individuals.

4.3.1.2 Distribution

Humpback whales generally undertake seasonal migrations from their tropical calving and breeding grounds in winter to their high-latitude feeding grounds in summer, although some individuals may remain in Alaska waters year-round. Most humpbacks that feed in Alaska winter in temperate or tropical waters near Mexico, Hawaii, or in the western Pacific near Japan. In the spring, those animals migrate back to Alaska, where food is abundant. They tend to concentrate in several areas, including Southeast Alaska, Prince William Sound, Kodiak, the mouth of Cook Inlet, and along the Aleutian Islands (Ferguson et al. 2015). Large numbers of humpbacks have also been reported in waters over the continental shelf, extending up to 100 nm offshore in the western Gulf of Alaska (Wade 2021).

The area around the Aleutian Islands from Umnak Island northeastward along the Alaska Peninsula has been identified as a Biologically Important Area for humpback whales (Brower et al. 2022). Telemetry data from Kennedy et al. (2014) supported findings of historical data showing that humpback whales congregate in the shallow, highly productive coastal waters north of the eastern Aleutian Islands, between Unimak and Samalga Passes. The extremely high proportion of foraging within the narrow band 200 km east and west of Unalaska Bay further emphasizes the importance of the waters off the eastern Aleutian Islands for humpback whales (Kennedy et al. 2014). Annual vessel-based, photo-identification surveys in the Shumagin Islands from 1999 to 2015 identified 654 unique individual humpback whales between June and September (Witteveen and Wynne 2017).

4.3.1.3 Occurrence in the Action Area

The action area sits within critical habitat for Mexico DPS and WNP DPS humpback whales, making the presence of ESA-listed humpback whales within the action area highly likely.

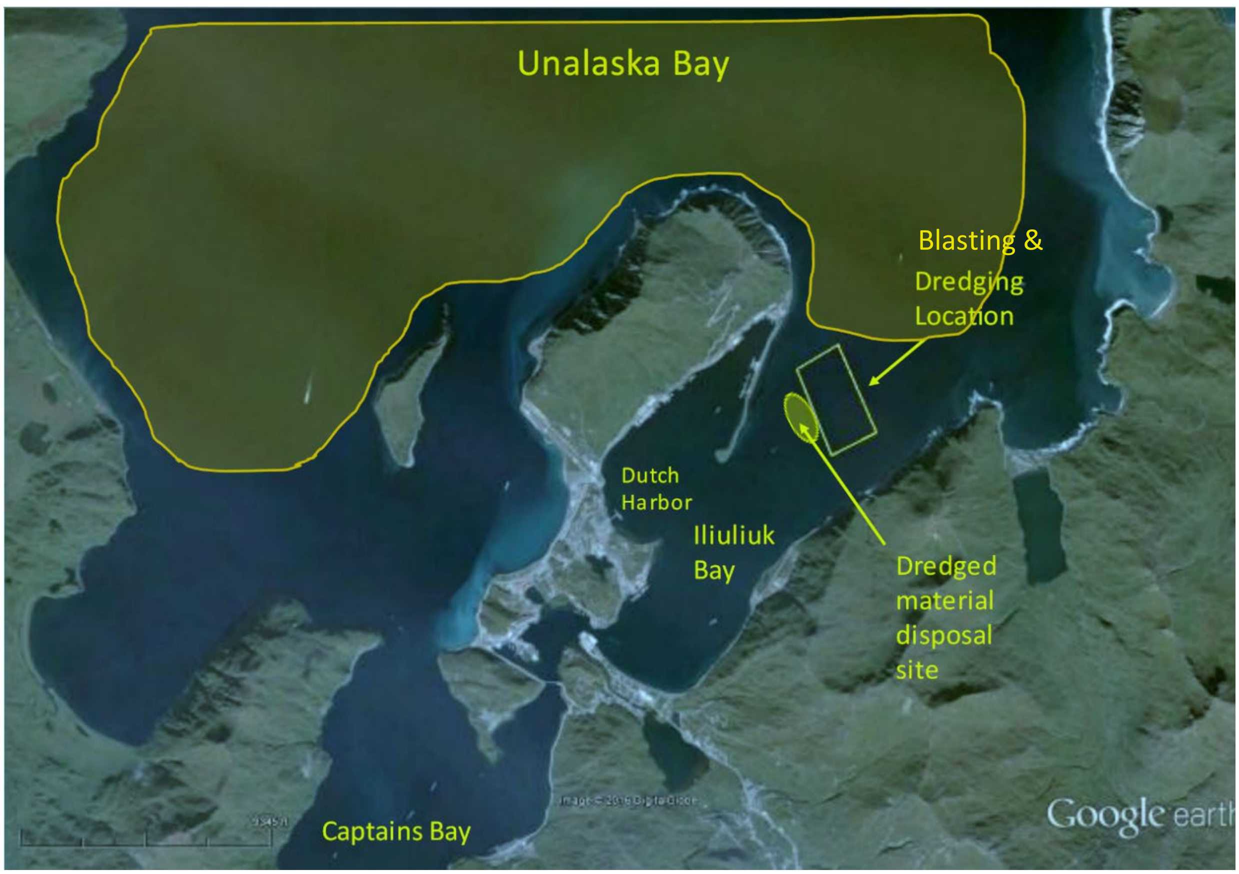

Figure 10: Typical humpback whale distribution within Unalaska Bay. (Image provided by applicant and modified by NOAA biologist for clarity).

Satellite tracking indicates humpbacks frequently congregate in shallow, highly productive coastal areas of the North Pacific Ocean and Bering Sea (Kennedy et al. 2014). The waters surrounding the eastern Aleutian Islands are dominated by strong tidal currents, water-column mixing, and unique bathymetry. These factors are thought to concentrate the small fish and zooplankton that compose the typical humpback diet in Alaska, creating a reliable and abundant food source for whales. Unalaska Island is situated between Unimak and Umnak Passes, which are known to be important humpback whale migration routes and feeding areas (Kennedy et al. 2014). Humpback whales are often present near the project area during summer and show up in the larger area of Unalaska Bay beginning in April and are present well into October most years (USACE 2019; USACE 2023). Presence in Unalaska Bay and Iliuliuk Bay appears to be largely prey-driven, so large variations in abundance between months and years is common.

According to the applicant, the most common areas to see most humpback whales in Unalaska Bay is shown in the yellow-green shading on Figure 10. Up to 60 humpback whales at one time have been observed during USACE 2018 surveys and use of this general area is supported by casual observations over the past 23 years of working in the area (USACE 2019). Humpback whales have been seen in Captains Bay, Iliuliuk Bay, and inside Dutch Harbor, but in smaller numbers in Unalaska.

4.3.1.4 Threats to the Species

Natural Threats

There is limited information on natural sources of injury or mortality to humpback whales. Based upon prevalence of tooth marks, attacks by killer whales appear to be highest among humpback whales migrating between Mexico and California, although populations throughout the Pacific Ocean appear to be targeted to some degree (Steiger et al. 2008). Juveniles appear to be the primary age group targeted.

Thirteen marine mammal species in Alaska were examined for domoic acid; humpback whales indicated a 38 percent prevalence (Lefebvre et al. 2016). Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales at 50 percent. The occurrence of the nematode *Crassicauda boopis* appears to increase the potential for kidney failure in humpback whales and may be preventing some populations from recovering (Lambertsen 1992).

Anthropogenic Threats

Historically, commercial whaling represented the greatest threat to every population of humpback whales and was ultimately responsible for listing humpback whales as an endangered species. Prior to 1970, the International Whaling Commission (IWC) banned commercial hunting of humpback whales in the Pacific Ocean, and in 1982 the IWC imposed a moratorium on commercial whaling of all species (to begin in 1985). As a result, this threat has largely been curtailed. No commercial whaling occurs within the range of Mexico DPS humpbacks, but some "commercial bycatch whaling" has been documented within the Western North Pacific DPS humpback range in Japan and South Korea (Bettridge et al. 2015). Aboriginal subsistence whaling is not subject to the IWC moratorium; however, Alaskan subsistence hunters are not issued quota to take humpback whales.

Vessel strike is one of the main sources of anthropogenic impacts to humpback whales in Alaska. Neilson et al. (2012) summarized 108 large whale ship-strike events in Alaska from 1978 to 2011; 86 percent involved humpback whales. Eighteen humpbacks were struck by vessels between 2016 and 2020 (Freed et al. 2022). Most ship strikes of humpback whales are reported in Southeast Alaska (Helker et al. 2019), where high vessel traffic overlaps with whale presence.

Fishing gear entanglement is another major anthropogenic threat. Entanglement may result in only minor injury or may potentially significantly affect individual health, reproduction, or survival. Every year humpback whales are reported entangled in fishing gear in Alaska, particularly pot gear and gill net gear. The minimum estimated mean annual mortality and serious injury rate due to interactions with all fisheries between 2016 and 2020 is 5.8 humpbacks for the WNP DPS and 12.3 humpbacks for the Mexico DPS (Carretta et al. 2023; Young et al. 2023). Between 2016 and 2020, entanglement of humpback whales (n = 47) was the most frequent human-caused source of mortality and injury of large whales (Freed et al. 2022).

4.3.1.5 Recovery Goals

The 1991 Humpback whale recovery plan (NMFS 1991) lays out three main recovery goals,

1. Biological Goal: building and maintaining populations large enough to be resilient to chance events such as episodic changes in oceanographic conditions, epizootics, anthropogenic environmental catastrophes, or inbreeding.
2. Numeric Goal: the long-term numerical goal is to achieve population sizes equal to at least 60% of the historical environmental carrying capacity for those population in each of the North Atlantic and North Pacific Oceans that contain whales which enter waters under U.S. jurisdiction.
3. Political Goal: being able to change the classification of particular stocks of humpback whales from “endangered” to “threatened” or removing then from the list of protected species.

There is also a new recovery plan in development by NOAA, which is planned to be completed in 2023 (87 FR 35178). There is currently no change to the original recovery goals provided in the in-term guidance recovery outline document (NMFS 2022). However, it is possible these goals may change by the start of project activities.

4.3.1.6 Reproduction and Growth

Humpbacks in the Northern Hemisphere give birth and presumably mate on low-latitude wintering grounds in January to March. Females attain sexual maturity at five years in some populations and exhibit a mean calving interval of approximately two years (Clapham 1992;

Barlow and Clapham 1997). Gestation is about 12 months, and calves are probably weaned by the end of their first year (Perry et al. 1999).

4.3.1.7 Feeding and Prey Selection

Humpback whales exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively (Clapham 1993). Humpback whales are 'gulp' or 'lunge' feeders, capturing large mouthfuls of prey during feeding rather than continuously filtering food, as may be observed in some other large baleen whales (Goldbogen et al. 2008; Simon et al. 2012). When lunge feeding, whales advance on prey with their mouths wide open, then close their mouths around the prey and trap them by forcing engulfed water out past the baleen plates. Compared to some other baleen whales, humpbacks are relatively generalized in their prey selection. In the Northern Hemisphere, known prey includes: euphausiids (krill); copepods; juvenile salmonids; herring; Arctic cod; walleye pollock; pteropods; and cephalopods (Johnson and Wolman 1984; Perry et al. 1999; Straley et al. 2018). In the North Pacific, humpback whales forage in the coastal and inland waters along California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomilin 1967; Johnson and Wolman 1984). Presence in Unalaska Bay and Iliuliuk Bay appears to be largely prey-driven, so large variations in abundance between months and years is common.

4.3.1.8 Diving and Social Behavior

Humpback whales remain almost exclusively within the 1,800 m isobath and usually within water depths less than 182 m. Maximum diving depths are approximately 170 m but usually less than 60 m (Hamilton et al. 1997). Humpback whales observed feeding on Stellwagen Bank dove less than 40 m (Hain et al. 1995). Because most humpback prey is likely found above 300 m depths most humpback dives are probably relatively shallow. Hamilton et al. (1997) tracked one whale near Bermuda possibly diving and feeding to 240 m depth. The deepest dives in Southeast Alaska were recorded to 148 m (Dolphin 1987).

Humpback whales may remain submerged during a dive for up to 21 min (Dolphin 1987). In Southeast Alaska average dive times were 2.8 min for feeding whales, 3.0 min for non-feeding whales, and 4.3 min for resting whales (Dolphin 1987).

In a review of the social behavior of humpback whales, Clapham (1996) reported that they form small, unstable social groups during the breeding season. 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 on feeding grounds (Clapham 1994; Clapham 1996) and calving areas (Tyack 1981).

4.3.1.9 Vocalization, Hearing, and Other Sensory Capabilities

NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with a generalized hearing range between 7 Hz and 35 kHz (NMFS 2018). Baleen whales have inner ears that appear to be specialized for low-frequency hearing. In a study of the morphology of the mysticete auditory apparatus, Ketten (1997) hypothesized that large mysticetes have acute infrasonic hearing.

Humpback whales produce a wide variety of sounds ranging from 20 Hz to 10 kHz. During the breeding season males sing long, complex songs, with frequencies in the 20-5,000 Hz range and intensities as high as 181 dB (Payne 1970; Winn et al. 1970; Thompson et al. 1986). Source levels average 155 dB and range from 144 to 174 dB (Thompson et al. 1979). The songs appear to have an effective range of approximately 10 to 20 km. Animals in mating groups produce a variety of sounds (Tyack 1981; Silber 1986).

Social sounds associated with aggressive behavior by male humpback whales in breeding areas are very different than songs and extend from 50 Hz to 10 kHz (or higher), with most energy in components below 3 kHz (Tyack and Whitehead 1983; Silber 1986). These sounds appear to have an effective range of up to 9 km (Tyack and Whitehead 1983).

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 et al. 1986). These sounds are attractive and appear to rally animals to the feeding activity (D'Vincent et al. 1985; Sharpe and Dill 1997).

4.3.2 Western DPS Steller Sea Lion

4.3.2.1 Status and Population Structure

Steller sea lions were listed as a threatened species under the ESA on December 4, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs (62 FR 24345; May 5, 1997); the eastern DPS was listed as threatened and the Western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66140). Information on Steller sea lion biology, threats, and habitat (including critical habitat) is available in the revised Steller Sea Lion Recovery Plan (NMFS 2008) and 5-year Status Review (NMFS 2020).

The Western DPS of Steller sea lions decreased from an estimated 220,000 to 265,000 animals in the late 1970s to fewer than 50,000 in 2000 (Muto et al. 2022). Factors that may have contributed to this decline include incidental take in fisheries, competition with fisheries for prey, legal and illegal shooting, predation, exposure to contaminants, disease, and ocean regime shift-driven climate change (NMFS 2008). The most recent comprehensive aerial photographic and land-based surveys of Western DPS Steller sea lions estimated a total Alaska population (both pups and non-pups) of 52,932 (Muto et al. 2022). There are strong regional differences in trends in abundance of Western DPS Steller sea lions, with mostly positive trends in the Gulf of Alaska and eastern Aleutian Islands and generally negative trends in the central and western Aleutian

Islands.

Pup counts increased in the areas east of Samalga Pass in the Aleutian Islands of Alaska between 2015 and 2017 (Sweeney et al. 2017). While the pup counts did increase, they did not increase as much as predicted. The population increase falling short, was mostly attributed to a decrease in pup counts in the Gulf of Alaska (Sweeney et al. 2017). This decline may have been due to changes in prey availability from the marine heatwave that occurred in the northern Gulf of Alaska from 2014 to 2016 (Bond et al. 2015; Petersen et al. 2016; Muto et al. 2022). Non-pup counts have also increased from 2002-2019 in eastern Aleutian Islands (Muto et al. 2022).

4.3.2.2 Distribution

Steller sea lion's range along the North Pacific rim from northern Japan to California, with centers of abundance in the Gulf of Alaska and Aleutian Islands (Loughlin et al. 1984). Although Steller sea lions seasonally inhabit coastal waters of Japan in the winter, breeding rookeries outside of the United States are located only in Russia (Burkanov and Loughlin 2005). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late May to early July) (Jemison et al. 2013; Muto et al. 2022).

Land sites used by Steller sea lions are referred to as rookeries and haulouts (Figure 11). Rookeries are used by adult sea lions for pupping, nursing, and mating during the reproductive season. Haulouts are used by all age classes of both sexes but are generally not where sea lions reproduce. At the end of the reproductive season, some females may move with their pups to other haulout sites and males may migrate to distant foraging locations (Spalding 1964; Pitcher and Calkins 1981). Sea lions may make semi-permanent or permanent one-way movements from one site to another (Chumbley et al. 1997; Burkanov and Loughlin 2005). Round trip migrations of greater than 6,500 km by individual Steller sea lions have been documented (Jemison et al. 2013).

Most adult Steller sea lions occupy rookeries during the pupping and breeding season (Pitcher and Calkins 1981; Gisiner 1985) and exhibit high site fidelity (Sandegren 1970). During the breeding season some juveniles and non-breeding adults occur at or near the rookeries, but most are on haulouts (Rice 1998; Ban 2005; Call and Loughlin 2005).

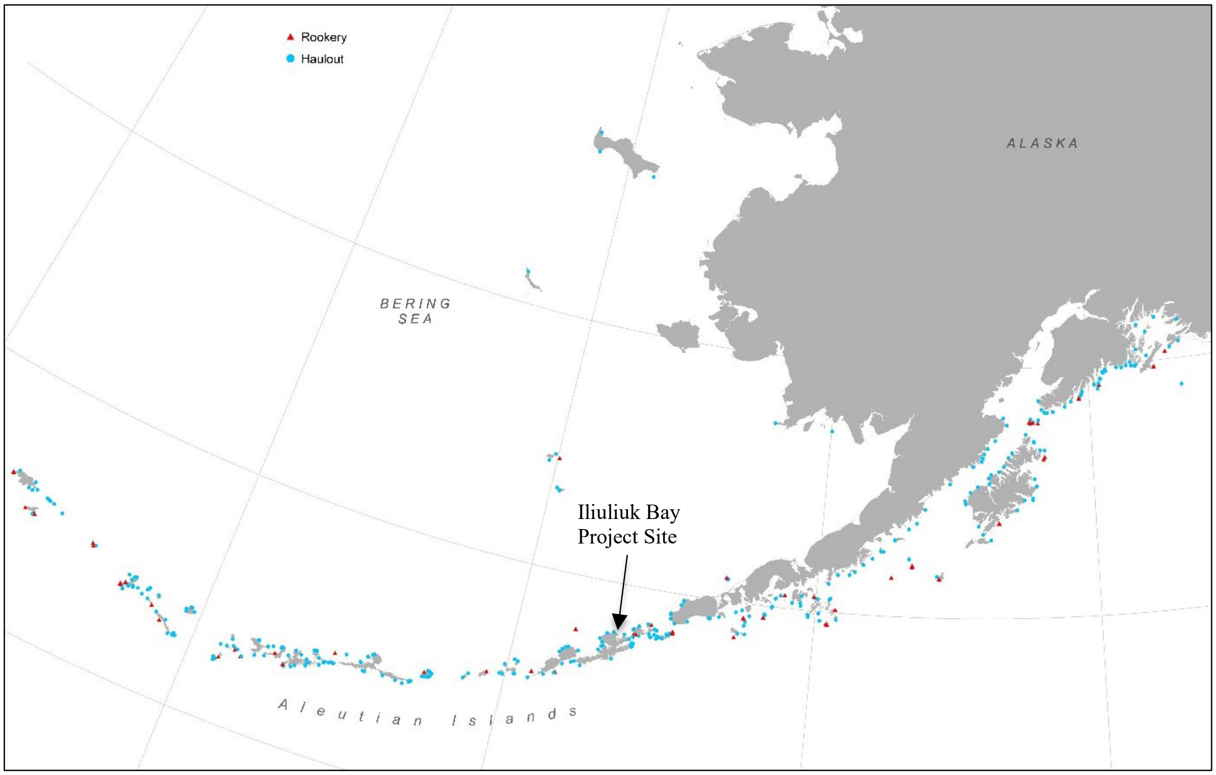

Figure 11. Project site relative to Western DPS Steller sea lion haulouts and rookeries in the Aleutian Islands.

