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

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

Hydaburg Seaplane Facility Refurbishment

NMFS Consultation Number: AKRO-2022-03506

Action Agencies: National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division; Alaska Department of Transportation & Public Facilities

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?
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	No	No	No	No
Sunflower Sea Star (*Pycnopodia helianthoides*)	Proposed	Yes	N/A	No	N/A

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By: [signature]
For Jonathan M. Kurland
Regional Administrator

Date: December 19, 2023

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TERMS AND ABBREVIATIONS

µPa	Micro Pascal
ADOT	Alaska Department of Transportation & Public Facilities
AKR	Alaska Region
ARBO	Arctic Regional Biological Opinion
ASLC	Alaska SeaLife Center
BA	Biological Assessment
CI	Confidence Interval
CSEL	Cumulative Sound Exposure Level
Cui	Cubic Inches
CV	Coefficient of Variance
CWA	Clean Water Act
dB re 1µPa	Decibel referenced 1 microPascal
District Court	U.S. District Court for the District of Alaska
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act
°F	Fahrenheit
FR	Federal Register
ft	Feet
g	Gallons
HSF	Hydaburg Seaplane Facility
HTL	High Tide Line
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
IWC	International Whaling Commission
kHz	Kilohertz
km	Kilometers
kn	Knots
L	Liter

m	Meter
mi	Mile
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
ms	Milliseconds
μPa	Micro Pascal
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
NSF	National Science Foundation
Opinion	Biological Opinion
Pa	Pascals
PR1	NMFS Permits Division
PTS	Permanent Threshold Shift
RMS	Root Mean Square
RPA	Reasonable and Prudent Alternative
s	Second
SEL	Sound Exposure Level
SPLASH	Structure of Populations, Level of Abundance and Status of Humpback Whales
SSL	Steller Sea Lion
TTS	Temporary Threshold Shift
VMS	Vessel Monitoring System

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. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, 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 and 88 FR 40764).

In this document, the action agency is the Federal Aviation Administration (FAA), which proposes to make improvements to the Hydaburg Seaplane Facility in Hydaburg, Alaska. On December 29, 2022 the FAA officially designated the Alaska Department of Transportation & Public Facilities (ADOT) as the non-federal representative. The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's Biological and Conference Opinion (opinion) on the effects of this proposal on listed and proposed 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 November 30, 2022, Biological Assessment (BA) and subsequent revisions, and the Incidental Harassment Application (IHA) and subsequent revisions prepared and submitted by HDR Inc. (HDR). A complete record of this consultation is on file at NMFS's Alaska Regional Office.

The proposed action involves maintenance improvements to the existing Hydaburg Seaplane Facility located in Hydaburg, AK (Figure 1) with an expected start in fall 2024 and expected to occur over 26 non-consecutive days during a 2-month construction window.

This opinion considers the effects of the following in-water activities:

1. removal of existing piles;
2. installation and removal of temporary support piles;
3. installation of permanent piles; and
4. support and material supply vessel transit.

This opinion considers the effects of the associated proposed issuance of an IHA on threatened Mexico Distinct Population Segment (DPS) humpback whales (*Megaptera novaeangliae*). In addition, the action agency requested a discretionary conference on the proposed listing of the sunflower sea star (*Pycnopodia helianthoides*) (88 FR 16212, March 16, 2023).

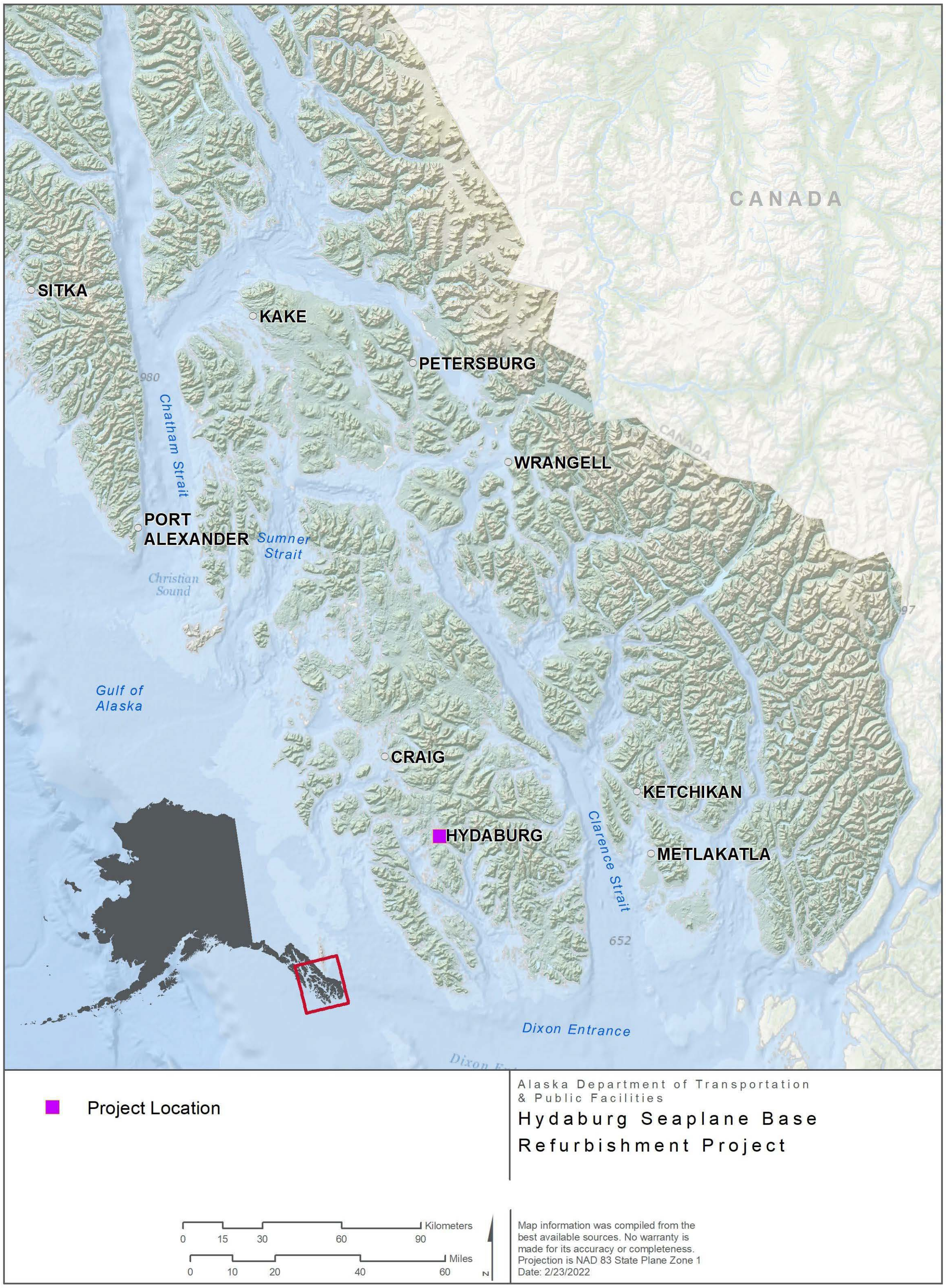

Figure 1. Project Location in Southeast Alaska (HDR 2022)

Figure 2. Project Location in Hydaburg, AK (HDR 2022)