4.3.2.3 Presence in the Action Area

Steller sea lions are distributed throughout the Aleutian Islands, occurring year-round in the proposed action area. Steller sea lions are drawn to fish processing plants and high forage value areas, such as anadromous streams. Dutch Harbor is one of the busiest commercial fishing ports in the United States, with consistent fishing vessel traffic in and out of Iliuliuk Bay. Steller sea lions were common during periodic USACE winter surveys in Dutch Harbor between 2000 and 2016, but they were not abundant near the proposed project area. Single Steller sea lions were observed on occasion outside the Dutch Harbor spit. In past years during winter surveys during 2000 to 2006, there were two areas outside of Iliuliuk Bay where large aggregations of 50 to 60 Steller sea lions were common (USACE, unpublished data; see Figure 4–5 of the IHA application for further detail).

4.3.2.4 Threats to the Species

Natural Threats

Killer whale predation on the Western DPS, under reduced population size, may cause significant reductions in the stock (NMFS 2008). Steller sea lions are also vulnerable to predation from sleeper sharks. Juvenile Steller sea lions were found to underutilize foraging habitats and prey resources based on predation risk by killer whales and sleeper sharks (Frid et al. 2009).

Steller sea lions have tested positive for several pathogens, and parasites are common; however, disease levels and mortality resulting from infestation are unknown. Significant negative effects of these factors may occur in combination with stress, which may compromise the immune system. If other factors, such as disturbance, injury, or difficulty feeding occur, it is more likely that disease and parasitism can play a greater role in population reduction.

Anthropogenic Threats

The mean annual subsistence harvest of Western DPS Steller sea lions between 2014 and 2018 was 209 animals (Muto et al. 2022). Between 2016 and 2020 human-caused mortality and injury of the Western DPS Steller sea lions (n = 148), other than from Alaska Native subsistence harvest, was primarily caused by entanglement in fishing gear, in particular, commercial trawl gear (n = 113; Freed et al. 2022).

Concern also exists regarding competition between commercial fisheries and Steller sea lions for the same resource: stocks of pollock, Pacific cod, and Atka mackerel. Limitations on fishing grounds, duration of fishing season, and monitoring have been established to prevent Steller sea lion nutritional deficiencies as a result of inadequate prey availability.

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).

4.3.2.5 Recovery Goals

The Recovery Plan for the Steller Sea Lion (NMFS 2008), lays out two recovery goals for the Western DPS,

- Ultimate Goal: promote the recovery of the Western DPS of Steller sea lion, and its ecosystem, to a level sufficient to warrant its removal from the federal List of Endangered and Threatened Wildlife and Plants (List) under the ESA.
- Intermediate Goal: Reclassify the Western DPS from endangered to threatened.

4.3.2.6 Reproduction and Growth

Female Steller sea lions attain sexual maturity and first breed between three and eight years of age (Pitcher and Calkins 1981). The average age of reproducing females is about 10 years based on the life tables from Calkins and Pitcher (1982) and York (1994). They normally ovulate and breed annually after maturity although because of a high rate of reproductive failures, estimated birth rates have ranged from 55 to 70 percent (Pitcher and Calkins 1981; Calkins and Goodwin 1988; Altukhov et al. 2015). They give birth to a single pup from late May through early July and then breed about 11 days after giving birth. They undergo delayed implantation and the blastocyst implants about 3.5 months after breeding. Some offspring are weaned near their first birthday while others continue suckling for an additional year or more. While males may attain physiological maturity before 7 years of age, they are seldom able to establish and defend a territory until 8 years or older (Thorsteinson and Lensink 1962; Pitcher and Calkins 1981).

4.3.2.7 Feeding, Diving, and Social Behavior

The foraging strategy of Steller sea lions is strongly influenced by seasonality of sea lion reproductive activities on rookeries and the seasonal presence of many prey species. Steller sea lions are generalist predators that eat a variety of fishes and cephalopods (Pitcher and Calkins 1981; Calkins and Goodwin 1988; NMFS 2008), and occasionally other marine mammals and birds (Pitcher and Fay 1982; NMFS 2008).

During summer, Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 20 nm of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites.

Steller sea lions tend to make shallow dives of less than 250 m but are capable of deeper dives (NMFS 2008). Female foraging trips during winter tend to be longer in duration, farther from shore, and with deeper dives. Summer foraging dives, on the other hand, tend to be closer to shore and are shallower (Merrick and Loughlin 1997). Adult females begin a regular routine of alternating foraging trips at sea with nursing their pups on land a few days after birth.

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 usually solitary (Loughlin 2002).

4.3.2.8 Vocalization, Hearing, and Other Sensory Capabilities

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 pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2018). Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 and 25 kHz (Kastelein et al. 2005), and in air between 250 Hz and 30 kHz (Mulsow and Reichmuth 2010). Sound signals from vessels are typically within the hearing range of Steller sea lions, whether the animals are in the water or hauled out.

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 areas that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation 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

NMFS Alaska Region (AKR) issued a biological opinion in 2017 on the effects on ESA-listed species of USACE's permit authorizing the renovation and expansion of the UMC Dock within Dutch Harbor. For that consultation NMFS authorized take by level B harassment of Western DPS Steller sea lions and Mexico DPS and Western North Pacific DPS humpback whales due to pile driving activities associated with the dock construction. Seventy-two Steller sea lions and nine humpback whales were reported taken by Level B harassment while no animals were taken at Level A.

The biological opinion is available on the NOAA Fisheries website at: https://repository.library.noaa.gov/view/noaa/17151

Other formal consultations that included vessel traffic in the Gulf of Alaska over the past 5 years include:

Consultation ID	Consultation Title
AKRO-2023-00339	ADOT Tongass Narrows (Gravina Access) 2023 Reinitiation
AKRO-2022-02953	Whittier Head of the Bay Cruise Ship Dock
AKRO-2022-02952	Skagway Ore Terminal redevelopment project

AKRO-2022-02861	Lease Sale 258 Cook Inlet
AKRO-2021-03484	Hilcorp Cook Inlet Tugs Towing Rigs
AKRO-2021-02754	NOAA OMAO Ketchikan Port Facility Recapitalization Project
AKRO-2020-03675	City of Hoonah Marine Industrial Center Cargo Dock
AKRO-2018-01552	Taiya Inlet Railroad Dock Dolphin Project
AKRO-2018-01551	Alaska Department of Transportation- Gravina Access
AKRO-2018-01546	Statter Harbor Improvements Project
AKRO-2018-01544	Tenakee Springs Ferry Terminal Improvements Project

While a very small number of animals were likely taken via acoustic harassment, those effects were almost certainly ephemeral. No serious injury or mortality occurred as a result of these projects, and none of them were expected to result in, or resulted in, jeopardy to any of the species that may have been affected.

5.2 Marine Vessel Activity

Dutch Harbor is an industrial area, with several marine docks, a nearby small boat harbor, and other docking facilities. The harbor is one of the larger ports within the Aleutian Island chain and mainly services industrial shipping and local fishing vessels. Dutch Harbor experiences moderate levels of marine vessel traffic year-round; for example, between early September and early October 2023, the daily number of vessels that entered or left the port averaged 36 (range: 10-63).[2] Existing vessel traffic is primarily composed of large, slow moving oil tanker ships, commercial fishing vessels, and cargo ships with some fast-moving recreational boat traffic occurring mainly during summer months by local residents for fishing (USACE 2022). Container ships are the largest vessels that routinely visit the port (USACE 2019). Peak traffic usually occurs from July to October which corresponds with peak humpback abundance in the area. The proposed vessel transit routes include mobilization/demobilization travel between Seattle, Washington, and the Unalaska project site. We expect this project vessel travel will occur along usual transit corridors where vessel traffic is generally present year-round at levels far lower than most transit corridors in the Atlantic and Pacific oceans.(e.g., Silber et al. 2021).

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 and in the Dutch Harbor area. Based on these factors, injury and mortality of humpback whales as a result of vessel strike may likely continue, or possibly increase, in the future (NMFS 2006).

Vessel noise and presence can impact whales by causing behavioral disturbances, auditory interference, or non-auditory physical and physiological effects (e.g., vessel strike). From 1978-

[2] Dutch Harbor Port (USDUT). Accessed October 2023. Port Call Statistics. https://www.marinetraffic.com/en/ais/details/ports/193?name=DUTCH-HARBOR&country=USA

2011, there were at least 108 recorded whale-vessel collisions in Alaska, with the majority occurring in Southeast Alaska between May and September (Neilson et al. 2012). Small recreational vessels traveling at speeds over 13 knots were most commonly involved in ship strike encounters; however, all types and sizes of vessels were reported (Neilson et al. 2012). The majority of vessel strikes involved humpback whales (86 percent) and the number of humpback strikes increased annually by 5.8 percent from 1978 to 2011. Seventeen humpback whales were reported struck by vessels between 2013 and 2015 (Delean et al. 2020) and 18 humpbacks were reported struck by vessels between 2016 and 2020 (Freed et al. 2022). No ship strikes of humpback whale were reported near Unalaska Island between 2015 and 2021, however there was a single reported strike of a fin whale in 2020 (NMFS Alaska Regional Office Stranding Database accessed August 2023). 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)).

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). There are four records of stranded Steller sea lions with injuries indicative of vessel strike in Alaska, however, none of them occurred near Unalaska Island (NMFS Alaska Regional Office Stranding Database accessed August 2023). The risk of vessel strike has not been identified as a significant concern for Steller sea lions.

The project area is subject to noise from many anthropogenic sources, including marine vessels, shoreline construction, and land-based vehicles. Beyond Iliuliuk Bay's immediate surroundings, the project action area extends into Unalaska Bay. Some parts of the Unalaska Bay area are highly developed, e.g., Dutch Harbor, while others are completely undeveloped. However, regular vessel traffic within Dutch Harbor, Iliuliuk Bay, and Unalaska Bay contribute to the baseline noise levels in the action area.

5.3 Fisheries Interactions Including Entanglement

Dutch Harbor is home to one of the largest commercial fisheries in Alaska, as well as to recreational, and subsistence fisheries in and around the action area. Commercial fisheries pose a threat to recovering marine mammal stocks in the Aleutian Islands. Bettridge et al. (2015) report that fishing gear entanglements may moderately reduce the population size or the growth rate of ESA-listed whales. Humpback whales have been killed and injured during interactions with commercial fishing gear. Most entanglements occur between early June and early September, when humpbacks are foraging in nearshore Alaska waters. Three humpback whales have been reported as entangled in fishing gear near Unalaska between 2015 and 2023 (NMFS Alaska Regional Office Stranding Database accessed August 2023).

The minimum estimated mean annual mortality and serious injury rate in all fisheries between 2014 and 2018 was 38 individuals (Muto et al. 2022). This is likely an underestimate as it is an actual count of verified human-caused deaths and serious injuries, and not all entangled animals strand nor are all stranded animals found, reported, or have the cause of death determined. Between 2016 and 2020 human-caused mortality and injury of the Western DPS Steller sea lions (n = 148) was primarily caused by entanglement in fishing gear, in particular, commercial trawl gear (n=113), (Freed et al. 2022). However, the NMFS Alaska Marine Mammal Stranding Network database has no records of Steller sea lions reported as stranded due to interactions with fishing gear (NMFS Alaska Regional Office Stranding Database accessed August 2023).

Commercial fisheries may indirectly affect marine mammals by reducing the amount of available prey or affecting prey species composition. Competition could exist between listed species and commercial fishing for prey species as certain fisheries target key Steller sea lion and humpback whale prey, including Pacific cod, salmon, and herring. Fishery management measures have reduced this potential competition in some regions (e.g., gear restrictions on various fisheries in the area). The broad distribution of prey and seasonal fisheries that differ from listed species presence in the area may minimize such competition as well.

5.4 Pollution

Intentional and accidental discharges of contaminants pollute the marine waters of Alaska. 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.

Leaks and spills have been reported from fuel tanks and tank farms in the Unalaska area. The State of Alaska Department of Environmental Conservation (ADEC) listed Dutch Harbor as "impaired" on the 1990 Clean Water Act section 303(d) list of impaired waters due to non-attainment of water quality standard for petroleum hydrocarbons and petroleum products (i.e., oil and grease). In its 2010 (i.e., most recent) section 303(d) total maximum daily load assessment of the area, ADEC found that Dutch Harbor met applicable water quality standards and removed the waterbody from the 303(d) list. However, two areas of Dutch Harbor are still considered impaired due to oil sheens in sediments (ADEC 2010). The 2010 report found that Dutch Harbor was among the most impacted areas within the areas reported in Unalaska, with contamination more likely to occur around active docks. The potential sources of this contamination include several previously contaminated sites nearby as well as many industrial sources that currently operate within the harbor area. OASIS (2006) provides more information on contaminants at Dutch Harbor.

Possible sources of pollution and contaminants would be ballast water discharge and accidental spills of oil, fuel, and other materials from project related vessels. Ships can potentially release pollutants and non-indigenous organisms through the discharge of ballast water. Marine organisms picked up in ship ballast water and released into non-native habitats are responsible for significant ecological and economic perturbations costing billions of dollars; this is a recognized worldwide problem. The Alaska Department of Fish and Game (ADF&G) developed an Aquatic Nuisance Species Management Plan (Fay 2002) in order to protect Alaska's waters.

The effects of discharged ballast water and the possible introduction of invasive species on humpback whales and Steller sea lions are unknown. Currently, deep draft vessels visiting Dutch Harbor must discharge large amounts of ballast water in order to pass over the bar within Iliuliuk Bay (USACE 2019). Lowering the bar as part of the proposed action here would remove the need for vessels to conduct this practice.

Vessel activity in the action area creates the risk of accidental fuel and lubricant spills. Accidental spills may occur from a vessel leak or if the vessel runs aground. From 1995 to 2012, approximately 400 spills (100 to 300,000 gallons) occurred in Alaska's marine waters. Most were in nearshore and shallow coastal waters and were primarily diesel (BLM 2019). Small spills combined with the dispersive action of waves and currents likely reduces the probability of an encounter and adverse reaction of a listed species to extremely low levels.

5.5 Coastal Zone Development

Coastal zone development results in the loss and alteration of nearshore marine mammal habitat and changes in habitat quality. The shoreline near the construction site is moderately developed, with man-made structures and impervious surfaces along parts of the shoreline while other coastline areas have not been impacted by human development. Marine facilities in the Dutch Harbor include a USCG dock, small boat harbor, split dock facility, light cargo dock, and other infrastructure. Beyond Dutch Harbor, Iliuliuk Bay is mostly undeveloped with a gravel road ringing the bay. The exception is the city of Unalaska which sits along the southernmost shoreline within the bay and has and has extensively developed the shoreline. Of the roughly 7.8 miles (12.58 km) of shoreline within Dutch Harbor and Iliuliuk Bay about 1.7 miles (2.7 km) is heavily developed.

5.6 Climate and Environmental Change

Since the 1950s the atmosphere and oceans have warmed, snow and sea ice have diminished, sea levels have risen, and concentrations of greenhouse gases have increased (IPCC 2014). There is little doubt that human influence has been the dominant cause of the observed warming since the mid-20th century (IPCC 2014). The impacts of climate change are especially pronounced at high latitudes and in polar regions. Average temperatures have increased across Alaska at more than twice the rate of the rest of the United States and the consequences for listed species in Alaska are hard to predict.

Indirect threats associated with climate change include increased human activity as a result of regional warming. Less ice could mean increased vessel activity or construction activities with an associated increase in sound, pollution, and risk of ship strike. Human fishing pressure could change the abundance, seasonality, or composition of prey species. Fisheries in Alaska are managed with the goal of sustainability; however, not all fish stocks are assessed, and it is unknown whether management of fisheries for optimal returns provides sufficient densities in feeding areas for efficient foraging by ESA-listed marine mammal species.

An Unusual Mortality Event (UME) of large cetaceans occurred in Alaskan waters in 2015-2016. Reports of dead whales included 22 dead humpback, 12 fin, 2 gray, 1 sperm, and 6 unidentified whales. The fin whales were observed stranded within a 27-day period around Kodiak Island. This was concurrent with an unusually large number of dead whales found in British Columbia. The strandings were concurrent with the arrival of the Pacific marine heatwave, one of the strongest El Nino weather patterns on record, decreasing ice extent in the Bering Sea, and one of the warmest years on record in Alaska in terms of air temperature.

Recent studies and observations have shown changes in distribution (Brower et al. 2018), body condition (Neilson and Gabriele 2020), and migratory patterns of humpback whales, likely in response to climate change. The indirect effects of climate change on Mexico DPS and WNP DPS humpback whales over time would likely include changes in the distribution of ocean temperatures suitable for many stages of their life history, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

The Pacific marine heatwave is also likely responsible for poor growth and survival of Pacific cod, an important prey species for Steller sea lions. The 2018 Pacific cod stock assessment estimated that the female spawning biomass of Pacific cod was at its lowest point in the 41-year time series considered. This assessment was conducted following three years of poor recruitment and increased natural mortality during the Gulf of Alaska marine heat wave from 2014 to 2016 (Barbeaux et al. 2018).

The Recovery Plan for the Steller Sea Lion 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. 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). 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).

5.7 Subsistence Harvest

The ESA and MMPA allow for the harvest of marine mammals by Alaska Natives for subsistence purposes and for creating and selling authentic native articles of handicraft. However, with the exception of bowhead whales, which are regulated by the aboriginal subsistence harvest quota system under the authority of the International Convention for the Regulation of Whaling through the International Whaling Commission (IWC), subsistence hunters in Alaska are not authorized to take large whales. As of 2009, annual statewide data on community subsistence harvests are no longer being consistently collected. The most recent estimate of annual statewide harvest for the period 2004-2008 (172) excluding St. Paul, St. George, and Atka Islands, which actively collect harvest data, combined with the mean annual harvest between 2014 and 2018 for St. Paul (30), St. George (1.4), and Atka (6) Islands is 209 Western DPS Steller sea lions (Muto et al. 2022).

5.8 Environmental Baseline Summary

A number of activities described in the Environmental Baseline influence the condition of listed species or their habitats in the action area:

- Vessel traffic in the action area poses varying levels of threat to the listed species, depending on the type and intensity of the shipping activity and its degree of spatial and temporal overlap with habitats. Vessel types involved in whale strikes have included cruise ships, recreational vessels, and fishing vessels. The presence, movements, and sound of ships in the vicinity of some species may cause them to abandon breeding or foraging areas. We are unaware of vessel strikes having occurred due to vessel traffic associated with projects upon which NMFS consulted.
- Commercial fisheries may have reduced prey availability.
- Humpback whales and Steller sea lions have been impacted by entanglement.
- The proposed project is in an area of moderately high human use and some existing habitat alteration.
- There are insufficient data to make reliable estimations of the impact of climate change on marine mammals considered in this opinion. The feeding range of humpback whales is larger than that of other species and consequently, as feeding generalists, it is likely that these whales may be more resilient to climate change than other species with more restricted foraging habits.
- Although the effects of climate change and other large-scale environmental phenomena on Steller sea lion habitat cannot be predicted with certainty, impacts to their prey from oceanic regime shifts, or changes in freshwater habitat (hydrologic changes, increased water temperature) are projected to occur.

Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions in the action area appear to be increasing in population size – or, at least, their population sizes do not appear to be declining.

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 biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS aims to minimize the likelihood of false negative conclusions (i.e., concluding 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.

6.1 Project Stressors

Stressors are any physical, chemical or biological phenomena 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 BA (USACE 2023), the IHA application, personal communications, and available literature as referenced in this biological opinion, our analysis recognizes that the proposed action may cause these primary stressors:

- Underwater noise produced by impulsive noise sources such as blasting;
- Underwater noise produced by continuous noise sources such as dredging, borehole drilling, and vessel traffic;
- Injury or disturbance due to vessel traffic;
- Disturbance to seafloor, marine mammal habitat, and marine mammal prey; and
- Pollution from unauthorized spills.

6.1.1 Minor Stressors on ESA-Listed Species

Based on a review of available information, we determined the following stressors are either unlikely to occur or likely to have minimal impacts on, Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions.

6.1.1.1 Vessel Strike or Disturbance

As discussed in the Environmental Baseline section, Iliuliuk Bay and Dutch Harbor experience moderate levels of vessel traffic year-round, with a seasonal summer increase. Existing vessel traffic is primarily from cargo ships and fishing vessels, with some recreation in the summer.

Project-dedicated barges, tugboats and crew boats, will be present during the in-water work of the proposed action. Thus, there may be a temporary, localized, and small increase in vessel traffic during the dredging and blasting phases. During dredging operations, tugboats will be used to move the dredge barge and dump barge around the dredge area. During blasting operations, a tugboat will be used to move a borehole drilling and charge setting barge around the blasting area. We anticipate local barge movement around the dredging/blasting area will occur at very low speeds (<2 knots) in small increments. Crew boats will transport workers from Dutch Harbor to the dredging site, a distance of less than 1.6 miles (2.6 km), with a majority of the transit taking place within Dutch Harbor. The project action could increase vessel traffic by up to an estimated five vessels per day, assuming dredging and blasting operations do not take place at the same time. In addition, the project-dedicated barges will be towed by tugs between Seattle, Washington, and the project site during project mobilization and demobilization. This transit to and from the project site by up to five project-specific tugs/barges represent a very small incremental increase in vessel traffic.

An increase in annual deep draft ships visiting Dutch Harbor is not expected upon lowering the bar (USACE 2019). Nor will lowering the bar increase the number of large vessels allowed within Dutch Harbor and thus Iliuliuk Bay. Currently only one large vessel is allowed in the bay at a time due to harbor management practices. Upon questioning by the USACE, Dutch Harbor management said they do not plan to change this procedure. Therefore, lowering the bar will not have an impact on the vessel strike risk of marine mammals within Iliuliuk Bay or Dutch Harbor. However, lowering the bar will likely decrease the number of small vessels traveling in and around Iliuliuk Bay because under current conditions many of the deep draft ships must anchor outside the bay and have people and supplies transported to and from the ship via smaller vessels. With the deep draft ships able to enter the bay the trips by the smaller boats will not be necessary.

Ship strikes can cause serious injury or mortality to marine mammals. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or a vessel propeller could injure or kill an animal below the water surface. From 1978-2011, there were at least 108 recorded whale-vessel collisions in Alaska, with the majority occurring in

Southeast Alaska between May and September (Neilson et al. 2012). Small recreational vessels traveling at speeds over 13 knots were most commonly involved in ship strike encounters; however, all types and sizes of vessels were reported (Neilson et al. 2012).

The majority of vessel strikes involved humpback whales (86 percent) and the number of humpback strikes increased annually by 5.8 percent from 1978 to 2011. Seventeen humpback whales were reported struck by vessels between 2013 and 2015 (Delean et al. 2020), and 18 humpbacks were reported struck by vessels between 2016 and 2020 (Freed et al. 2022) in Alaskan waters. There has been one reported ship strike of a whale near Unalaska between 2015 and 2023, (NMFS Alaska Regional Office Stranding Database accessed August 2023). The strike involved a fin whale and an unknown vessel, no strikes of humpback whales have been reported near or within Unalaska Bay.

There are only four records of stranded Steller sea lions with injuries indicative of vessel strike in Alaska; and none of them are near Unalaska; three occurred in Sitka and one in Kachemak Bay (NMFS Alaska Regional Office Stranding Database accessed August 2023). Steller sea lions are likely 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). The risk of vessel strike, however, has not been identified as a significant concern for Steller sea lions.

There may be an increased risk of vessel strike due to the increased traffic associated with the proposed vessel activities. Most ship strikes of large whales occur when vessels are traveling at speeds of 14 knots or more (Jensen and Silber 2004). The slow operational speeds of project vessels and the implementation of mitigation measures (i.e., not approaching marine mammals within 100 yards, not changing direction or speed and reducing speeds around marine mammals) will help minimize the risk of collision for marine mammals that may be present in the action area. Thus, NMFS assumes that no vessel strikes will occur during the proposed action. Once the action is complete, however, the action agencies will not have control over lasting effects of the action, such as large container ships traveling to Dutch Harbor once the bar is lowered. However, given that Dutch Harbor management do not plan to change the number of large ships allowed within the harbor combined with the prediction that lowering the bar will not increase the number of large ships visiting Dutch Harbor a year, make it improbable that lowering the bar will have any effect on the probably of vessel strikes by large vessels. Additionally, given that small vessels will no longer have to travel to and from the large ships outside of Iliuliuk Bay the risk of vessel strike from these smaller vessels will likely decrease.

All of these factors limit the risk of strike from the proposed action; therefore, NMFS concludes that the likelihood of vessel strike of humpback whales or Steller sea lions is considered to be improbable.

6.1.1.2 Vessel Noise

Project vessels are likely to generate underwater sound levels exceeding the non-impulsive, continuous threshold of 120 dB, and disturbance to listed species could occur from project vessel noise. The source levels for project vessels are estimated at between 149–170 dB rms and would drop to 120 dB within 2,154 m (or less) of the source (Richardson et al. 1995; Bisson et al. 2013). Although some marine mammals could receive sound levels exceeding the acoustic threshold of 120 dB from the project vessels, disturbances rising to the level of harassment are extremely unlikely to occur.

The nature of the exposure will be low-frequency, with much of the acoustic energy emitted by project vessels at frequencies below the best hearing ranges of listed marine mammals in the action area. In addition, because vessels will be in transit or used to briefly reposition the excavation, drilling, or fill barges, the duration of the exposure to ship noise will be temporary and brief. The project vessels will emit continuous sound while in transit, which will alert marine mammals before the received sound level exceeds 120 dB.

A startle response is not expected. Rather, slight deflection and avoidance are expected to be common responses in those instances where there is any response at all. Free-ranging marine mammals may engage in avoidance behavior when surface vessels move toward them, similar to their behavioral responses to predators. Animals have been observed reducing their visibility at the water surface and moving horizontally away from the source of disturbance or adopting erratic swimming strategies (Williams et al. 2002; Lusseau 2003; Lusseau 2006). Studies indicate that dive times and swimming speeds increase, vocalizations and jumping usually decrease, and individuals in groups move closer together (Kruse 1991; Evans et al. 1994; Lusseau 2006). Most animals in confined spaces, such as shallow bays, moved towards more open, deeper waters when vessels approached (Kruse 1991).

Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects from anthropogenic sounds such as shipping traffic. Baleen whales may also exhibit behavioral changes in response to vessel noise. Marine mammals that have been disturbed by anthropogenic noise and vessel approaches are commonly reported to shift from resting behavioral states to active behavioral states, suggesting an energetic cost to the affected animal. Responding to vessels is likely stressful to humpback whales, but the biological significance of that stress is unknown (Bauer and Herman 1986). Humpback cow-calf pairs significantly reduced the amount of time spent resting and milling when vessels approached, as compared to undisturbed whales (Morete et al. 2007).

Potential impacts of vessel disturbance on Steller sea lions have not been well studied, and the responses will likely depend on the season and stage in the reproductive cycle (NMFS 2008). Steller sea lions are more likely to be disturbed at haulouts and near rookeries, where in-air vessel noise or visual presence could cause behavioral responses such as avoidance of the sound source, spatial displacement from the immediate surrounding area, trampling, and abandonment of pups (Calkins and Pitcher 1982; Kucey 2005). Repeated disturbances that result in abandonment or reduced use of rookeries by lactating females could negatively affect body condition and survival of pups through interruption of normal nursing cycles (NMFS 2008).

Increases in ambient noise from vessel traffic, however temporary, also have the potential to mask communication between sea lions and affect their ability to detect predators (Richardson and Malme 1993; Weilgart 2007).

Some Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions could be exposed to vessel noise as a result of this action. If exposure occurs, it will be temporary and localized, and likely cause responses that are at a low energy cost to individuals. The proposed mitigation measures are expected to further reduce the number of times marine mammals react to transiting vessels. NMFS concludes that any disturbance of Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions from vessel noise will be temporary and the effects to these species from vessel noise will be extremely small.

6.1.1.3 Dredging and Bore Hole Drilling Noise

The proposed action includes the use of various low-level non-impulsive acoustic sources, including dredging and small diameter borehole drilling, that would consistently emit noise for an extended period of time. Material will be removed from the sea floor by mechanical dredging, using either an excavator or a clamshell dredge.

Excavator dredging activities are considered a continuous noise source that has the potential to impact marine mammals (Todd et al. 2015). The processes which comprise sound sources associated with mechanical backhoe (excavator) dredging activities fall within several categories. Physical removal of sediment from the substrate as the bucket is inserted into the bed, forced through the bed in a “scooping” arc, and removed from the bed produces grinding and scraping sounds (Reine et al. 2012). Reine et al. (2012) calculated the source level for a backhoe dredger of 179 dB re 1 µPa at 1 m. Bottom grab sounds were not detected beyond 175 m from the source. Based on Reine et al. (2012), it would be extremely unlikely for Mexico DPS and WNP DPS humpback whales or Western DPS Steller sea lions to be exposed to continuous noise levels ≥120 dB rms re 1µPa if dredging operations are shut down whenever these marine mammals appear likely to approach within 300 m of the sound source. The impacts from the dredging noise are therefore expected to be negligible.

Clamshell dredging activities cause continuous noise that has the potential to impact marine mammals (Todd et al. 2015). Clamshell dredging (e.g., grab dredging) in Cook Inlet measured 124 dB re 1 µPa at the 150 m isopleth (Dickerson et al. 2001). Based on this information, we anticipate that received levels would reach the 120 dB isopleth at approximately 293 m using the practical spreading model. The peak sound levels were associated with the dredger striking the hard ocean floor (Dickerson et al. 2001). In order to prevent Level B acoustic exposure to Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions from this continuous noise source, in-water dredging work will be shut down if a humpback whale or Steller sea lion approaches a zone 300 m from the sound source. With implementation of the appropriate shutdown zone, the impacts from clamshell dredging noise are expected to be negligible.

Drilling of boreholes is not expected to produce sound levels that would reach or exceed the 120 dB threshold for continuous noise beyond 1 m from the source. NMFS has authorized take in association with certain types of drilling in other projects (e.g., 83 FR 53217, October 22, 2018), but those sources have much larger holes being drilled, use different equipment for drilling (e.g., down-the-hole hammering/drilling), and/or other circumstances which lead to an expectation of louder sound levels than are expected here. Because of the small borehole size, acoustic impacts from drilling are likely to be very small, are not expected to rise to the level 120 dB. The impacts from the drilling of boreholes are therefore expected to be negligible.

6.1.1.4 Disturbance to Seafloor, Habitat, and Prey

Blasting, dredging, and fill dumping may cause temporary and localized turbidity through sediment disturbance. Turbidity plumes during bar lowering activities will be localized around the dredging site, blasting area, and dumping site. These activities will not take place simultaneously, limiting the amount of sediment stirred up at any given time. Humpback whales are not expected to be close enough to project activities to experience the effects of turbidity, and Steller sea lions can easily avoid localized areas of turbidity at no measurable cost to them. Local strong currents are expected to disperse any additional suspended sediments produced by project activities at moderate to rapid rates depending on tidal stage. Due to temporary, localized, and low levels of turbidity increases, it is not expected that turbidity would measurably impact the Mexico DPS and WNP DPS of humpback whale, or Western DPS Steller sea lion.

6.1.1.5 Pollution

Measures to prevent spills of oil and other pollutants as described in Section 2.1.2 of this opinion will be implemented during construction. The risk of spills and pollutants related to the project will be mitigated by implementing best management practices and policies to prevent accidental spills. Plans will be in place and materials will be available for cleanup activities if a spill were to occur during project construction. The proposed activities will be conducted in accordance with Clean Water Act Section 404 and 401 regulations to minimize potential construction-related impacts on water quality, and any effects to Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions would be immeasurably small. Therefore, we conclude that the effects from this stressor are negligible.

Commercial ships have the potential to impact water quality through accidental leakage of fuel, oil, and dumping of wastewater or ballast water into the ocean during transit. Lowering the bar within Iliuliuk Bay will decrease the amount of ballast water discharged into the bay because deep draft vessels will no longer need to remove ballast water in order to pass over the bar. Additionally, deep draft vessels will no longer need to wait for extended periods of time, for ideal tide and ocean conditions to pass over the bar. Instead, they will be able to enter the bay and thus the harbor much faster. The less time the deep draft vessels have to wait in Unalaska Bay means less wastewater being flushed into the area. Therefor lowering the bar in Iliuliuk Bay will have no adverse effect on pollution.

6.1.2 Major Stressors on ESA-Listed Species

Underwater noise from blasting is likely to adversely affect WNP DPS and Mexico DPS humpback whales and Western DPS Steller sea lions. This stressor will be analyzed further in the Exposure Analysis and Response Analysis.

Sound sources can be divided into broad categories based on various criteria or for various purposes. With regard to temporal properties, sounds are generally considered to be either continuous or transient (i.e., intermittent). Continuous sounds are those whose sound pressure level remains above ambient sound during the observation period (2005). Intermittent sounds are defined as sounds with interrupted levels of low or no sound (NIOSH 1998). Sound sources may also be categorized by spectral property. The sounds produced by the USACE's activities fall into two general sound types: impulsive (discussed below) and non-impulsive (discussed under "Minor Stressors" above). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing. Please see (Southall et al. 2007) for an in-depth discussion of these concepts. Impulsive sound sources (e.g., explosions, gunshots, sonic booms, impact pile driving) are by definition intermittent, and produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI 1986; Harris 1998; NIOSH 1998; ISO (International Organization for Standardization) 2003; ANSI (American National Standards Institute) 2005) and occur either as isolated events or repeated in some succession. All impulsive sounds are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features. Explosives used for blasting emit an impulsive sound, which is characterized by a short duration, abrupt onset, and rapid decay. Exposure to high intensity sound may result in behavioral reactions and auditory effects such as a noise-induced threshold shift—an increase in the auditory threshold after exposure to noise (Finneran et al. 2005).

6.1.2.1 Acoustic Thresholds

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 has developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS) (83 FR 28824; June 21, 2018; 81 FR 51693; August 4, 2016). NMFS is in the process of developing guidance for acoustic harassment (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels,[3] expressed in root mean square[4] (rms), from broadband sounds that cause behavioral disturbance (acoustic harassment), and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA) (16 U.S.C § 1362(18)(A)(ii)):

- impulsive sound: 160 dB_{rms} re 1 μPa
- non-impulsive sound: 120 dB_{rms} re 1μPa

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds (Table 5) for underwater sounds that cause injury (acoustic harm), referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 U.S.C § 1362(18)(A)(i))(NMFS 2018). 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 4.

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.

Acoustic harm (Level A) can be calculated using the optional user spreadsheet[5] 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); 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)).

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). For purposes of this consultation, any exposure to Level A or Level B disturbance sound thresholds under the MMPA is considered to be an incidental "take" under the ESA and must be authorized by the ITS (Section 10 of this opinion)

[3] 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.

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

[5] The Optional User Spreadsheet can be downloaded from the following website: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance

(except that take is not prohibited for threatened species that do not have ESA section 4(d) regulations).

Table 4: 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 whale WNP DPS humpback whale	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 lion	60 Hz to 39 kHz

[1]Respresents 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).

Table 5: PTS onset acoustic thresholds for Level A harassment (NMFS 2018).

Hearing Group	PTS Onset Acoustic Thresholds[1] (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
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

Hearing Group	PTS Onset Acoustic Thresholds[1] (Received Level)	
	Impulsive	Non-impulsive
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

[1] 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 1µPa^{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.

As described below, we expect that exposures to listed marine mammals from noise associated with the proposed blasting may result in behavioral harassment and TTS. With use of the mitigation measures in Section 2.1.2 above, it is unlikely but possible that exposures may result in PTS in a few individual animals. However, no non-auditory injuries or mortalities are expected.

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 gender 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, the USACE proposed mitigation measures that should avoid or minimize exposure of Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions to stressors associated with the proposed bar removal project.

6.2.1 Exposure to Sound from Blasting

Mexico DPS and WNP 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 blasting is being conducted and could be exposed to temporarily elevated underwater sound levels resulting in harassment.

Temporarily elevated underwater noise during blasting has the potential to result in Level B harassment of marine mammals in the form of behavioral disturbance and TTS. Level A harassment of marine mammals (resulting in PTS and/or injury) is not expected to occur as a result of the proposed action because shutdown zones will be implemented, and the mitigation measures proposed in Section 2.1.2 will reduce the potential for exposure to levels of underwater noise above the threshold for Level A harassment established by NMFS. However, due to the explosives best practices protocol that set explosives cannot sit longer than 24 hours without being detonated, it is possible that a humpback whale or Steller sea lion could incur PTS in the event that the explosives must be detonated.

For acoustic impacts, generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) the number of days of activities. Note that while these factors can contribute to a basic calculation to provide an initial prediction of potential takes, additional information that can qualitatively inform take estimates is also sometimes available (e.g., previous monitoring results or average group size).

6.2.2 Ensonified Area

This section describes the operational and environmental parameters for the proposed blasting that allow NMFS to estimate the area ensonified above the acoustic harassment thresholds.