1.2 Consultation History

- June 17, 2022- NMFS Permits Division (PR1) received an Incidental Harassment Authorization (IHA) application for the Hydaburg Seaplane Facility (HSF) refurbishment project;
- August 22, 2022- NMFS Alaska Region (AKR) received an email from ADOT requesting technical assistance on the HSF project;
- November 30, 2022- Early Review Team (ERT), with participants from NMFS AKR and PR1 met to discuss the project;
- December 30, 2022- NMFS AKR received a letter requesting consultation from the FAA. The letter also designated ADOT as the non-federal representative for the project;
- December 30, 2022- NMFS AKR received the BA prepared by HDR;
- January 30, 2023 NMFS AKR sent an email to ADOT requesting more information on the BA;
- February 6, 2023- NMFS AKR received a letter from ADOT responding to questions on the BA;
- February 16, 2023- NMFS AKR received a letter from ADOT requesting a meeting regarding the inclusion of the proposed sunflower sea star in the consultation;
- March 6, 2023- NMFS and ADOT meet to discuss sunflower sea stars and agree to include them in the opinion;
- March 13, 2023- PR1 determined the IHA application adequate and complete;
- May 24, 2023- NMFS AKR received the draft federal register notice and IHA from PR1;
- July 17, 2023- Proposed IHA published in the Federal Register; NMFS AKR received a request for consultation from PR1; consultation initiated;
- August 1, 2023- NMFS AKR received updated sunflower sea star language for the project from ADOT;
- October 11, 2023- ADOT revised sunflower sea star determination from "Not Likely to Adversely Affect" to "Likely to Adversely Affect" and estimated take for 15 sunflower sea stars.

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).

This opinion considers the effects of ADOT's proposed maintenance improvements to the existing HSF. The project includes the removal and installation of both temporary and permanent piles to support replacement of the floating dock structure. Additional above-water improvements will include repairs to the vehicle gangway and installation of an electrical lighting system for the approach and the new floating dock. Construction will be permitted by USACE, as well as PR1 issuance of an IHA to take marine mammals by harassment under the Marine Mammal Protection Act (MMPA) incidental to these actions in Sukkwan Strait near Hydaburg, AK. Construction is expected to occur over approximately 2 months beginning as early as fall 2024.

2.1.1 Proposed Activities

Hydaburg is located on Prince of Wales Island, approximately 76 kilometers west of Ketchikan in southeast Alaska (Figure 1). HSF is located at the Hydaburg city dock in Sukkwan Strait (Figure 2). Replacement of existing float structures is required to continue safe operations of HSF, which is an aging facility that has experienced deterioration in recent years.

The Project will involve the removal of five existing steel pipe piles (16-inch diameter) that support the existing multiple-float structure. The multiple-float timber structure, which covers 4,000 square feet, will also be removed. A new 4,800-square-foot, single-float timber structure will be installed in the same general location. Four 24-inch and four 20-inch permanent steel pipe piles will be installed to act as restraints for the new seaplane float. Up to 10 temporary 24- inch steel pipe piles will be installed to support permanent pile installation and will be removed following completion of construction. Rock sockets and tension anchors will be required on all four 24-inch piles and two 20-inch piles. Rock sockets will also be potentially required on five of the temporary piles.

Down-the-hole (DTH) pile installation involves drilling rock sockets into the bedrock to support installation of piles. A rock socket is formed by inserting the pile in a hole drilled into the underlying bedrock after the pile has been driven through the overlying softer sediments to refusal by vibratory or impact methods. The pile is advanced farther into this drilled hole to properly secure the bottom portion of the pile into the rock. The depth of the rock socket varies, but up to 20 feet may be required for this project. The diameter of the rock socket is slightly larger than the pile being driven. Rock sockets are constructed using a DTH device consisting of a drill bit that drills through the bedrock using both rotary and pulse impact mechanisms. This breaks up the rock to allow removal of the fragments and insertion of the pile. The pile is usually advanced at the same time that drilling occurs. Drill cuttings are expelled from the top of the pile using compressed air. It is estimated that drilling rock sockets into the bedrock may take up to 8 hours per pile in extreme circumstances; however, an average of 4 hours has been used by ADOT to calculate days of construction.