NMFS computed cumulative sound exposure impact zones from the blasting information provided by the USACE. Peak source levels of the confined blasts were calculated based on Hempen et al. (2007), and scaled using a distance of 10 feet (3 m) and a weight of 95 lbs (43.1 kg) for a single charge. The total charge weight is defined as the product of the single charge weight and the number of charges. In this case, the number of charges is 75. Explosive energy was then computed from peak pressure of the single maximum charge, using the pressure and time relationship of a shock wave (Urick 1983). Due to time and spatial separation of each single charge by a distance of 10 feet (3m), the accumulation of acoustic energy is added sequentially, assuming the transmission loss follows cylindrical spreading within the matrix of charges. The sound exposure level (SEL) from each charge at its source can then be calculated, followed by the received SEL from each charge. Since the charges will be deployed in a grid of 10 feet (3 m) by 10 feet (3 m) apart, the received SELs from different charges to a given point will vary depending on the distance of the charges from the receiver. Without specific information regarding the layout of the charges, the modeling assumes a grid of eight by nine charges with an additional three charges located in three peripheral locations. Among the various total SELs calculated (one at a receiver location corresponding to each perimeter charge), the largest value, SELtotal (max) is selected to calculate the impact range. Using the pressure versus time relationship above, the frequency spectrum of the explosion can be computed by taking the Fourier transform of the pressure (Weston 1960), and subsequently be used to produce hearing range weighted metrics.

Frequency specific transmission loss of acoustic energy due to absorption is computed using the absorption coefficient, α (dB/km), summarized by François and Garrison (1982). Seawater properties for computing sound speed and absorption coefficient were based on NMFS Alaska Fisheries Science Center's report of mean measurements in Auke Bay (Sturdevant and Landingham 1993) and the 2022 average seawater temperature from Unalaska. Transmission loss was calculated using the sonar equation:

$$TL = SEL_{total(m)} - SEL_{threshold}$$

where $SEL_{threshold}$ is the acoustic harm (Level A harassment) threshold. The distances, R, where such transmission loss is achieved, were computed numerically by combining both geometric transmission loss, and transmission loss due to frequency-specific absorption. A spreading coefficient of 20 is assumed to account for acoustic energy loss from the sediment into the water column. The outputs from this model are summarized in Table 6.

Table 6: Model results of impact zones for blasting in meters (m).

Marine Mammal Hearing Group	Mortality	Slight Lung Injury	GI Tract	PTS: SEL_{cum}	PTS: SPL_{pk}	TTS: SEL_{cum}	TTS: SPL_{pk}
Low-Frequency Cetaceans	4.0	9.2	25.8	*344.7	205.3	*1,918	409.6
Otariid Pinnipeds	13.8	32.3	25.8	40.0	*91.9	*249.8	183.4
* For the dual criteria of SELcum and SPLpk, the largest of the two calculated distances for each species group was used in our analysis. The PTS and TTS distances for Steller sea lions resulting from the model seemed uncharacteristically small when compared to the other thresholds resulting from the model and were doubled to 92 m and 230 m respectively for take estimation, mitigation, and monitoring.							

Using the model described above, the underwater noise was determined to fall below the Level B harassment threshold for humpback whales at a maximum radial distance of 1,918 m for blasting. The geography of Iliuliuk Bay, however, obstructs underwater sound transmission to the north and south of the project site preventing blasting related sound from spreading to the full 1,918-m isopleth (Figure 3). However, to the east and west the sound can propagate out to the full 1,918 m. The Level B isopleth for Steller sea lions from blasting is 249.8 m, and is not limited by geography. All acoustic harassment isopleths for blasting are summarized in Table 7.

Table 7: Level A and Level B harassment isopleths for blasting.

Action	Acoustic Harm (PTS) (MMPA Level A) Zone (m)		Acoustic Harassment (TTS) (MMPA Level B) Zone (m)	
	Low-frequency Cetaceans	Otariid Pinnipeds	Low-frequency Cetaceans	Otariid Pinnipeds
Blasting	205.3	91.9	1,918	249.8

6.2.3 Marine Mammal Occurrence and Exposure Estimates

This section, provides information about the occurrence of marine mammals, including density or other relevant information that will inform the take calculations. Reliable densities are not available for Iliuliuk Bay and generalized densities for the North Pacific are not applicable given the high variability in occurrence and density at specific areas around the Aleutian Island chain. Therefore, the USACE consulted previous survey data in and around Iliuliuk Bay and Dutch Harbor to arrive at a number of animals expected to occur within the project area per day.

Figure 12 and Table 8 (from the IHA application) provide further detail on observations of humpback whales and Steller sea lions in and around Iliuliuk Bay.

6.2.3.1 Take Estimation

Table 8 is comprised of data from 2018 surveys that were conducted in Unalaska Bay in the green, yellow, and orange zones depicted in Figure 12. Additionally, surveys were done for a local construction monitoring program in 2017 that extensively surveyed the red zone. Surveys were conducted in April through October for 4 days per month.

Since reliable densities are not available, the USACE has requested take based on the maximum number of animals that may occur in the blasting area per day multiplied by the number of days of the activity. The applicant varied these calculations based on certain factors. Because of the nature of the proposed blasting (i.e., no more than one blasting event per day), the behavioral acoustic harassment thresholds associated with the activity are the same as for the onset of TTS for all species. Both behavioral disturbance and TTS may occur.

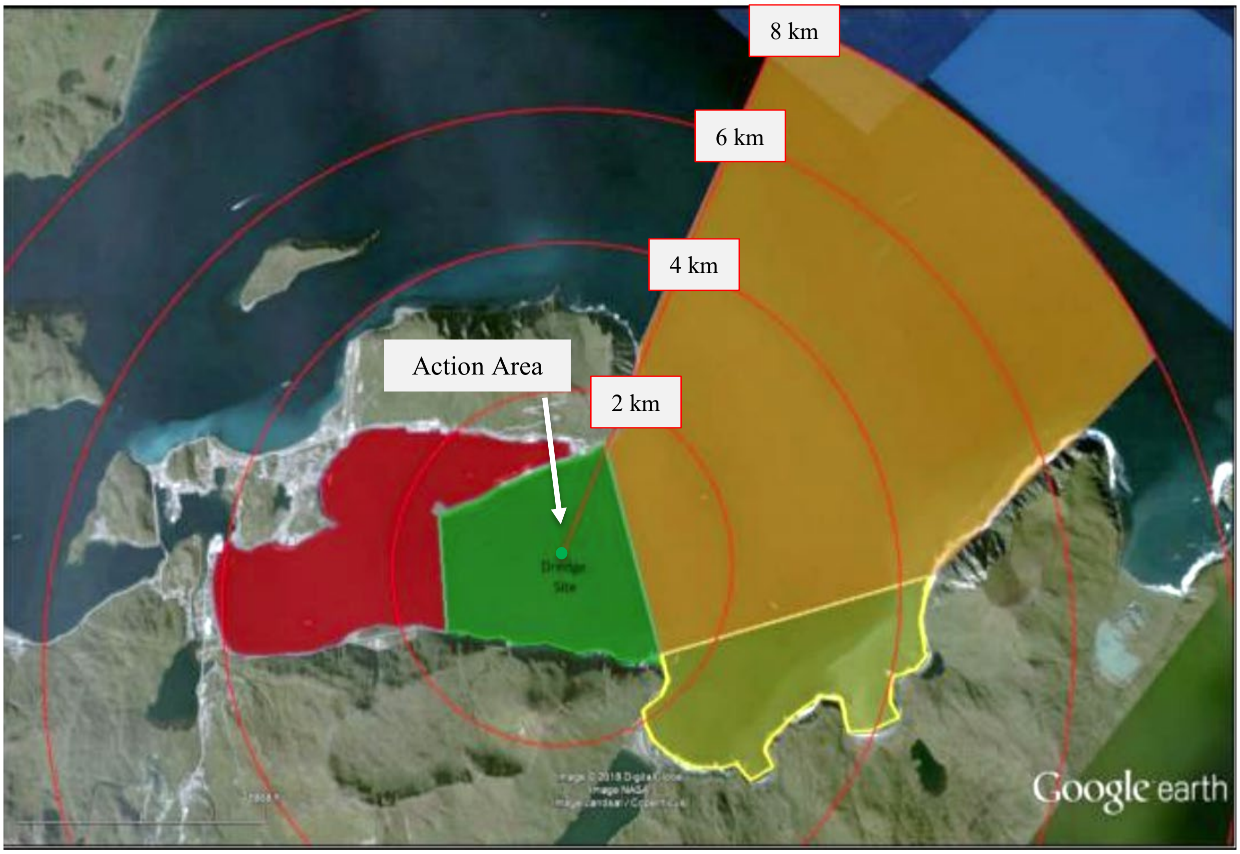

Figure 12: Marine mammal surveys 2017 and 2018 survey zones. (Figure 4-8 from IHA application, modified by NOAA biologist for clarity).

Table 8: Iliuliuk Bay marine mammal surveys 2018 observation data (Table 4-3 from IHA application).

2018 Marine Mammal Surveys*												
Month	Humpback Whale				Harbor Seal				Steller Sea Lion			
	Orange Zone	Yellow Zone	Green Zone	Red Zone	Orange Zone	Yellow Zone	Green Zone	Red Zone	Orange Zone	Yellow Zone	Green Zone	Red Zone
April	1	0	0	NS	9	2	8	NS	4	0	0	NS
May	2	0	0	NS	7	1	3	NS	7	0	1	NS
June	10	0	0	1	38	5	6	3	0	2	1	3
July	13	0	0	0	43	5	8	4	0	5	32	4
August	40	0	0	4	40	6	9	6	4	0	3	9
September	47	0	0	2	27	8	7	4	0	1	0	23
October	7	0	0	1	5	2	4	2	0	0	7	11
Total	**120**	**0**	**0**	**8**	**169**	**29**	**45**	**20**	**15**	**8**	**44**	**50**

*These data show the daily "worst case" total observed of these three species in each zone for each month surveyed.

Humpback whales are commonly sighted outside the mouth of Iliuliuk Bay and were most common in August and September between 2 and 8 km from the survey site outside the mouth of the bay (Table 8). Humpbacks were also spotted within Iliuliuk Bay in much lower numbers (maximum daily sightings within the bay: 4; outside the bay: 47) (USACE 2023). Based on the previous monitoring efforts in and around Iliuliuk Bay, NMFS conservatively estimated that a maximum of two animals may be present within the Level B (acoustic harassment) threshold per day.

The following equation was used to calculate the number of estimated exposures of Mexico DPS and WNP DPS humpback whales to Level B acoustic harassment:

$$Acoustic\ Harassment\ Estimate = \frac{(N_{whales} * N_{bd})}{frequency\ of\ whale\ occurrence} * \%\ ESA$$

where N_{whales} is the number of whales in the Level B acoustic harassment zone, N_{bd} is the number of blasting days, and the frequency of whale occurrence refers to the number of days over which N_{whales} occur. Percent ESA refers to the number of humpback whales within the regional population which are within an ESA-listed DPS. Two percent of humpback whales within the Aleutian Islands are estimated to be from the WNP DPS and seven percent are estimated to be from the Mexico DPS (Wade 2021).

Based on occurrence information in the area, we conservatively estimate that a group of two humpback whales will be sighted within the Level B acoustic harassment zone during each of the maximum 24 potential blasting days. Therefore:

$$\frac{2 * 24}{1} = 48\ whales\ in\ Level\ B\ acoustic\ harrassment\ zone$$

$$48\ humpbacks * 0.09 \approx 5\ ESA\text{-}listed\ whales$$

The results of the analysis indicate that 48 humpbacks are expected within the Level B acoustic harassment zone during blasting days. Of those 48 animals it is estimated that four are from the ESA-listed, Mexico DPS and one is from the WNP DPS. While NMFS expects that the monitoring and mitigation described in Section 2.1.2 will be effective at preventing injurious take of marine mammals, we recognize that humpback whales are common in the area, and that animals may enter the blasting area after charges have been set. Given that there is a limit on the amount of time detonation may be safely delayed it is possible that blasting will have to occur while a humpback whale is present in the Level A acoustic harm zone. We therefore conservatively estimate up to 10 percent of the blasting events may occur while there is a humpback whale within the Level A acoustic harm isopleth. As a result, three humpback whales are expected to be taken by Level A acoustic harm (as per NMFS proposed IHA for this project). However, of those three humpbacks, only 0.21 are expected to be from the Mexico DPS and 0.06 from the WNP DPS. Therefore, NMFS has determined that there is an extremely low probability that any ESA-listed humpbacks will be exposed to sound levels sufficient to result in Level A acoustic harm. Therefore, we expect this project will result in five takes of listed humpback whales due to sound capable of causing Level B acoustic harassment and no takes due to sound capable of causing Level A acoustic harm.

During previous monitoring efforts, Steller sea lions were observed most frequently inside of Iliuliuk Bay, within 4 km of the proposed project area. The maximum number of sightings in a single day was 32, though it is unclear whether this includes multiple sightings of the same large group of 10 to 12 individuals (USACE 2023). Steller sea lions in this area are known to congregate around and follow fishing vessels that regularly transit into and out of Dutch Harbor. Given the previous monitoring data, NMFS conservatively estimates that a maximum of two animals may be within the Level B harassment zone for each blast. While NMFS expects that the monitoring and mitigation described in Section 2.1.2 will be effective at preventing injurious take of marine mammals, we recognize that Steller sea lions are common in the area, that animals may enter the blasting area after charges have been set, and that there is a limit on the amount of time detonation may be safely delayed. Steller sea lions may be difficult for observers to detect before charges are laid on a blasting day, and we therefore conservatively estimate up to two Steller sea lions may be within the Level A acoustic harm isopleth for up to 20 percent of the blasting events. Using the same equation as for humpback whales above, with two animals expected per day, multiplied by a maximum of 24 days of blasting, we expect 48 Western DPS Steller sea lions will be exposed to sound capable of causing Level B acoustic harassment, and five will be exposed to sound capable of causing Level B acoustic harm

Table 9 summarizes the estimated exposures of Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions to blasting. Take is not authorized for dredging, as we consider it a minor stressor (see Section 6.1.1.3).

Table 9. Estimated Level A and Level B harassment exposures.

Species	DPS	Estimated Level B Acoustic Harassment Exposures	Estimated Level A Acoustic Harm Exposures
Humpback Whale	Mexico	4	0
	WNP	1	0
Steller Sea Lion	Western	48	5

6.3 Response Analysis

As discussed in the Approach to the Assessment section of this opinion, response analyses determine how listed species / critical habitats 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 (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals.

6.3.1 Responses to Major Noise Sources (Blasting)

Loud underwater noise can result in physical effects on the marine environment that can affect marine organisms. Possible responses by Mexico DPS humpback whales, WNP DPS humpback whales, and Western DPS Steller sea lions to the impulsive sound produced by blasting include:

- Physical Responses
  - Temporary or permanent hearing impairment (threshold shift)
  - 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/flight

As described in the Exposure Analysis, Mexico DPS and WNP DPS humpback whales, and Western DPS Steller sea lions are expected to occur in the action area and to overlap with sound associated with blasting activities. We expect that some individuals will be exposed to, and respond to, this sound source, should the blasting occur. Recall that blasting will only occur if dredging cannot remove the substrate to the desired depth.

The introduction of anthropogenic noise into the aquatic environment from blasting activities is the primary means by which marine mammals may be harassed by project activities. In general, animals exposed to natural or anthropogenic sound may experience physical and physiological effects, ranging in magnitude from none to severe (Southall et al. 2007). Exposure to anthropogenic noise can also lead to non-observable physiological responses such an increase in stress hormones. Additional noise in a marine mammal's habitat can mask acoustic cues used by marine mammals to carry out daily functions such as communication and predator and prey detection.

Exposure to blasting has the potential to result in auditory threshold shifts and behavioral reactions (e.g., avoidance, temporary cessation of foraging and vocalizing, changes in dive behavior). The effects of blasting on marine mammals are dependent on several factors, including, but not limited to, the species, age and sex class (e.g., adult male vs. cow with calf), duration of exposure, the distance between the blast and the animal, received levels, behavior at time of exposure, and previous history with exposure (Wartzok et al. 2003; Southall et al. 2007). Here we discuss physical auditory effects (threshold shifts) followed by behavioral effects.

6.3.1.1 Threshold Shifts

NMFS defines a noise-induced threshold shift (TS) as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). In other words, a threshold shift is a hearing impairment, and may be temporary (such as ringing ears after a loud rock concert) or permanent (such as the loss of the ability to hear certain frequencies or partial or complete deafness). There are numerous factors to consider when examining the consequence of TS, including: the signal’s temporal pattern (e.g., impulsive or non-impulsive); likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS; the magnitude of the TS; time to recovery; the frequency range of the exposure (i.e., spectral content); the hearing and vocalization frequency range of the exposed species relative to the signal's frequency spectrum (i.e., how and animal uses sound within the frequency band of the signal; (Kastelein et al. 2014); and the overlap between the animal and the sound (e.g., spatial, temporal, and spectral; NMFS 2018). The amount of threshold shift is customarily expressed in dB.

Temporary Threshold Shift

Temporary threshold shift (TTS) is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter 1970). While experiencing TTS, the hearing threshold rises, and a sound must be stronger in order to be heard. In terrestrial mammals, TTS can last from minutes to days (in cases of strong TTS). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the sound ends. Few data exist on the sound levels and durations necessary to elicit mild TTS in marine mammals, and none of the published data describe TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in (Southall et al. 2007).

For explosive activities using single detonations *(*i.e.*,* no more than one detonation within a day), such as those described in the proposed activity, NMFS uses TTS onset thresholds to assess the likelihood of behavioral acoustic harassment, rather than the acoustic harassment (Level B) threshold of 160 dB rms for impulsive sounds. While marine mammals may also respond behaviorally to single explosive detonations, these responses are expected to typically be in the form of startle reaction, rather than a more meaningful disruption of a behavioral pattern. On the rare occasion that a single detonation might result in a behavioral response that qualifies as acoustic harassment (Level B), it would be expected to be in response to a comparatively higher received level. Although acoustic harassment exposures may occur, the noise thresholds for the onset of TTS are conservative and not all instances of take will result in TTS. If TTS does occur, it is expected to be mild and temporary and not likely to affect the long-term fitness of the affected individuals.

Permanent Threshold Shift

When permanent threshold shift (PTS) occurs, there is physical damage to the sound receptors in the ear. The animal will have an impaired ability to hear sounds in specific frequency ranges, and there can be total or partial deafness in severe cases (Kryter 1985). There is no specific evidence that exposure to pulses of sound can cause PTS in any marine mammal. However, given the possibility that mammals close to a sound source can incur TTS, it is possible that some individuals will incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing the onset of TTS might elicit PTS.

Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals, based on anatomical similarities. PTS might occur at a received sound level at least several decibels above that which induces mild TTS, if the animal were exposed to strong sound pulses with rapid rise time. For non-impulsive exposures (i.e., vibratory pile driving), a variety of terrestrial and marine mammal data sources indicate that threshold shift up to 40 to 50 dB may be induced without PTS, and that 40 dB is a conservative upper limit for threshold shift to prevent PTS. An exposure causing 40 dB of TTS is, therefore, considered equivalent to PTS onset (NMFS 2018).

Zero listed humpback whales and five Western DPS Steller sea lions are expected to be exposed to sound from underwater blasts sufficient to cause PTS. This may occur because explosives must be detonated within 24 hours of underwater deployment and cannot be detonated at night. However, in the submitted BA, the USACE stresses that they will avoid detonations in the presence of marine mammals whenever possible.

6.3.1.2 Non-Auditory Physiological Effects

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

Because the USACE will confine their blasts, the energy of the resultant shock wave is reduced by as much as 60-90 percent compared to unconfined, open-water detonations in a free field. Given the low weight of the charges and confined nature of the blasts, in conjunction with monitoring and mitigation measures discussed in Section 2.1.2, the USACE's 24 possible blasting events are not likely to cause mortality or severe injuries to marine mammals in the project vicinity, like neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage, or mortality, but could cause other non-auditory physiological effects, like stress responses, of listed humpback whales and Steller sea lions.

An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (Moberg 2000). In many cases, an animal's first, and sometimes most economical (in terms of energetic costs), response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficiently to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (Jessop et al. 2003; Lankford et al. 2005; Crespi et al. 2013). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano et al. 2002) and, more rarely, studied in wild populations (Romano et al. 2002). For example, noise reduction from reduced ship traffic in the Bay of Fundy following September 11, 2001 was linked to a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased noise levels, although not acutely injurious, can produce stress (Rolland et al. 2012). These stress hormones returned to their previous level within 24 hours after the resumption of shipping traffic. Exposure to loud noise can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011). In a variety of factors, including behavioral and physiological responses, females appear to be more sensitive or respond more strongly than males (Kight and Swaddle 2011).

These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress". In addition, any animal experiencing TTS would likely also experience stress responses (NRC 2003). Given the short duration of the noise produced by blasting, the fact that only a single blasting event will occur on a given day, and that blasting events would occur on a maximum of 24 days, any physiological stress responses experienced by individual listed humpback whales and Steller sea lions upon exposure to underwater sound from blasting are expected to be temporary and not likely to affect the long-term fitness of the affected individuals.

6.3.1.3 Behavioral Disturbance Reactions

Behavioral responses are influenced by an animal's assessment of whether a potential stressor poses a threat or risk. Behavioral responses may include: changing durations of surfacing and dives, number of blows per surfacing, or changing direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or, flight responses.

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

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices, but also including blasting) have been varied, but often consist of avoidance behavior or other behavioral changes, suggesting discomfort (Morton and Symonds 2002; Wartzok et al. 2003; Thorson and Reyff 2006; Nowacek et al. 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be biologically significant if the change affects growth, survival, or fitness. Significant behavioral modifications that could potentially lead to effects on growth, survival, or fitness include:

- Drastic changes in diving/surfacing patterns;
- Longer-term habitat abandonment due to loss of desirable acoustic environment;
- Longer-term cessation of feeding or social interaction; and,
- Cow/calf separation.

The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) making it difficult to predict (Southall et al. 2007). Given the nature of the proposed blasting activities (single, short-duration blasts on nonconsecutive days), and the monitoring and mitigation measures described in Section 2.1.2, NMFS considers the most likely impact to marine mammals to be a short-term, temporary behavioral disturbance such as a startle or change in orientation. It is expected that animals would return to their normal behavioral patterns within a few minutes after the blasting event, and that no habitat abandonment is likely as a result of the proposed blasting activities. The behavioral responses discussed would not likely cause a listed humpback whale or Steller sea lion to expend an amount of energy which would measurably reduce its survival or fitness.

6.3.1.4 Auditory Masking

Natural and artificial sounds can disrupt behavior by masking, or interfering with, a marine mammal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher levels. Chronic exposure to excessive, though not high-intensity, sound could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions. Masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance or fitness in survival and reproduction. If the coincident (masking) sound were anthropogenic, it could be potentially harassing if it disrupted hearing-related behavior. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs only during the sound exposure. Because masking (without resulting in threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

Masking occurs at the frequency band the animals utilize, so the frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Lower frequency man-made sounds are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey sound. Anthropogenic sounds may also affect communication signals when both occur in the same sound band and thus reduce the communication space of animals (Clark et al. 2009), and cause increased stress levels (Foote et al. 2004; Holt et al. 2009).

Masking has the potential to affect species at the population or community levels as well as at individual levels. Masking affects both senders and receivers of the signals and can potentially have long-term chronic effects on marine mammal species and populations. Recent research suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than a three-fold increase in terms of SPL) in the world's ocean from pre-industrial periods, and that most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic sound sources, such as those from vessel traffic, blasting, and dredging activities, contribute to the elevated ambient sound levels, thus intensifying masking.

Given the short duration (approximately 1 second each) and non-consecutive nature of the blasting events proposed, and the limited affected area, it is unlikely that masking would occur for any marine mammal species.

6.3.2 Response Analysis Summary

Probable responses of humpback whales and Steller sea lions to blasting include short-term behavioral disturbance reactions such as changes in activity and vocalizations, avoidance or displacement, and/or more serious effects such as TTS or PTS. These reactions and behavioral changes are expected to be temporary and subside quickly when the exposure ceases. The primary mechanism by which these reactions and behavioral changes may affect the fitness of individual animals is through the animal's energy expenditure, time cost, or both (the two are related because foraging requires time). We expect most animals will leave the area after blasting occurs if they were disturbed, and high-quality habitat is located throughout Unalaska Bay and neighboring Aleutian Islands, as evidenced by their frequent presence there in substantial numbers. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to measurably affect humpback whales and Steller sea lions, and their exposure to noise sources are not likely to reduce their fitness.

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.

Some continuing non-Federal activities are certain to contribute to climate change 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 Environmental Baseline (Section 5).

Coastal development, associated industrial sources of pollutants and discharges, and subsistence harvest described in the Environmental Baseline are expected to continue with similar impacts. Reasonably foreseeable future state, local, or private actions include activities that relate to vessel traffic: oil transport, cargo shipping, and commercial fishing.

7.1 Vessel traffic

The project area experiences moderate levels of marine vessel traffic year-round with the highest volumes occurring April through October. Marine vessels that use Iliuliuk and Unalaska Bays include: oil transport vessels, commercial fishing vessels, barges, freight vessels, and recreational vessels.

Container ships and oil transport vessels are the largest vessels that routinely transit through Iliuliuk and Unalaska Bays. Approximately 90 percent of the bulk cargo coming into the port is petroleum related products, although fishing vessels, commercial and private, make up a majority of the port's traffic (USACE 2019).

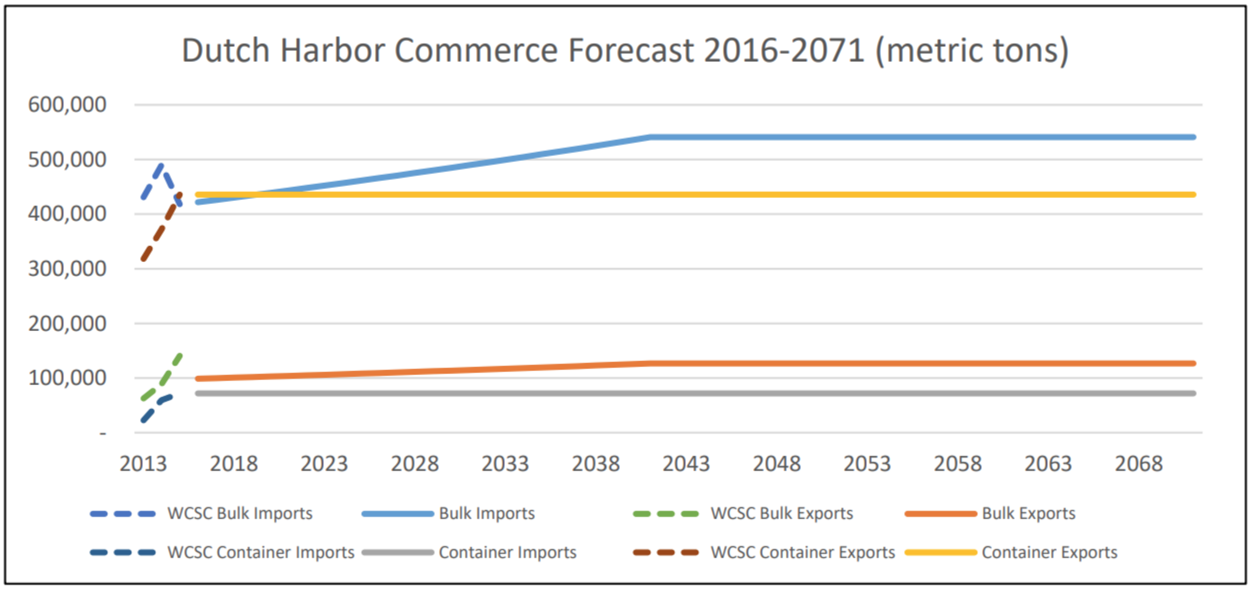

Figure 13: Historical commerce and forecasted commerce levels (metric tons). Waterborne Commerce Statistics Center (WCSC) (USACE 2019).

Vessel traffic is expected to continue in Dutch Harbor, as well as between Dutch Harbor and Seattle, Washington. It is predicted that overall vessel traffic and shipping will increase in the future, however the exact amount depends largely on economics and factors other than the lower bar (Figure 13) (USACE 2019). As mentioned before, a slight decrease in vessel traffic is expected in the Dutch Harbor vicinity with the lowering of the bar, because small vessels will no longer need to ferry cargo and crew between Dutch Harbor and the large vessels which are currently incapable of traveling over the bar. However, with the ability to move in and out of Iliuliuk Bay once the bar is lowered, a future increase in large oil and freight vessel traffic within the bay is possible. Additionally, while Dutch Harbor management currently doesn't plan to allow more than one large vessel into Iliuliuk Bay at a time, this could change in the future. As a result, there would be continued if not increased risk to marine mammals of ship strikes, exposure to vessel noise and presence, and small spills. However, due to the small area within Iliuliuk Bay, large commercial vessels will still be required to travel at slow speeds, significantly reducing the chance of a vessel strike. Adverse effects from this very small incremental increase in vessel presence (if it occurs) and the small increase in risk of petroleum product spills may occur, but the probability of that occurring is extremely low, and if those effects do occur, they are expected to be extremely small in magnitude.

Further economic development due to the increase in large vessel traffic could lead to more industrial and residential growth within the communities of Dutch Harbor and Unalaska. As a result, increased shoreline hardening, industrial and residential pollution, and construction activities could further encroach on and adversely affect physical and biological features of critical habitat for Steller sea lions, and Mexico DPS and WNP DPS humpback whales. While the amount of critical habitat available to these species within Iliuliuk and Unalaska Bays is substantial, any reduction in habitat quantity or quality can have adverse effects to ESA-listed species. These effects could include a possible reduction of available prey, or loss of undisturbed areas necessary to rear young.

7.2 Fishing

Fishing is expected to continue in the Gulf of Alaska and the Bering Sea, with many vessels making port calls in the action area. As a result, there will be continued risk to marine mammals due to prey competition, ship strikes, harassment, and entanglement in fishing gear. Fisheries under NMFS management will continue to undergo ESA section 7 consultation regarding effects to listed species. NMFS assumes that ADF&G will continue to manage fish stocks and monitor and regulate fishing under their jurisdiction to maintain sustainable stocks. It remains unknown whether, and to what extent, marine mammal prey may be less available due to commercial, subsistence, personal use, and sport fishing. In addition, we do not know the full extent of the effects of fishing vessel traffic on availability of prey to listed species. Lowering the bar in Iliuliuk Bay is not expected to have any effect on the amount of fishing or fishing vessel traffic within or around Iliuliuk Bay.

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 direct or indirect alterations that appreciably diminish the value of designated critical habitat as a whole 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 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 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 Humpback Whale Risk Analysis

The ESA-listed humpback whales in the action area belong to either the threatened Mexico DPS or the endangered WNP DPS. Whales from both of these DPSs may feed seasonally in the action area. There are approximately 1,084 animals in the WNP DPS and 2,913 animals in the Mexico DPS. Population growth rates are currently unavailable for these DPSs. The best available information indicates that two percent of humpbacks in the portion of the action area where construction-related effects will occur (near Iliuliuk Bay) are from the WNP DPS, and seven percent are from the Mexico DPS.

As described in the Environmental Baseline (Section 5), Mexico DPS and WNP DPS humpback whales have been and will continue to be affected within the action area by marine vessel traffic, fisheries interactions, including entanglement in fishing gear, coastal development, exposure to pollutants and contaminants, and climate and environmental change. Vessel noise and presence can impact whales by causing behavioral disturbances, auditory interference, or non-auditory physical and physiological effects (e.g., vessel strike). Vessel collisions with humpback whales are 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 and in the Dutch Harbor area. As described in Section 7, vessel traffic and shipping are expected to increase in the future, but the exact amount depends largely on economics and factors other than deepening the bar at the entrance of Iliuliuk Bay. Humpback whales have also been killed and injured during interactions with commercial fishing gear in Alaska waters. Indirect threats to humpback whales associated with climate change, among others, include changes in the distribution and abundance of the whales' prey, and in the distribution and abundance of competitors or predators.

Exposure of humpback whales to vessel noise from transit and potential for vessel strike may occur as a result of the proposed activities, but adverse effects from vessel disturbance and noise will be insignificant due to the small marginal increase in such activities relative to the environmental baseline and the transitory nature of vessel sound. Adverse effects from vessel strike are considered extremely unlikely to occur because of the few additional vessels introduced by the action and the unlikelihood of these type of interactions occurring as a result of exposure to these few vessels. Based on the localized nature of small oil spills, the relatively rapid weathering expected, and the safeguards in place to avoid and minimize oil spills, the probability of the proposed action causing a small oil spill and exposing humpback whales to spilled petroleum products is extremely small, and thus the effects are considered highly unlikely to occur.

In general, impacts of the proposed project on the whales' prey species are expected to be minor and temporary, and we do not expect these effects will limit prey available to Mexico DPS and WNP DPS humpback whales. In addition, the size of the area that will be affected by dredging and potential blasting to deepen the bar at the entrance to Iliuliuk Bay is very small relative to the available habitat for humpback whales in Iliuliuk and Unalaska Bays and the total amount of critical habitat available to Mexico DPS and WNP DPS humpback whales. The effect of the direct alteration of 40,000 square yards (33,445 m^2, 8.26 acres, 3.34 ha) of seafloor within designated critical habitat for Mexico DPS and WNP DPS humpback whales is therefore considered insignificant.

Based on the results of the exposure analysis (Section 6.2), we expect a maximum of 48 humpback whales may be exposed to sound levels sufficient to result in Level B harassment, including behavioral harassment and TTS, over 24 blasting events; seven percent, or a maximum of four of these whales, are expected to be from the Mexico DPS and two percent, or a maximum of one of these whales, are expected to be from the WNP DPS. No ESA-listed humpback whales are expected to be exposed to sound levels sufficient to result in Level A acoustic harm over the 24 blasting events (Table 10). These estimates represent the maximum number of takes that may be expected to occur, but not necessarily the number of individuals taken, as a single individual may be taken multiple times over the course of the proposed action.

Table 10: Estimated Level A acoustic harm and Level B acoustic harassment exposures of ESA-listed humpback whales from blasting.

Species	DPS	Estimated Level B Exposures	Estimated Level A Exposures
Humpback whale	Mexico	4	0
	WNP	1	0

Given the nature of the proposed blasting activities (single, short-duration blasts on nonconsecutive days), and USACE's implementation of monitoring and mitigation measures to reduce exposure to high levels of sound, humpback whales' probable response to noise from blasting is expected to include brief startle reactions or short-term behavioral modification.

These reactions and behavioral changes are expected to subside quickly (within a few minutes) when the exposures cease. The primary mechanism by which the behavioral changes discussed affect the fitness of individual animals is through energy expenditures, and by taking time away from other natural behaviors such as foraging. The individual and cumulative behavioral responses discussed would not likely cause a humpback whale to expend an amount of energy which would measurably reduce its survival or fitness. Further, while humpback whales might be briefly disturbed from foraging or other natural behaviors, they will likely return to normal behaviors a few minutes after the blast has occurred. The alteration in the whale's behavior for those few minutes is so brief that it will likely have an insignificant impact on the whale's fitness.

Because fitness consequences to individual humpback whales are not likely from the instances of TTS and behavioral disruption, we do not expect measureable changes in the number, distribution, or reproductive potential of Mexico DPS or WNP DPS humpback whales. For this reason, the effects from the proposed action are not expected to appreciably reduce the likelihood of survival or recovery of the Mexico DPS or WNP DPS of humpback whales.

8.2 Western DPS Steller Sea Lion Risk Analysis

The estimated size of the Alaska population of Western DPS Steller sea lions is 52,932 (both pups and non-pups). There are strong regional differences in trends in abundance of Western DPS Steller sea lions, with mostly positive trends in the Gulf of Alaska and eastern Aleutian Islands and generally negative trends in the central and western Aleutian Islands.

Western DPS Steller sea lions have been and will continue to be affected within the action area by many of the same stressors described above for humpback whales. Vessel noise and presence can impact Steller sea lions by causing behavioral disturbances, auditory interference, or non-auditory physical and physiological effects (e.g., vessel strike). As described in Section 7, it is predicted that overall vessel traffic and shipping will increase in the future, but the exact amount depends largely on economics and factors other than deepening the bar at the entrance of Iliuliuk Bay. Western DPS Steller sea lions have been killed and injured by entanglement in fishing gear in Alaska waters. Indirect threats to Western DPS Steller sea lions associated with climate change, among others, include changes in the distribution and abundance of the sea lions' prey, and in the distribution and abundance of competitors or predators.

Exposure of Steller sea lions to vessel noise from transit and potential for vessel strike may occur as a result of the proposed activities, but adverse effects from vessel disturbance and noise will be insignificant due to the small marginal increase in such activities relative to the environmental baseline and the transitory nature of vessel sound. The increase in daily vessel traffic from project vessels during the proposed action is unlikely to result in a vessel strike. Project vessels will be traveling at slow speeds, the increase in vessel traffic will be small, and vessel strike is not considered a significant concern for Steller sea lions (only four reports of potential vessel strikes involving Steller sea lions have been reported in Alaska). Based on the localized nature of small oil spills, the relatively rapid weathering expected, and the safeguards in place to avoid and minimize oil spills, the probability of the proposed action causing a small oil spill and exposing Steller sea lions to spilled petroleum products is extremely small, and thus the effects are considered highly unlikely to occur.

In general, impacts of the proposed project on the prey species of Western DPS Steller sea lions are expected to be minor and temporary, and we do not expect these effects will limit prey available to Steller sea lions. In addition, the size of the area that will be affected by dredging and potential blasting to deepen the bar at the entrance to Iliuliuk Bay is very small relative to the available habitat for Steller sea lions in Iliuliuk and Unalaska Bays and the total amount of critical habitat available to Western DPS Steller sea lions. The effect of the direct alteration 40,000 square yards (33,445 m^2 ,8.26 acres, 3.34 ha) of seafloor within designated critical habitat for Steller sea lions is therefore considered insignificant.