Tension anchors will be installed in six of the permanent piles (four 24-inch and two 20-inch piles). Tension anchors are installed within piles that are drilled into the bedrock below the elevation of the pile tip after the pile has been driven through the sediment layer to refusal. A 6- or 8-inch-diameter steel pipe casing will be inserted inside the larger-diameter production pile. A rock drill will be inserted into the casing, and a 6- to 8-inch-diameter hole will be drilled into bedrock with rotary and percussion drilling methods. The drilling work is contained within the steel pile casing and the steel pipe pile. The typical depth of the drilled hole varies, but 20–30 feet is common. Rock fragments will be removed through the top of the casing with compressed air. A steel rod will then be grouted into the drilled hole and affixed to the top of the pile. The purpose of a tension anchor is to secure the pile to the bedrock to withstand uplift forces. ADOT calculates that tension anchor installation will take about 1–4 hours per pile. Table 1-1 indicates the expected numbers of piles and locations where tension anchors are required. Figure 1-3 depicts a schematic of DTH pile installation and tension anchor installation techniques. Hereafter, DTH pile installation refers to both rock socket drilling and tension anchor installation unless specified.

Pile removal would be conducted using a vibratory hammer. Pile installation would be conducted using both a vibratory and an impact hammer and DTH pile installation methods. Piles would be advanced to refusal using a vibratory hammer. After DTH pile installation, the final approximately 3 m of driving would be conducted using an impact hammer so that the structural capacity of the pile embedment could be verified. The pile installation methods used would depend on sediment depth and conditions at each pile location. Pile installation and removal would occur in waters approximately 6-7 m in depth.

See Table 1 for a summary of the numbers and types of piles to be installed and removed, as well as the estimated durations of each activity.

Table 1. Summary of Piles to be Installed and Removed

Pile Diameter and Type	Number of Piles	Number of Rock Sockets	Number of Tension Anchors	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Rock Socket DTH Pile Installation, Duration per Pile, minutes (range)	Tension Anchor DTH Pile Installation, Duration per Pile, minutes (range)	Total Duration of Activity per Pile, hours	Typical Production Rate in Piles per Day (range)	Days of Installation or Removal
Pile Installation										
24” Steel Plumb Piles (Permanent)	4	4	4	50	15	240 (60-480)	120 (60-240)	6.75	0.5 (0-1)	8
20” Steel Plumb Piles (Permanent)	4	2	2	50	15	240 (60-480)	120 (60-240)	0.75 / 6.75[1]	0.5 (0-1)	8
24” Steel Piles (Temporary)	10	5	N/A	N/A	15	240 (60-480)	N/A	4.25	2.5 (1-10)	4
Pile Removal										
16” Steel Cantilevered Piles	5	N/A	N/A	N/A	30	N/A	N/A	0.5	2.5 (2-4	2
24” Steel Piles (Temporary)	10	N/A	N/A	N/A	30	N/A	N/A	0.5	2.5 (2-4)	4
Totals	23	11	6	N/A	N/A	N/A	N/A	N/A	N/A	26

[1] Two of the 20-inch plumb piles will include vibratory and impact installation in addition to rock sockets and tension anchors, estimated at 6.75 hours duration total, and two will only use vibratory and impact, estimated at 0.75 hours duration total.

2.1.2 Construction Vessels and Movements

The Contractor is expected to mobilize two barges: one with a crane mounted on it and a staging/work barge that will be moved into place with a tugboat. Additional barges and tugs will be used to deliver equipment as needed. While it is not yet known where construction materials will arrive from, all vessels associated with the project will follow well-established, frequently used navigation lanes throughout Southeast Alaska. Within the action area, project-related vessels will not exceed 10 knots.

2.1.3 Construction Sequence and Duration

Construction of the project is expected to occur over approximately 2 months beginning as early as fall 2024. Pile installation and removal will be intermittent during this period, depending on weather, construction and mechanical delays, protected species shutdowns, and other potential delays and logistical constraints. Pile installation will occur intermittently during the work period for durations of minutes to hours at a time. Pile installation and removal will occur over 26 non-consecutive days within the 2-month construction window.

2.1.4 Mitigation Measures

For all reporting that results from implementation of these mitigation measures, NMFS will be contacted using the contact information specified in Table 2. In all cases, notification will reference the NMFS consultation tracking number AKRO-2022-03506.

2.1.4.1 General Mitigation Measures

1. ADOT will inform NMFS of impending in-water activities a minimum of one week prior to the onset of those activities.
2. If construction activities will occur outside of the time window specified in these measures, 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. Project-associated staff will cut all materials that form closed loops (e.g., plastic packing bands, rubber bands, and all other loops) prior to proper disposal in a closed and secured trash bin. Trash bins will be properly secured with locked or secured lids that cannot blow open, preventing trash from entering into the environment, thus reducing the risk of marine mammal entanglement should waste enter marine waters.
4. Project-associated staff will properly secure all ropes, nets, and other marine mammal entanglement hazards to ensure they do not blow or wash overboard.

2.1.4.2 Protected Species Observer (PSO) Measures

5. NMFS-approved PSOs, able to accurately identify and distinguish species of Alaska marine mammals, will be present before and during all Pile installation and removal activities. For each in-water activity, PSOs will monitor all marine waters within the indicated shutdown and/or monitoring zone radius for that activity. See Figures 3, 4, and

5 in Section 2.2 for specific shutdown and monitoring zones. A minimum of two PSOs will be required for DTH pile installation.

6. PSOs will be positioned such that they will collectively be able to monitor the entirety of each activity's shutdown zone. The action agency will coordinate with NMFS on the placement of PSOs prior to commencing in-water work.
7. Prior to commencing any in-water work, PSOs will scan waters within the appropriate shutdown zone and confirm no listed marine mammal species are within the shutdown zone for at least 30 minutes immediately prior to initiation of in-water activity. If one or more listed marine mammal species are observed within the shutdown zone, the in-water activity will not begin until the listed marine mammal species exit the shutdown zone of their own accord. Alternately, if the PSO has continuously scanned these waters and has not observed listed marine mammals within the zone for 30 minutes, then the in-water work may commence.
8. The pre-construction-activity observation period described in the above measure will take place at the start of each day of in-water activities, each time in-water activities have been shut down or delayed due the presence of a listed marine mammal species, and following cessation of in-water activities for a period of 30 minutes or longer.
9. The on-duty PSOs will continuously monitor the shutdown zone and adjacent waters during all in-water operations for the presence of listed species.
10. Pile installation and removal will take place only:
    a. between local sunrise and sunset;
    b. during conditions with a Beaufort Sea State of 4 or less; and
    c. when the entire shutdown zone and adjacent waters are visible (e.g., monitoring effectiveness is not reduced due to rain, fog, snow, haze or other environmental or atmospheric conditions).
11. If visibility degrades such that a PSO can no longer ensure that the shutdown zone remains devoid of listed marine mammal species during in-water work, 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 marine mammal species for 30 minutes.
12. The PSO will order in-water activities to immediately cease if one or more listed marine mammal species has entered, or appears likely to enter, the associated shutdown zone.
13. If in-water activities are shut down for less than 30 minutes due to the presence of listed marine mammal species in the shutdown zone, in-water work may commence when the PSO provides assurance that listed marine mammal species were observed exiting the shutdown zone. Otherwise, the activities may only re-commence after the PSO provides assurance that listed species have not been seen in the shutdown zone for 30 minutes (for cetaceans) or 15 minutes (for pinnipeds).
14. Following a lapse of in-water activities of more than 30 minutes, the PSO will authorize resumption of activities (using soft-start procedures for impact pile driving activities)

only after the PSO provides assurance that listed marine mammal species have not been present in the shutdown zone for at least 30 minutes immediately prior to resumption of operations.