Based on the results of the exposure analysis, we expect a maximum of 48 Western DPS Steller sea lions may be exposed to sound levels sufficient to result in Level B harassment, including behavioral harassment and TTS, over 24 blasting events. A maximum of five Western DPS Steller sea lions are expected to be exposed to noise levels sufficient to result in Level A acoustic harm in the form of PTS over the 24 blasting events (Table 11). These estimates represent the maximum number of takes that may be expected to occur, but not necessarily the number of individuals taken, as a single individual may be taken multiple times over the course of the proposed action.

Table 11: Estimated Level A acoustic harm and Level B acoustic harassment exposures of Western DPS Steller sea lions to blasting sound.

Species	DPS	Estimated Level B Exposures	Estimated Level A Exposures
Steller Sea Lion	Western	48	5

It is difficult to estimate the behavioral responses, if any, that Western DPS Steller sea lions in the action area may exhibit to underwater sounds generated by project activities. Though the sounds produced during project activities may or may not greatly exceed levels that Steller sea lions already experience in Unalaska and Iliuliuk Bays, the sources proposed for use in this project are not among sounds to which they are commonly exposed. In response to project-related sounds, some Steller sea lions may move out of the area or change from one behavioral state to another, while other Steller sea lions may exhibit no apparent behavioral changes at all.

The primary mechanism by which the behavioral changes may affect the fitness of individual animals is through reduction of the animal's energy reserves, reduction of time spent foraging, or both. Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (NMFS 2008). The closest rookery is 19 nautical miles east of the project site, and the nearest major haulout is 15 km southeast of the project site.

Given the nature of the proposed blasting activities (single, short-duration blasts on nonconsecutive days), and the monitoring and mitigation measures to reduce exposure to high levels of sound, Steller sea lions' probable behavioral response to noise from blasting is expected to include brief startle reactions or short-term behavioral modification. These reactions and behavioral changes are expected to subside quickly (within a few minutes) when the exposures cease. The individual and cumulative behavioral responses discussed would not likely cause a Steller sea lion to expend an amount of energy which would measurably reduce its survival or fitness. Further, while Steller sea lions might be briefly disturbed from foraging or other natural behaviors, they will likely return to normal behaviors a few minutes after the blast has occurred. The alteration in the sea lion's behavior for those few minutes is so brief that it will likely have an insignificant impact on its fitness. Thus fitness consequences to individual Steller sea lions are not likely from the instances of TTS and behavioral disruption. Noise associated with blasting events is expected to impact the fitness of up to five individual Steller sea lions as a result of harm incurred in the form of PTS of some degree. The number of Western DPS Steller sea lions that may experience PTS as a result of the proposed action represents a very small percentage of the population. Thus, we do not expect that the instances of PTS will result in appreciable changes in the number, distribution, or reproductive potential of Western DPS Steller sea lions.

In summary, the impacts expected to occur and affect Western DPS Steller sea lions in the action area would not be expected to result in reductions in overall reproduction, abundance, or distribution of this population. For this reason, the effects of the proposed action are not expected to appreciably reduce the likelihood of survival or recovery of Western DPS Steller sea lions.

9 CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mexico DPS humpback whale, WNP DPS humpback whale, or Western DPS Steller sea lions. NMFS also concludes that the proposed action is not likely to adversely affect the North Pacific right whale, blue whale, fin whale, sperm whale, sei whale, WNP DPS gray whale, Southern Resident DPS killer whale, or proposed sunflower sea star, or to destroy or adversely modify designated critical habitat for the Mexico DPS and WNP DPS humpback whale, Southern Resident killer whale, or Steller sea lion.

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 U.S.C. § 1532(19)). "Incidental take" is defined as take that results from, but is not the purpose of, the carrying out of an otherwise lawful activity conducted by the action agency or applicant (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 [herein Level A harm]; 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 [herein Level B harassment] (16 U.S.C. § 1362(18)(A)(i) and (ii)). For this consultation, NMFS expects that take of listed humpback whales will be by Level B harassment only and take of Western DPS Steller sea lions will be by Level B harassment and may be by Level A harassment. In the event that blasting must be used to accomplish this project's objective, we expect a few instances of Western DPS Steller sea lions being taken by sound capable of causing acoustic harm (Level A). Both listed humpbacks and listed Steller sea lions are expected to be taken by sound capable of causing acoustic harassment (Level B) (Table 12).

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 C.F.R. § 223.213).

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

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. The USACE and NMFS Permits Division have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, the USACE and NMFS Permits Division must monitor and report on the progress of the action and its impact on the species as specified in the ITS (50 CFR § 402.14(i)(3)). If the USACE or NMFS Permits Division (1) fail to require the permit 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 utilize 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).

We expect take in the form of acoustic harm of five Western DPS Steller sea lions due to exposure to sound from underwater detonation. We expect take in the form of acoustic harassment of 48 Western DPS Steller sea lions due to exposure to sound from underwater explosions at a received level capable of causing Level B harassment, including behavioral harassment and TTS. We also expect take in the form of acoustic harassment of four Mexico DPS humpback whales and one WNP DPS humpback whale due to exposure to underwater explosions at a received level capable of causing Level B harassment, including behavioral harassment and TTS. No takes of Mexico DPS or WNP DPS humpback whales due to acoustic harm are expected or authorized.

Table 12. Summary of instances of exposure associated with the proposed blasting and dredging activities resulting in incidental take of ESA-listed species by Level A and Level B harassment.

Species	Authorized Take due to Acoustic Harm	Authorized Take due to Acoustic Harassment	Authorized Take due to Acoustic Harm	Authorized Take due to Acoustic Harassment	Expected Timing of Take
Action	**Blasting**		**Dredging**		**Both**
Western DPS Steller sea lion (*Eumetopias jubatus*)	5	48	0	0	November 1 through October 31, of the following year
Mexico DPS Humpback whale (*Megaptera novaeangliae*)	0	4[6]	0	0	
Western North Pacific DPS Humpback whale	0	1	0	0	

[6] The proposed IHA (88 FR 21630) indicated a requested Level A take of 3 humpback whales, and a Level B take of 48 humpback whales. Humpback whales in Aleutian Islands include individuals from three DPSs. Of the proposed takes, 7% are expected to be of ESA-listed Mexico DPS animals and 2% are expected to be of ESA-listed Western North Pacific DPS animals.

10.2 Effect of the Take

Both acoustic harm and harassment take are authorized during the proposed action. Acoustic harm will be avoided when possible, by the USACE; however, it has been authorized for Western DPS Steller sea lions due to blasting best practices whereby charges that have been deployed into the marine environment cannot be left undetonated for more than 24 hours. This consultation has assumed that exposure to blasting events might disrupt one or more behavioral patterns that are essential to an individual animal's life history and may cause permanent harm to a few individuals. However, any acoustic harm or harassment of Western DPS Steller sea lions, and any acoustic harassment of ESA-listed humpback whales, is not expected to measurably affect the reproduction, survival, or recovery of the species.

In Section 9 of this opinion, NMFS determined that the level of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

10.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPM) are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take." (50 CFR 402.02). Failure to comply with RPMs (and the terms and conditions that implement 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 and WNP DPS humpback whales, and Western DPS Steller sea lions resulting from the proposed action.

1. The NMFS Permits Division and USACE will require any contractors to conduct operations in a manner that will minimize impacts to Mexico DPS and WNP DPS humpback whales and Western DPS Steller sea lions that occur within or in the vicinity of the project action area.
2. The NMFS Permits Division and USACE will require USACE staff or contractors to implement a comprehensive monitoring program to ensure that Mexico DPS and WNP DPS humpback whales and Western DPS Steller sea lions are not taken in numbers or in a manner not anticipated by this opinion, and to submit a final report to NMFS AKR evaluating 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, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. These terms and conditions are in addition to the mitigation measures included in the proposed action, as set forth in Section 2.1.2 of this opinion. The USACE and NMFS Permits Division, or any applicant, has 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. If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the action may lapse.

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: NMFS Permits Division, or USACE, must undertake the following:

1.1. Implement all mitigation measures, including monitoring and shut down zones and other requirements, as described in the final IHA and the marine mammal monitoring and mitigation plan.
1.2. Following a prohibited take, the NMFS Permits Division and USACE will be required to reinitiate consultation under 50 CFR § 402.16, and any subsequent activities causing incidental take will not be exempt from the take prohibitions of ESA section 9 until the reinitiated consultation is completed. NMFS AKR will work with the NMFS Permits Division and USACE to determine what is necessary to minimize the likelihood of further prohibited take and ensure ESA compliance.

To carry out RPM #2: NMFS Permits Division, USACE, or lead action agency must:

2.1 Adhere to all monitoring and reporting requirements as detailed in the IHA issued by NMFS under section 101(a)(5) of the MMPA as reflected in the marine mammal monitoring and mitigation plan.
2.2 Submit a project-specific report within 90 days of the conclusion of in-water work associated with this project. The report must analyze and summarize marine mammal interactions during this project. The report should be emailed to NMFS AKR at AKR.section7@noaa.gov. This report must also contain information described in the mitigation measures of this opinion.
2.3 Immediately report any incident that causes serious injury or mortality of a marine mammal (e.g., ship strike, stranding, and/or entanglement), to NMFS AKR

(AKR.section7@noaa.gov), Tammy Olson (tammy.olson@noaa.gov) and the Marine Mammal Stranding Hotline at 877-925- 7773 (Table 2).

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 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).

1. Project vessel crews should participate in the WhaleAlert program to report real-time sightings of whales while transiting to and working within the action area and to minimize the risk of vessel strikes. More information is available at https://www.fisheries.noaa.gov/resource/tool-app/whale-alert.
2. Without approaching whales, project vessel crews should attempt to photograph humpback whale flukes and record GPS coordinates of the sightings during transit. These data should be included in the final report submitted to NMFS AKR.
3. Without approaching whales, project vessel crews should attempt to photograph and/or video North Pacific right whales and record GPS coordinates of the sightings during transit. These data should be submitted to NMFS AKR as soon as possible.
4. Without approaching sea lions, project vessel crews should attempt to photograph Steller sea lions when brand numbers are visible and record GPS coordinates of brand sightings. These data should be included in the final report submitted to NMFS AKR.

In order to keep NMFS's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, USACE 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)).

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, USACE, 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 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 literature cited 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.

14 REFERENCES

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

Aimone-Martin, C., and K. D. Kolden. 2019. Managing the impacts of blast-induced vibration and overpressure on fish and fish habitat. Prepared by Aimone-Martin Associates and Alaska Seismic and Environmental for the U.S. Dept. of Transportation, Federal Highway Administration, January 2019. Publication FHWA-FLH/TD-19-001, 85 p.

Altukhov, A. V., R. D. Andrews, D. G. Calkins, T. S. Gelatt, E. D. Gurarie, T. R. Loughlin, E. G. Mamaev, V. S. Nikulin, P. A. Permyakov, S. D. Ryazanov, V. V. Vertyankin, and V. N. Burkanov. 2015. Age specific survival rates of Steller sea lions at rookeries with divergent population trends in the Russian Far East. PLoS One 10(5):e0127292.

ANSI. 1986. Methods of measurement for impulse noise 3 (ANSI S12.7-1986). American National Standards Institute, Acoustical Society of America, Woodbury, NY.

ANSI (American National Standards Institute). 2005. Measurement of sound pressure levels in air (ANSI S1.13-2005). Acoustical Society of America, Woodbury, NY.

Ban, S. S. 2005. Modelling and characterization of Steller sea lion haulouts and rookeries using oceanographic and shoreline type data. Master's thesis. University of British Columbia, Vancouver, BC, 103 p.

Barbeaux, S., K. Aydin, B. Fissel, K. Holsman, B. Laurel, W. Palsson, K. Shotwell, Q. Yang, and S. Zador. 2018. Assessment of the Pacific cod stock in the Gulf of Alaska, in Stock Assessments and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. Plan Team for the Groundfish Fisheries of the Gulf of Alaska, North Pacific Fishery Management Council, Seattle, WA, December 2018.

Barlow, J., and P. J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecology 78(2):535-546.

Bates, N. R., J. T. Mathis, and L. W. Cooper. 2009. Ocean acidification and biologically induced seasonality of carbonate mineral saturation states in the western Arctic Ocean. Journal of Geophysical Research 114(C11007).

Bauer, G. B., and L. M. Herman. 1986. Effects of vessel traffic on the behavior of humpback whales in Hawaii, Final report to the National Marine Fisheries Service, Honolulu, HI, February 14, 1986, 151 p.

Bettridge, S., C. S. Baker, J. Barlow, P. Clapham, M. Ford, D. Gouveia, D. Mattila, R. Pace, P. E. Rosel, G. K. Silber, and P. Wade. 2015. Status review of the humpback whale (*Megaptera novaeangliae*) under the Endangered Species Act. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, March 2015. NOAA Technical Memorandum NMFS-SWFSC-540, 263 p.

Bisson, L. N., H.J. Reider, H.M. Patterson, M. Austin, J.R. Brandon, T. Thomas, and M. L. Bourdon. 2013. Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort seas, July–November 2012: Draft 90-day report. Report from LGL Alaska Research Associates, Anchorage, AK, and JASCO Applied Sciences, Victoria, BC, for Shell Offshore, Houston, TX, National Marine Fisheries Service, Silver Spring, MD, and U.S. Fish and Wildlife Service., Anchorage, AK, LGL Report P1272D–1, 266 p. + appendices.

BLM. 2019. Biological evaluation for the implementation of the oil and gas lease sales for the Arctic Wildlife Refuge Coastal Plain. Submitted to National Marine Fisheries Service, Alaska Region, Anchorage, AK, May 10, 2019, 113 p.

Blunden, J., and D. S. Arndt. 2020. State of the climate in 2019. Bulletin of the American Meteorological Society 101(8):Si-S429.

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophysical Research Letters 42(9):3414-3420.

Brower, A., A. Willoughby, and M. Ferguson. 2022. Distribution and relative abundance of bowhead whales and other marine mammals in the western Beaufort Sea, 2020. U.S. Dept. of Commerce, National Oceanic and Oceanic Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, July 2022. NOAA Technical Memorandum NMFS-AFSC-439, 155 p.

Brower, A. A., J. T. Clarke, and M. C. Ferguson. 2018. Increased sightings of subArctic cetaceans in the eastern Chukchi Sea, 2008–2016: population recovery, response to climate change, or increased survey effort? Polar Biology 41(5):1033-1039.

Burkanov, V. N., and T. R. Loughlin. 2005. Distribution and abundance of Steller sea lions, *Eumetopias jubatus*, on the Asian coast, 1720's-2005. Marine Fisheries Review 67(2):1-62.

Calkins, D. G., and E. Goodwin. 1988. Investigation of the declining sea lion population in the Gulf of Alaska. Alaska Dept. of Fish and Game, Anchorage, AK, August 1988, 76 p.

Calkins, D. G., and K. W. Pitcher. 1982. Population assessment, ecology and trophic relationships of Steller sea lions in the Gulf of Alaska. Pages 447-546 *in* Environmental Assessment of the Alaska Continental Shelf. Prepared by the Alaska Department of Fish and Game for the Outer Continental Shelf Environmental Assessment Program, Final Report: Research Unit 243, ACE 8094521, Anchorage, AK.

Call, K. A., and T. R. Loughlin. 2005. An ecological classification of Alaskan Steller sea lion (*Eumetopias jubatus*) rookeries: A tool for conservation/management. Fisheries Oceanography 14(Supplement 1):212-222.

Carretta, J. V., E. M. Oleson, K. A. Forney, D. W. Weller, A. R. Lang, J. Baker, A. J. Orr, B. Hanson, J. Barlow, J. E. Moore, M. Wallen, and J. Brownell, R. L. 2023. U.S. Pacific marine mammal stock assessments: 2022. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, July 2023. NOAA Technical Memorandum NMFS-SWFSC-684, 404 p.

Cavole, L. M., A. M. Demko, R. E. Diner, A. Giddings, I. Koester, C. M. Pagniello, M.-L. Paulsen, A. Ramirez-Valdez, S. M. Schwenck, and N. K. Yen. 2016. Biological impacts of the 2013–2015 warm-water anomaly in the Northeast Pacific: Winners, losers, and the future. Oceanography 29(2):273-285.

Chapin, F. S., III, S. F. Trainor, P. Cochran, H. Huntington, C. Markon, M. McCammon, A. D. McGuire, and M. Serreze. 2014. Ch. 22: Alaska. Pages 514-536 *in* J. M. Melillo, E. L. Richmond, and G. W. Yohe, editors. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program.

Cheng, L., J. Abraham, J. Zhu, K. E. Trenberth, J. Fasullo, T. Boyer, R. Locarnini, B. Zhang, F. Yu, L. Wan, X. Chen, X. Song, Y. Liu, and M. E. Mann. 2020. Record-setting ocean warmth continued in 2019. Advances in Atmospheric Sciences 37(2):137-142.

Chu, K. H., C. C. Sze, and C. K. Wong. 1996. Swimming behaviour during the larval development of the shrimp *Metapenaeus ensis* (De Haan, 1844) (Decapoda, Penaeidae). Crustaceana 69(3):368-378.

Chumbley, K., J. Sease, M. Strick, and R. Towell. 1997. Field studies of Steller sea lions (*Eumetopias jubatus*) at Marmot Island, Alaska 1979 through 1994. U.S. Dept. of Commerce, National Oceanic and Atsmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, August 1997. NOAA Technical Memorandum NMFS-AFSC-77, 99 p.

Clapham, P. J. 1992. Age at attainment of sexual maturity in humpback whales, *Megaptera novaeangliae*. Canadian Journal of Zoology 70(7):1470-1472.

Clapham, P. J. 1993. Social organization of humpback whales on a North Atlantic feeding ground. Symposium of the Zoological Society of London 66:131-145.

Clapham, P. J. 1994. Maturational changes in patterns of association in male and female humpback whales, *Megaptera novaeangliae*. Journal of Zoology 234:265-274.

Clapham, P. J. 1996. The social and reproductive biology of Humpback Whales: An ecological perspective. Mammal Review 26(1):27-49.

Clapham, P. J., A. S. Kennedy, B. K. Rone, A. N. Zerbini, J. L. Crance, and C. L. Berchok. 2012. North Pacific right whales in the southeastern Bering Sea: Final report. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, July 2012. OCS Study BOEM 2012-074, 175 p.

Clark, C., W. T. Ellison, B. Southall, L. Hatch, S. M. Van Parijs, A. S. Frankel, D. Ponirakis, and G. C. Gagnon. 2009. Acoustic masking of baleen whale communications: potential impacts from anthropogenic sources (Abstract). Page 56 *in* Abstracts of the 18th Biennial Conference on the Biology of Marine Mammals, October 12-16, 2009, Québec City, Canada. Society for Marine Mammalogy.

Cooke, J. G. 2020. Population assessment update for Sakhalin gray whales, Paper WGWAP-21/13 at the 21st meeting of the Western Gray Whale Advisory Panel, 10 p.

Cox, T. M., T. J. Ragen, A. J. Read, E. Vos, R. W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, and L. Crum. 2006. Understanding the impacts of anthropogenic sound on beaked whales. Journal of Cetacean Research and Management 7(3):177-187.

Crespi, E. J., T. D. Williams, T. S. Jessop, and B. Delehanty. 2013. Life history and the ecology of stress: how do glucocorticoid hormones influence life-history variation in animals? Functional Ecology 27(1):93-106.