15. If a listed marine mammal 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.
16. PSOs will have no other primary duties beyond watching for, acting on, and reporting events related to listed species.
17. 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 disapproval in instances where an individual is not approved.
18. At least one PSO will have prior experience performing the duties of a PSO during construction activity.
19. At least one PSO on the project will complete PSO training prior to deployment (contact NMFS AKR PRD for a list of trained and experienced PSOs). 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.
20. When a team of three or more PSOs are required, a lead observer or monitoring coordinator will be designated.
21. PSOs will:
    a. have vision that allows for adequate monitoring of the entire shutdown zone;
    b. have the ability to effectively communicate orally, by radio and in person, with project personnel;
    c. be able to collect field observations and record field data accurately and in accordance with project protocols;
    d. be able to identify to species all marine mammals that occur in the action area; and
    e. have writing skills sufficient to create understandable records of observations.
22. 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.

23. PSOs will have the ability and authority to order appropriate mitigation responses, including shutdowns, to avoid takes of all listed species.
24. The PSOs will have the following equipment to address their duties:
    a. tools which enable them to accurately determine the position of a marine mammal in relationship to the shutdown zone;
    b. two-way radio communication, or equivalent, with onsite project manager;
    c. tide tables for the project area;
    d. watch or chronometer;
    e. binoculars (7x50 or higher magnification) with built-in rangefinder or reticles (rangefinder may be provided separately);
    f. instruments that allow observer to determine geographic coordinates of observed marine mammals;
    g. a legible copy of this opinion and all appendices; and
    h. legible and fillable observation record form allowing for required PSO data entry.
25. 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.

2.1.4.3 Impact Pile driving

26. If no listed species are observed within the impact pile driving shutdown zone for 30 minutes immediately prior to pile driving, soft-start procedures will be implemented immediately prior to activities. Soft start requires contractors to provide an initial set of strikes at no more than half the operational power, followed by a 30 second waiting period, then two subsequent reduced power strike sets. A soft start must be implemented at the start of each day's impact pile driving, any time pile driving has been shutdown or delayed due the presence of a listed species, and following cessation of pile driving for a period of 30 minutes or longer.
27. Following this soft-start procedure, operational impact pile driving may commence and continue provided listed species remain absent from the shutdown zone.

2.1.4.4 Down the Hole (DTH) drilling

28. If no listed species are observed within the DTH pile driving shutdown zone for 30 minutes immediately prior to pile driving, soft-start procedures will be implemented immediately prior to activities. Soft start requires contractors to activate the drilling

equipment at no more than half the operational power for several seconds, followed by a 30 second waiting period, then two subsequent reduced power start-ups. A soft start must be implemented at the start of each day's DTH pile driving, any time pile driving has been shut down or delayed due the presence of a listed species, and following cessation of pile driving for a period of 30 minutes or longer.

29. Following this soft-start procedure, operational pile driving may commence and continue provided listed species remain absent from the shutdown zone.
30. Following a lapse of pile driving activities of more than 30 minutes, the PSO will authorize resumption of pile driving only after the PSO provides assurance that listed species have not been present in the shutdown zone for at least 30 minutes immediately prior to resumption of operations.

2.1.4.5 Vessels

31. 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;
    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 vessel gets underway; and
    g. reduce vessel speed to 10 knots or less when weather conditions reduce visibility to 1.6 km (1 mi) or less.
32. 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; or
    c. disrupt the normal behavior or prior activity of a whale by any other act or omission.
33. 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.

34. Vessels will take reasonable steps to alert other vessels in the vicinity of whale(s).
35. 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, Western DPS Steller Sea Lions, and their Critical Habitat.