Crowley, T. J. 2000. Causes of climate change over the past 1000 years. Science 289(5477):270-277.

D'Vincent, C. G., R. M. Nilson, and R. E. Hanna. 1985. Vocalization and coordinated feeding behavior of the humpback whale in southeastern Alaska. Scientific Reports of the Whales Research Institute 36:41–47.

DeGrandpre, M., W. Evans, M.-L. Timmermans, R. Krishfield, B. Williams, and M. Steele. 2020. Changes in the Arctic Ocean carbon cycle with diminishing ice cover. Geophysical Research Letters 47(12):e2020GL088051.

Delean, B. J., V. T. Helker, M. M. Muto, K. Savage, S. Teerlink, L. A. Jemison, K. Wilkinson, J. E. Jannot, and N. C. Young. 2020. Human-caused mortality and injury of NMFS-managed Alaska marine mammal stocks, 2013-2017. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, January 2020. NOAA Technical Memorandum NMFS-AFSC-401, 86 p.

Dickerson, C., K. J. Reine, and D. G. Clarke. 2001. Characterization of underwater sounds produced by bucket dredging operations. U.S. Army Corps of Engineers Dredging Operations and Environmental Research, Vicksburg, MS, August 2001. DOER Technical Notes Collection ERDC TN-DOER-E14, 17 p.

Dolphin, W. F. 1987. Dive behavior and estimated energy expenditure of foraging humpback whales in southeast Alaska. Canadian Journal of Zoology 65(2):354-362.

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate change impacts on marine ecosystems. Annual Reviews in Marine Science 4:11-37.

Eisner, L. B., Y. I. Zuenko, E. O. Basyuk, L. L. Britt, J. T. Duffy-Anderson, S. Kotwicki, C. Ladd, and W. Cheng. 2020. Environmental impacts on walleye pollock (*Gadus chalcogrammus*) distribution across the Bering Sea shelf. Deep Sea Research Part II: Topical Studies in Oceanography 181-182:104881.

Evans, P. G. H., Q. Carson., P. Fisher, W. Jordan, R. Limer, and R. I. 1994. A study of the reactions of harbour porpoises to various boats in the coastal waters of southeast Shetland. European Research on Cetaceans 8:60-64.

Fabry, V. J., J. B. McClintock, J. T. Mathis, and J. M. Grebmeier. 2009. Ocean acidification at high latitudes: the Bellweather. Oceanography 22(4):160-171.

Fabry, V. J., B. A. Seibel, R. A. Feely, and J. C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Science 65:414-432.

Fair, P. A., and P. R. Becker. 2000. Review of stress in marine mammals. Journal of Aquatic Ecosystem Stress and Recovery 7(4):335-354.

Fay, V. 2002. Alaska aquatic nuisance species management plan. Alaska Dept. of Fish and Game, Juneau, AK, October 2002, 103 p.

Fedewa, E. J., T. M. Jackson, J. I. Richar, J. L. Gardner, and M. A. Litzow. 2020. Recent shifts in northern Bering Sea snow crab (*Chionoecetes opilio*) size structure and the potential role of climate-mediated range contraction. Deep Sea Research Part II: Topical Studies in Oceanography:104878.

Feely, R. A., S. C. Doney, and S. R. Cooley. 2009. Ocean acidification: present conditions and future changes in a high-CO_2 world. Oceanography 22(4):37-47.

Feely, R. A., C. L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. J. Fabry, and F. J. Millero. 2004. Impact of anthropogenic CO_2 on the $CaCO_3$ system in the oceans. Science 305(5682):362-366.

Ferguson, M. C., J. M. Waite, C. Curtice, J. T. Clarke, and J. Harrison. 2015. 7. Biologically important areas for cetaceans within U.S. waters-Aleutian Islands and Bering Sea region. Aquatic Mammals 41(1):79.

Finneran, J. J., D. A. Carder, C. E. Schlundt, and S. H. Ridgway. 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. Journal of the Acoustical Society of America 118(4):2696-2705.

Finneran, J. J., R. Dear, D. A. Carder, and S. H. Ridgway. 2003. Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. Journal of the Acoustical Society of America 114(3):1667-1677.

Foote, A. D., R. W. Osborne, and A. R. Hoelzel. 2004. Whale-call response to masking boat noise. Nature 428:910.

François, R. E., and G. R. Garrison. 1982. Sound absorption based on ocean measurements: Part I: Pure water and magnesium sulfate contributions. The Journal of the Acoustical Society of America 72(3):896-907.

Freed, J. C., N. C. Young, B. J. Delean, V. T. Helker, M. M. Muto, K. M. Savage, S. S. Teerlink, L. A. Jemison, K. M. Wilkinson, and J. E. Jannot. 2022. Human-caused mortality and injury of NMFS-managed Alaska marine mammal stocks, 2016-2020. U. S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, August 2022. NOAA Technical Memorandum NMFS-AFSC-442, 116 p.

Frid, A., J. Burns, G. G. Baker, and R. E. Thorne. 2009. Predicting synergistic effects of resources and predators on foraging decisions by juvenile Steller sea lions. Oecologia 158:12.

Frölicher, T. L., E. M. Fischer, and N. Gruber. 2018. Marine heatwaves under global warming. Nature 560(7718):360-364.

Gisiner, R. C. 1985. Male territorial and reproductive behavior in the Steller sea lion, *Eumetopias jubatus*. Doctoral dissertation. University of California, Santa Cruz, CA, 145 p.

Goldbogen, J. A., J. Calambokidis, D. A. Croll, J. T. Harvey, K. M. Newton, E. M. Oleson, G. Schorr, and R. E. Shadwick. 2008. Foraging behavior of humpback whales: kinematic and respiratory patterns suggest a high cost for a lunge. Journal of Experimental Biology 211(23):3712-3719.

Gravem, S. A., W. N. Heady, V. R. Saccomanno, K. F. Alvstad, A. L. M. Gehman, T. N. Frierson, and S. L. Hamilton. 2021. *Pycnopodia helianthoides*, IUCN Red List of Threatened Species 2021, 43 p.

Grebmeier, J. M., J. E. Overland, S. E. Moore, E. V. Farley, E. C. Carmack, L. W. Cooper, K. E. Frey, J. H. Helle, F. A. McLaughlin, and S. L. McNutt. 2006. A major ecosystem shift in the northern Bering Sea. Science 311(5766):1461-1464.

Guarino, M.-V., L. C. Sime, D. Schröeder, I. Malmierca-Vallet, E. Rosenblum, M. Ringer, J. Ridley, D. Feltham, C. Bitz, and E. J. Steig. 2020. Sea-ice-free Arctic during the Last Interglacial supports fast future loss. Nature Climate Change 10:928-932.

Hain, J. H. W., S. L. Ellis, R. D. Kenney, P. J. Clapham, B. K. Gray, M. T. Weinrich, and I. G. Babb. 1995. Apparent bottom feeding by humpback whales on Stellwagen Bank. Marine Mammal Science 11(4):464-479.

Hamilton, P. K., G. S. Stone, and S. M. Martin. 1997. Note on a deep humpback whale *Megaptera novaeangliae* dive near Bermuda. Bulletin of Marine Science 61(2):491-494.

Harris, C. M., editor. 1998. Handbook of Acoustical Measurements and Noise Control. Acoustical Society of America, Woodbury, NY.

Hastings, M. C., and A. N. Popper. 2005. Effects of sound on fish. Report prepared by Jones and Stokes under contract 43A0139 with California Dept. of Transportation, Sacramento, CA, January 28, 2005, 82 p.

Helker, V. T., M. M. Muto, K. Savage, S. Teerlink, L. A. Jemison, K. Wilkinson, and J. Jannot. 2019. Human-caused mortality and injury of NMFS-managed Alaska marine mammal stocks, 2012-2016. U. S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, May 2019. NOAA Techical Memorandum NMFS-AFSC-392, 71 p.

Hemery, L. G., S. R. Marion, C. G. Romsos, A. L. Kurapov, and S. K. Henkel. 2016. Ecological niche and species distribution modelling of sea stars along the Pacific Northwest continental shelf. Diversity and Distributions 22(12):1314-1327.

Hempen, G. L., T. M. Keevin, and T. L. Jordan. 2007. Underwater blast pressures from a confined rock removal during the Miami Harbor Deepening Project. Pages 23-32 *in* Proceedings of the 33rd Annual Conference on Explosives and Blasting Technique, Nashville, TN. International Society of Explosive Engineers, Cleveland, OH.

Hildebrand, J. A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 395(5):5-20.

Hinzman, L. D., N. D. Bettez, W. R. Bolton, F. S. Chapin, M. B. Dyurgerov, C. L. Fastie, B. Griffith, R. D. Hollister, A. Hope, H. P. Huntington, A. M. Jensen, G. J. Jia, T. Jorgenson, D. L. Kane, D. R. Klein, G. Kofinas, A. H. Lynch, A. H. Lloyd, A. D. McGuire, F. E. Nelson, W. C. Oechel, T. E. Osterkamp, C. H. Racine, V. E. Romanovsky, R. S. Stone, D. A. Stow, M. Sturm, C. E. Tweedie, G. L. Vourlitis, M. D. Walker, D. A. Walker, P. J. Webber, J. M. Welker, K. S. Winker, and K. Yoshikawa. 2005. Evidence and implications of recent climate change in northern Alaska and other Arctic regions. Climatic Change 72(3):251-298.

Holt, M. M., D. P. Noren, V. Veirs, C. K. Emmons, and S. Veirs. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. Journal of the Acoustical Society of America 125(1):EL27-EL32.

Huntington, H. P., S. L. Danielson, F. K. Wiese, M. Baker, P. Boveng, J. J. Citta, A. De Robertis, D. M. Dickson, E. Farley, and J. C. George. 2020. Evidence suggests potential transformation of the Pacific Arctic ecosystem is underway. Nature Climate Change 10(4):342-348.

IPCC. 2001. Climate change 2001: Synthesis report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change (R. T. Watson and the Core Writing Team, editors). Cambridge University Press.

IPCC. 2013. Summary for policymakers. Pages 3-39 *in* T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley, editors. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York.

IPCC. 2014. Climate change 2014: Synthesis report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Core Writing Team, R. K. Pachauri, and L. A. Meyer, editors). IPCC, Geneva, Switzerland.

IPCC. 2019. Summary for Policymakers. Pages 3-35 *in* H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, and N. Weyer, editors. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. Cambridge University Press, Cambridge, UK and New York, NY.

Isaac, J. L. 2009. Effects of climate change on life history: implications for extinction risk in mammals. Endangered Species Research 7(2):115-123.

ISO (International Organization for Standardization). 2003. Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures (ISO 1996-1:2003(E)). International Organization for Standardization, Geneva.

Jemison, L. A., G. W. Pendleton, L. W. Fritz, K. K. Hastings, J. M. Maniscalco, A. W. Trites, and T. S. Gelatt. 2013. Inter-population movements of Steller sea lions in Alaska with implications for population separation. PLoS One 8(8):e70167.

Jensen, A. S., and G. K. Silber. 2004. Large whale ship strike database. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD, January 2004. NOAA Technical Memorandum NMFS-OPR-25, 37 p.

Jessop, T. S., A. D. Tucker, C. J. Limpus, and J. M. Whittier. 2003. Interactions between ecology, demography, capture stress, and profiles of corticosterone and glucose in a free-living population of Australian freshwater crocodiles. General and Comparative Endocrinology 132(1):161-170.

Jiang, L., R. A. Feely, B. R. Carter, D. J. Greeley, D. K. Gledhill, and K. M. Arzayus. 2015. Climatological distribution of aragonite saturation state in the global oceans. Global Biogeochemical Cycles 29:1656-1673.

Johnson, J. H., and A. A. Wolman. 1984. The humpback whale, *Megaptera novaeangliae*. Marine Fisheries Review 46(4):300-337.

Kastelein, R. A., L. Hoek, R. Gransier, M. Rambags, and N. Claeys. 2014. Effect of level, duration, and inter-pulse interval of 1-2 kHz sonar signal exposures on harbor porpoise hearing. Journal of the Acoustical Society of America 136(1):412-22.

Kastelein, R. A., R. Van Schie, W. C. Verboom, and D. de Haan. 2005. Underwater hearing sensitivity of a male and a female Steller sea lion (*Eumetopias jubatus*). Journal of the Acoustical Society of America 118(3):1820-1829.

Kennedy, A. S., A. N. Zerbini, B. K. Rone, and P. J. Clapham. 2014. Individual variation in movements of satellite-tracked humpback whales Megaptera novaeangliae in the eastern Aleutian Islands and Bering Sea. Endangered Species Research 23(2):187-195.

Keple, A. R. 2002. Seasonal abundance and distribution of marine mammals in the southern Strait of Georgia, British Columbia. Master's thesis. University of British Columbia.

Ketten, D. R. 1997. Structure and function in whale ears. Bioacoustics 8:103-135.

Kight, C. R., and J. P. Swaddle. 2011. How and why environmental noise impacts animals: an integrative, mechanistic review. Ecology Letters 14(10):1052-61.

Kolden, K. D., and C. Aimone-Martin. 2013. Blasting effects on salmonids. Prepared by Alaska Seismic and Environmental and Aimone-Martin Associates under Agency Contract IHP-13-051 for the Alaska Dept. of Fish and Game, Division of Habitat, Douglas, AK, June 2013. Final Report, 31 p.

Kruse, S. 1991. The interactions between killer whales and boats in Johnstone Strait, B.C. Pages 149-159 *in* K. Pryor, and K. Norris, editors. Dolphin Societies - Discoveries and Puzzles. University of California Press, Berkeley, CA.

Kryter, K. D. 1970. The Effects of Noise on Man. Academic Press, Inc., New York.

Kucey, L. 2005. Human disturbance and the hauling out behavior of steller sea lions (*Eumetopias jubatus*). Master's thesis. University of British Columbia.

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Lambert, P. 2000. Sea Stars of British Columbia, Southeast Alaska and Puget Sound. UBC Press, Vancouver, BC.

Lambertsen, R. H. 1992. Crassicaudosis: a parasitic disease threatening the health and population recovery of large baleen whales. Reviews of the Science and Technology Office for International Epizootics 11(4):1131-1141.

Lang, A. R., J. Calambokidis, J. Scordino, V. L. Pease, A. Klimek, V. N. Burkanov, P. Gearin, D. I. Litovka, K. M. Robertson, B. R. Mate, J. K. Jacobsen, and B. L. Taylor. 2014. Assessment of genetic structure among eastern North Pacific gray whales on their feeding grounds. Marine Mammal Science 30(4):1473-1493.

Lankford, S. E., T. E. Adams, R. A. Miller, and J. J. Cech Jr. 2005. The cost of chronic stress: impacts of a nonhabituating stress response on metabolic variables and swimming performance in sturgeon. Physiological and Biochemical Zoology 78(4):599-609.

Learmonth, J. A., C. D. Macleod, M. B. Santos, G. J. Pierce, H. Q. P. Crick, and R. A. Robinson. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology: An Annual Review 44:431-464.

Lefebvre, K. A., L. Quakenbush, E. Frame, K. B. Huntington, G. Sheffield, R. Stimmelmayr, A. Bryan, P. Kendrick, H. Ziel, T. Goldstein, J. A. Snyder, T. Gelatt, F. Gulland, B. Dickerson, and V. Gill. 2016. Prevalence of algal toxins in Alaskan marine mammals foraging in a changing arctic and subarctic environment. Harmful Algae 55:13-24.

Lischka, S., and U. Riebesell. 2012. Synergistic effects of ocean acidification and warming on overwintering pteropods in the Arctic. Global Change Biology 18(12):3517-3528.

Loughlin, T. R. 2002. Steller's sea lion *Eumetopias jubatus*. Pages 1181-1185 *in* W. F. Perrin, B. Würsig, and J. G. M. Thewissen, editors. Encyclopedia of Marine Mammals. Academic Press, San Diego, CA.

Loughlin, T. R., D. J. Rugh, and C. H. Fiscus. 1984. Northern sea lion distribution and abundance: 1956-80. Journal of Wildlife Management 48(3):729-740.

Lowry, D., S. Wright, M. Neuman, D. Stevenson, J. Hyde, M. R. Lindeberg, N. Tolimieri, S. Lonhart, S. B. Traiger, and R. G. Gustafson. 2022. Draft Endangered Species Act status review report: Sunflower sea star (*Pycnopodia helianthoides*). U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, WA, October 2022. Report to the National Marine Fisheries Service Office of Protected Resources, 89 p. + appendices.

Lusseau, D. 2003. Effects of tour boats on the behavior of bottlenose dolphins: Using Markov chains to model anthropogenic impacts. Conservation Biology 17(6):1785-1793.

Lusseau, D. 2006. The short-term behavioral reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand. Marine Mammal Science 22(4):802-818.

Lüthi, D., M. Le Floch, B. Bereiter, T. Blunier, J.-M. Barnola, U. Siegenthaler, D. Raynaud, J. Jouzel, H. Fischer, K. Kawamura, and T. F. Stocker. 2008. High-resolution carbon dioxide concentration record 650,000–800,000 years before present. Nature 453(7193):379-382.

Macleod, C. D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: A review and synthesis. Endangered Species Research 7(2):125-136.

Mate, B. R., V. Y. Ilyashenko, A. L. Bradford, V. V. Vertyankin, G. A. Tsidulko, V. V. Rozhnov, and L. M. Irvine. 2015. Critically endangered western gray whales migrate to the eastern North Pacific. Biology Letters 11(4):20150071.

McCauley, R. D., R. D. Day, K. M. Swadling, Q. P. Fitzgibbon, R. A. Watson, and J. M. Semmens. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. Nature Ecology & Evolution 1(7):0195.

Merrick, R. L., and T. R. Loughlin. 1997. Foraging behavior of adult female and young-of-the-year Steller sea lions in Alaskan waters. Canadian Journal of Zoology 75(5):776-786.

Moberg, G. P. 2000. Biological response to stress: Implications for animal welfare. Pages 1-21 *in* G. P. Moberg, and J. A. Mench, editors. The Biology of Animal Stress: Basic Principles and Implications for Animal Welfare. CABI Publishing, Oxon, UK.

Morete, M. E., T. L. Bisi, and S. Rosso. 2007. Mother and calf humpback whale responses to vessels around the Abrolhos Archipelago, Bahia, Brazil. Journal of Cetacean Research and Management 9(3):241-248.

Morton, A., and H. K. Symonds. 2002. Displacement of *Orcinus orca* (L.) by high amplitude sound in British Columbia, Canada. ICES Journal of Marine Science 59(1):71-80.

Mueter, F. J., C. Broms, K. F. Drinkwater, K. D. Friedland, J. A. Hare, G. L. Hunt Jr, W. Melle, and M. Taylor. 2009. Ecosystem responses to recent oceanographic variability in high-latitude Northern Hemisphere ecosystems. Progress in Oceanography 81:93-110.

Mueter, F. J., and M. A. Litzow. 2008. Sea ice retreat alters the biogeography of the Bering Sea continental shelf. Ecological Applications 18(2):309-320.

Mulsow, J., and C. Reichmuth. 2010. Psychophysical and electrophysiological aerial audiograms of a Steller sea lion (*Eumetopias jubatus*). The Journal of the Acoustical Society of America 127(4):2692-2701.