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

2.1.4.6 Sunflower Sea Stars

38. To prevent direct placement of a pile on a sunflower sea star, a pre-construction survey and biweekly survey of the pilings and seafloor near the project area will take place during pile installation and removal.
    a. If a sunflower sea star is identified during the pre-construction or biweekly surveys, more frequent surveys prior to piling may be required.
    b. The contractor, at their own discretion, may monitor the seafloor by diving or with a remotely operated vehicle (ROV) at the placement of every pile in lieu of a pre-construction or monthly surveys. Observation from the surface is allowed only when visibility is sufficiently clear to ID sea stars.
    c. If a sunflower sea star is attached to a pile being removed from the water, the sunflower sea star will be gently removed from the pile by the Lead PSO, or a crew delegate due to possible safety concerns, and immediately released into the water in an intertidal location nearby. General Data Collection and Reporting.

Data Collection

39. PSOs will record observations on data forms or into electronic data sheets.
40. The action agency 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).
41. 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. observations of marine mammal behaviors and reactions to anthropogenic sounds and human presence;

g. initial, closest, and last known 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;

h. 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; and

i. geographic coordinates for the observed animals, (or location noted on a chart) with the position recorded using the most precise coordinates practicable (coordinates will be recorded in decimal degrees, or similar standard and defined coordinate system).

Data Reporting

42. Observations of humpback whales will be transmitted to AKR.section7@noaa.gov by the end of the calendar year, including information specified in General Data Collection and Reporting (above) and photographs and videos obtained of humpback whales, most notably those of the whale's flukes.

Unauthorized Take

43. If a listed marine mammal is determined by the PSO to have been disturbed, harassed, harmed, injured, or killed (e.g., a listed marine mammal(s) is observed entering a shutdown zone before operations can be shut down, or is injured or killed as a direct or indirect result of this action), the PSO will report the incident to NMFS within one business day, with information submitted to AKR.section7@noaa.gov. These PSO records will include:

    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;

g. if a vessel struck a marine mammal, the contact information for the PSO on duty, or the contact information for the individual piloting the vessel if there was no PSO on duty; and

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

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

44. 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

45. 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 (Table 2; 1-800-853-1964).
46. Data submitted to NMFS will include date/time, location, description of the event, and any photos or videos taken.

Monthly Report

47. 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.
48. 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

49. A draft of the 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. A final report must be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 30 calendar days of receipt of the draft report, the report may be considered final. 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.

50. 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; and

    g. digital, queryable documents containing PSO observations and records, and digital, queryable reports.

2.1.4.7 Summary of Agency Contact Information

Table 2. Summary of Agency Contact Information

Reason for Contact	**Contact Information**
Consultation Questions & Unauthorized Take	AKR.prd.section7@noaa.gov and David Gann (david.gann@noaa.gov)
Reports & Data Submittal	AKR.section7@noaa.gov (please include NMFS tracking number AKRO-2022-03506 in subject line)
Stranded, Injured, or Dead Marine Mammal *(not related to project activities)*	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 Hydaburg Seaplane Base is located at the south end of Hydaburg on Prince of Wales Island, and is attached to the Hydaburg city dock on the north shore of the Sukkwan Strait (Figure 2).

NMFS defines the ensonified portion of the action area for this consultation to include the area within which project-related noise levels exceed 120 dB re 1 µPa root mean square (rms), and are expected to approach ambient noise levels (i.e., the point where no measurable effect from the project would occur).

Vibratory pile installation has the potential to affect the largest underwater area. Sound from vibratory pile installation has the potential to extend up to 5,412 meters (3.36 miles) from the noise source. However, because underwater sound does not propagate through land, the underwater portion of the action area is truncated by numerous obstructions. At Hydaburg, sound from the Project will be blocked by Sukkwan Island, Spook Island, Mushroom Island, and the coastline along Prince of Wales Island both southeast and northwest of the Project site (see Figure 3). The farthest that sound could travel for this project is approximately 5,196 meters (3.2 miles). The total area of the action area is 4.34 square kilometers (1.68 square miles).