Munger, L. M., S. M. Wiggins, S. E. Moore, and J. A. Hildebrand. 2008. North Pacific right whale (*Eubalaena japonica*) seasonal and diel calling patterns from long-term acoustic recordings in the southeastern Bering Sea, 2000–2006. Marine Mammal Science 24(4):795-814.

Muto, M. M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2018. Alaska marine mammal stock assessments, 2017. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, June 2018. NOAA Technical Memorandum NMFS-AFSC-378, 382 p.

Muto, M. M., V. T. Helker, B. J. Delean, N. C. Young, J. C. Freed, R. P. Angliss, N. A. Friday, P. L. Boveng, J. M. Breiwick, B. M. Brost, M. F. Cameron, P. J. Clapham, J. L. Crance, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, K. T. Goetz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, K. L. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2022. Alaska marine mammal stock assessments, 2021. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, August 2022. NOAA Technical Memorandum NMFS-AFSC-441, 398 p.

Neilson, J. L., and C. Gabriele. 2020. Glacier Bay and Icy Strait humpback whale population monitoring: 2019 update. National Park Service Resource Brief, Gustavus, AK, May 2020, 6 p.

Neilson, J. L., C. M. Gabriele, A. S. Jensen, K. Jackson, and J. M. Straley. 2012. Summary of reported whale-vessel collisions in Alaskan waters. Journal of Marine Biology 2012:Article ID 106282.

NIOSH. 1998. Criteria for a recommended standard: Occupational noise exposure. U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, Cincinnati, OH.

NMFS. 1991. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD, November 1991, 105 p.

NMFS. 2006. Biological Opinion on the Minerals Management Service's Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska; and Authorization of Small Takes Under the Marine Mammal Protection Act. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Regional Office, Anchorage, AK, June 16, 2006, 106 p.

NMFS. 2008. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Eastern and Western distinct population segments (*Eumetopias jubatus*). Revision. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD, March 2008, 325 p.

NMFS. 2018. Revision to technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (Version 2.0): underwater acoustic thresholds for onset of permanent and temporary threshold shifts. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD, April 2018. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

NMFS. 2020. Western distinct population segment Steller sea lion *Eumetopias jubatus* 5-year review: summary and evaluation. National Marine Fisheries Service, Protected Resources Division, Juneau, AK, February 2020, 61 p.

NMFS. 2022. Recovery outline for the Central America, Mexico, and Western North Pacific distinct population segments of humpback whales. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD, 15 p.

NMFS. 2023. Gray whale, Western North Pacific distinct population segment (*Eschrichtius robustus*) 5-year review: summary and evaluation. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD, 42 p.

Notz, D., and J. Stroeve. 2016. Observed Arctic sea-ice loss directly follows anthropogenic CO_2 emission. Science 354(6313):747-750.

Nowacek, D. P., L. H. Thorne, D. W. Johnston, and P. L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review 37(2):81-115.

NRC. 2003. Ocean Noise and Marine Mammals. National Research Council, Ocean Study Board, National Academy Press, Washington, D.C.

OASIS Environmental Inc. 2006. Dutch Harbor water quality and impairment analysis: Dutch Harbor, Iliuliuk Bay,and Iliuliuk Harbor, Unalaska, Alaska, Final report for the Alaska Dept. of Environmental Conservation, Anchorage, AK, June 2006, 42 p.

Oreskes, N. 2004. The scientifc consensus on climate change. Science 306:1686.

Orr, J. C., V. J. Fabry, O. Aumont, L. Bopp, S. C. Doney, R. A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, R. M. Key, K. Lindsay, E. Maier-Reimer, R. Matear, P. Monfray, A. Mouchet, R. G. Najjar, G.-K. Plattner, K. B. Rodgers, C. L. Sabine, J. L. Sarmiento, R. Schlitzer, R. D. Slater, I. J. Totterdell, M.-F. Weirig, Y. Yamanaka, and A. Yool. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature 437:681-686.

Overland, J. E. 2020. Less climatic resilience in the Arctic. Weather and Climate Extremes 30:100275.

Payne, R. S. 1970. Songs of the humpback whale. Capitol Records, Hollywood, CA.

Pearson, W. H., J. R. Skalski, and C. I. Malme. 1992. Effects of sounds from a geophysical survey device on behavior of captive rockfish (*Sebastes* spp.). Canadian Journal of Fisheries and Aquatic Sciences 49(7):1343-1356.

Perovich, D., W. Meier, M. Tschudi, S. Farrell, S. Hendricks, S. Gerland, L. Kaleschke, R. Ricker, X. Tian-Kunze, M. Webster, and K. Wood. 2019. Arctic report card: Update for 2019 sea ice. https://arctic.noaa.gov/Report-Card/Report-Card-2019/ArtMID/7916/ArticleID/841/Sea-Ice.

Perry, S. L., D. P. DeMaster, and G. K. Silber. 1999. The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Marine Fisheries Review 61(1):1-74.

Petersen, S., A. Krätschell, N. Augustin, J. Jamieson, J. R. Hein, and M. D. Hannington. 2016. News from the seabed – Geological characteristics and resource potential of deep-sea mineral resources. Marine Policy 70:175-187.

Peterson, W., N. Bond, and M. Robert. 2016. The blob (part three): Going, going, gone? PICES Press 24(1):46.

Pitcher, K. W., and D. G. Calkins. 1981. Reproductive biology of Steller sea lions in the Gulf of Alaska. Journal of Mammalogy 62(3):599-605.

Pitcher, K. W., and F. H. Fay. 1982. Feeding by Steller sea lions on harbor seals. The Murrelet:70-71.

Qi, D., L. Chen, B. Chen, Z. Gao, W. Zhong, Richard A. Feely, Leif G. Anderson, H. Sun, J. Chen, M. Chen, L. Zhan, Y. Zhang, and W.-J. Cai. 2017. Increase in acidifying water in the western Arctic Ocean. Nature Climate Change 7(3):195-199.

Rea, L. D., J. M. Castellini, L. Correa, B. S. Fadely, and T. M. O'Hara. 2013. Maternal Steller sea lion diets elevate fetal mercury concentrations in an area of population decline. Science of the Total Environment 454-455:277-282.

Reine, K., D. Clarke, and C. Dickerson. 2012. Characterization of underwater sounds produced by a backhoe dredge excavating rock and gravel. U.S. Army Engineer Research and Development Center, Vickburg, MS, December 2012. DOER Technical Notes Collection ERDC TN-DOER-E36, 30 p.

Reisdorph, S. C., and J. T. Mathis. 2014. The dynamic controls on carbonate mineral saturation states and ocean acidification in a glacially dominated estuary. Estuarine, Coastal and Shelf Science 144:8-18.

Rice, D. W. 1998. Marine Mammals of the World: Systematics and Distribution. Society for Marine Mammology, Lawrence, KS.

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

Richardson, W. J., and C. I. Malme. 1993. Man-made noise and behavioral responses. Pages 631-700 *in* J. J. Burns, J. J. Montague, and C. J. Cowles, editors. The Bowhead Whale, Special Publication Number 2. Society for Marine Mammology, Allen Press, Inc., Lawrence, KS.

Richter-Menge, J., J. E. Overland, J. T. Mathis, and E. Osborne, editors. 2017. Arctic report card 2017. http://www.arctic.noaa.gov/Report-Card.

Ridgway, S. H., D. A. Carder, R. R. Smith, T. Kamolnick, C. E. Schlunt, and W. R. Elsberry. 1997. Behavioural responses and temporary shift in masked hearing threshold of bottlenose dolphins, *Tursiops truncatus*, to 1-second tones of 141 to 201 dB re 1 mPa. Naval Command, Control and Surveillance Center, RDT&E Division, San Diego, CA, July 1997. Technical Report 1751, 16 p. + appendices.

Rolland, R. M., S. E. Parks, K. E. Hunt, M. Castellote, P. J. Corkeron, D. P. Nowacek, S. K. Wasser, and S. D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proceedings of the Royal Society B: Biological Sciences 279(1737):2363-2368.

Romano, T. A., D. L. Felten, S. Y. Stevens, J. A. Olschowka, V. Quaranta, and S. H. Ridgway. 2002. Immune response, stress, and environment: Implications for cetaceans. Pages 253-279 *in* C. J. Pfeiffer, editor. Molecular and Cell Biology of Marine Mammals. Krieger Publishing Co., Malabar, FL.

Sandegren, F. E. 1970. Breeding and maternal behavior of the Steller sea lion (*Eumetopias jubata*) in Alaska. Master's thesis. University of Alaska, Fairbanks, AK, 138 p.

Schoeman, R. P., C. Patterson-Abrolat, and S. Plon. 2020. A global review of vessel collisions with marine animals. Frontiers in Marine Science 7:25.

Serreze, M. C., and R. G. Barry. 2011. Processes and impacts of Arctic amplification: a research synthesis. Global and Planetary Change 77(1):85-96.

Sharpe, F. A., and L. M. Dill. 1997. The behavior of Pacific herring schools in response to artificial humpback whale bubbles. Canadian Journal of Zoology-Revue Canadienne De Zoologie 75(5):725-730.

Sigmond, M., J. C. Fyfe, and N. C. Swart. 2018. Ice-free Arctic projections under the Paris Agreement. Nature Climate Change 8(5):404-408.

Silber, G. K. 1986. The relationship of social vocalizations to surface behavior and aggression in the Hawaiian humpback whale (*Megaptera novaeangliae*). Canadian Journal of Zoology 64(10):2075-2080.

Silber, G. K., D. W. Weller, R. R. Reeves, J. D. Adams, and T. J. Moores. 2021. Co-occurrence of gray whales and vessel traffic in the North Pacific Ocean. Endangered Species Research 44:177-201.

SIMIP Community. 2020. Arctic Sea Ice in CMIP6. Geophysical Research Letters 47(10):e2019GL086749.

Simon, M., M. Johnson, and P. T. Madsen. 2012. Keeping momentum with a mouthful of water: behavior and kinematics of humpback whale lunge feeding. Journal of Experimental Biology 215(21):3786-3798.

Skalski, J. R., W. H. Pearson, and C. I. Malme. 1992. Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes* spp.). Canadian Journal of Fisheries and Aquatic Sciences 49(7):1357-1365.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4):411-521.

Spalding, D. J. 1964. Comparative feeding habits of the fur seal, sea lion and harbour seal on the British Columbia coast. Bulletin of the Fisheries Research Board of Canada No. 146, Ottawa, Ontario, 52 p.

Stafford, K. M., and D. K. Mellinger. 2009. Analysis of acoustic and oceanographic data from the Bering Sea, May 2006 – April 2007. Final report to the North Pacific Research Board, NPRB Project No. 719, Seattle, WA, June 30, 2009, 24 p.

Steiger, G. H., J. Calambokidis, J. M. Straley, L. M. Herman, S. Cerchio, D. R. Salden, J. Urban-R., J. K. Jacobsen, O. von Ziegesar, K. C. Balcomb, C. M. Gabriele, M. E. Dahlheim, S. Uchida, J. K. B. Ford, P. Ladron de Guevara-P., M. Yamaguchi, and J. Barlow. 2008. Geographic variation in killer whale attacks on humpback whales in the North Pacific: Implications for predation pressure. Endangered Species Research 4:247-256.

Straley, J. M., J. R. Moran, K. M. Boswell, J. J. Vollenweider, R. A. Heintz, T. J. Quinn Ii, B. H. Witteveen, and S. D. Rice. 2018. Seasonal presence and potential influence of humpback whales on wintering Pacific herring populations in the Gulf of Alaska. Deep Sea Research Part II: Topical Studies in Oceanography 147:173-186.

Stroeve, J., M. M. Holland, W. Meier, T. Scambos, and M. Serreze. 2007. Arctic sea ice decline: Faster than forecast. Geophysical Research Letters 34(9).

Stroeve, J., and D. Notz. 2018. Changing state of Arctic sea ice across all seasons. Environmental Research Letters 13(10):103001.

Sturdevant, M. V., and J. H. Landingham. 1993. Temperature, salinity, and zooplankton as indicators of environmental suitability for relase of hatchery-reared juvenile salmonids near Juneau, Alaska. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Auke Bay Laboratory, Juneau, AK, September 1993, 27 p.

Sweeney, K., L. Fritz, R. Towell, and T. Gelatt. 2017. Results of Steller sea lion surveys in Alaska, June-July 2017. Memorandum to the record, December 5, 2017. National Marine Fisheries Service, Alaska Fisheries Science Center, Marine Mammal Laboratory, 17 p.

Sweeney, K., R. Towell, and T. Gelatt. 2018. Results of Steller sea lion surveys in Alaska, June-July 2018. Memorandum to the record, December 4, 2018. National Marine Fisheries

Service, Alaska Fisheries Science Center, Marine Mammal Laboratory, Seattle, WA, 19 p.

Thoman, R., and J. Walsh. 2019. Alaska's changing environment: documenting Alaska's physical and biological changes through observations. International Arctic Research Center, University of Alaska Fairbanks, 16 p.

Thompson, P. O., W. C. Cummings, and S. J. Ha. 1986. Sounds, source levels, and associated behavior of humpback whales, southeast Alaska. Journal of the Acoustical Society of America 80(3):735-740.

Thompson, T. J., H. E. Winn, and P. J. Perkins. 1979. Mysticete sounds. Pages 403-431 *in* H. E. Winn, and B. L. Olla, editors. Behavior of Marine Animals: Current Perspectives in Research, Vol. 3: Cetaceans. Plenum Press, New York, NY.

Thorson, P., and J. Reyff. 2006. San Francisco-Oakland Bay bridge east span seismic safety project marine mammals and acoustic monitoring for the marine foundations at piers E2 and T1, January-September 2006. Prepared by SRS Technologies and Illingworth & Rodkin for the California Dept. of Transportation, December 2006, 51 p.

Thorsteinson, F. V., and C. J. Lensink. 1962. Biological observations of Steller sea lions taken during an experimental harvest. Journal of Wildlife Management 26(4):353-359.

Todd, V. L. G., I. B. Todd, J. C. Gardiner, E. C. N. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. 2015. A review of impacts of marine dredging activities on marine mammals. ICES (International Council for the Exploration of the Seas) Journal of Marine Science 72(2):328-340.

Tomilin, A. 1967. Mammals of the USSR and adjacent countries. Cetacea 9:666-696.

Tyack, P., and H. Whitehead. 1983. Male competition in large groups of wintering humpback whales. Behaviour 83(1/2):132-154.

Tyack, P. L. 1981. Interactions between singing Hawaiian humpback whales and conspecifics nearby. Behavioral Ecology and Sociobiology 8:105-116.

Urbán, J., D. Weller, S. Martinez A., O. Tyurneva, A. Bradford, A. Burdin, A. Lang, S. Swartz, O. Sychenko, L. Viloria-Gómora, and Y. Yakovlev. 2019. New information on the gray whale migratory movements between the western and eastern North Pacific. Paper SC/68a/CMP11 presented to the Scientific Committee of the International Whaling Commission, 11 p.

Urick, R. J. 1983. Principles of Underwater Sound. McGraw-Hill.

USACE. 2019. Final feasibility report and draft environmental assessment: Unalaska (Dutch Harbor) channels. U.S. Army Corps of Engineers, Alaska District, February 1, 2019, 180 p.

USACE. 2022. Request for an Incidental Harassment Authorization under the Marine Mammal Protection Act for Unalaska (Dutch Harbor) Channels, Unalaska, Alaska. U.S. Army Corps of Engineers, Alaska District, October 2022, 53 p.

USACE. 2023. Biological assessment for humpback whales and Steller sea lions in conjunction with Unalaska (Dutch Harbor) channels dredging and confined underwater blasting. U.S. Army Corps of Engineers, Alaska District, February 2023, 36 p.

Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. Marine Mammal Science 23(1):144-156.

Wade, P. R. 2021. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA. Paper submitted to the International Whaling Commission SC/68C/IA/03, 31 p.

Wang, F., and J. E. Overland. 2009. A sea ice free summer Arctic within 30 years? Geophysical Research Letters 36:L07502.

Wartzok, D., A. N. Popper, J. Gordon, and J. Merrill. 2003. Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal 37(4):6-15.

Wassmann, P., C. M. Duarte, S. Agusti, and M. K. Sejr. 2011. Footprints of climate change in the Arctic marine ecosystem. Global Change Biology 17(2):1235-1249.

Weilgart, L. S. 2007. A brief review of known effects of noise on marine mammals. International Journal of Comparative Psychology 20(2):159-168.

Weller, D. W., A. Klimek, A. L. Bradford, J. Calambokidis, A. R. Lang, B. Gisborne, A. M. Burdin, W. Szaniszlo, J. Urban, A. G.-G. Unzueta, S. Swartz, and R. L. Brownell Jr. 2012. Movements of gray whales between the western and eastern North Pacific. Endangered Species Research 18(2):193-199.

Weston, D. E. 1960. Underwater explosions as acoustic sources. Proceedings of the Physical Society 76:233-249.

Wiese, K. 1996. Sensory capacities of euphausiids in the context of schooling. Marine and Freshwater Behaviour and Physiology 28(3):183-194.

Wieting, D. S. 2016. Interim guidance on the Endangered Species Act term "harass." Memorandum from the Director, Office of Protected Resources, to Regional Administrators, October 21, 2016. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD, 6 p.

Williams, R., D. E. Bain, J. K. B. Ford, and A. W. Trites. 2002. Behavioural responses of male killer whales to a 'leapfrogging' vessel. Journal of Cetacean Research and Management 4(3):305-310.

Winn, H. E., P. J. Perkins, and T. C. Poulter. 1970. Sounds of the humpback whale. Pages 39-52 *in* Proceedings of the 7th Annual Conference on Biological Sonar and Diving Mammals, October 23 and 24, 1970, Stanford Research Institute, Menlo Park, CA.

Witteveen, B. H., and K. M. Wynne. 2017. Site fidelity and movement of humpback whales (*Megaptera novaeangliae*) in the western Gulf of Alaska as revealed by photo-identification. Canadian Journal of Zoology 95(3):169-175.

Wright, D., M. Castellote, C. L. Berchok, J. L. Crance, and P. J. Clapham. 2018. Acoustic detection of North Pacific right whales in a high-traffic Aleutian Pass, 2009–2015. Endangered Species Research 37:77-90.

Yamamoto, A., M. Kawamiya, A. Ishida, Y. Yamanaka, and S. Watanabe. 2012. Impact of rapid sea-ice reduction in the Arctic Ocean on the rate of ocean acidification. Biogeosciences 9(6):2365-2375.

York, A. E. 1994. The population dynamics of northern sea lions, 1975-1985. Marine Mammal Science 10(1):38-51.

Young, N. C., M. M. Muto, V. T. Helker, B. J. Delean, J. C. Freed, R. P. Angliss, N. A. Friday, P. L. Boveng, J. M. Breiwick, B. M. Brost, M. F. Cameron, P. J. Clapham, J. L. Crance, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, K. T. Goetz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, K. L. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2023. Alaska marine mammal stock assessments, 2022. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, July 2023. NOAA Technical Memorandum NMFS-AFSC-474, 316 p.