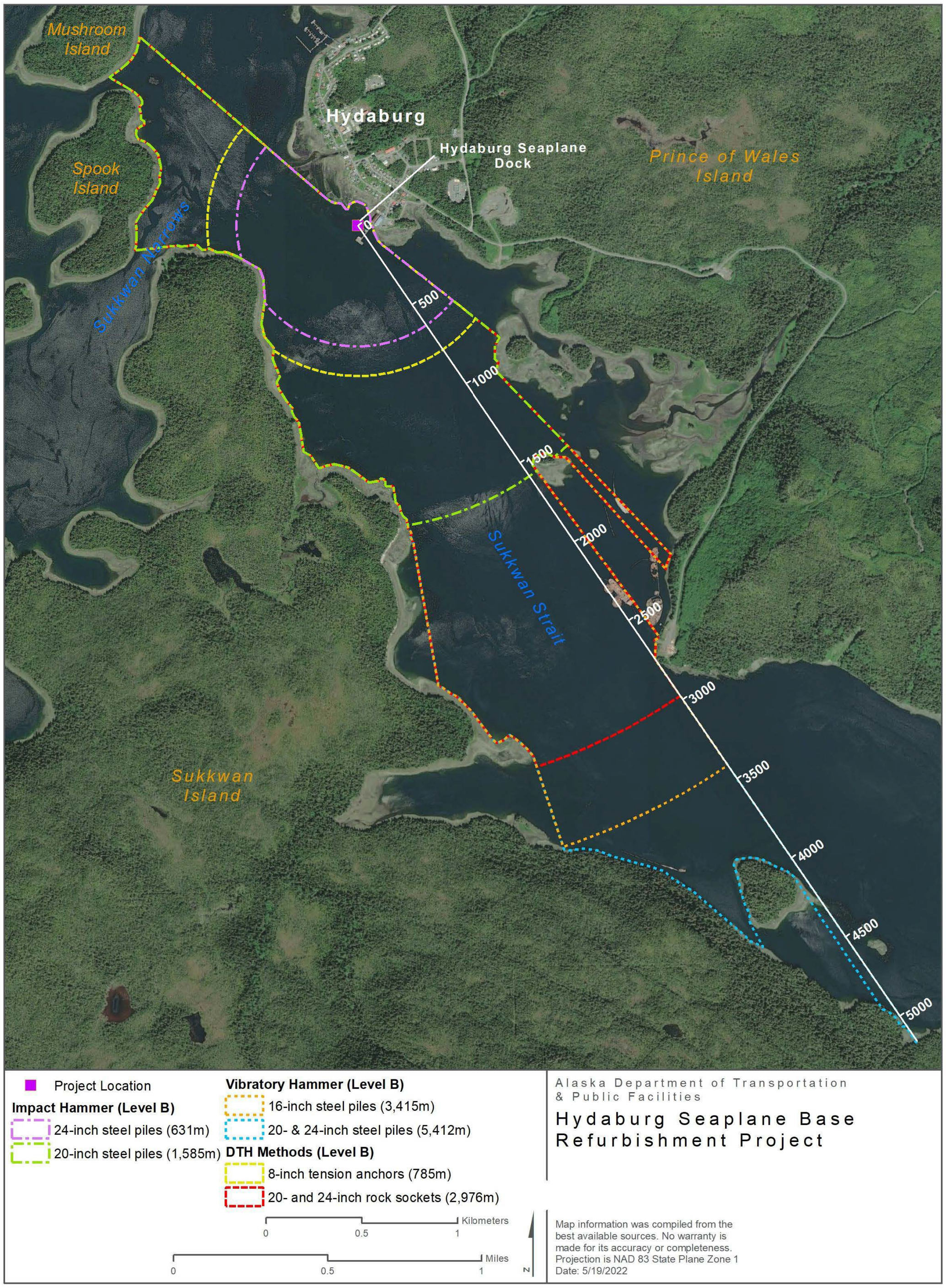

Figure 3. Hydaburg Seaplane Facility Action Area Showing Level B Isopleths (HDR 2022)

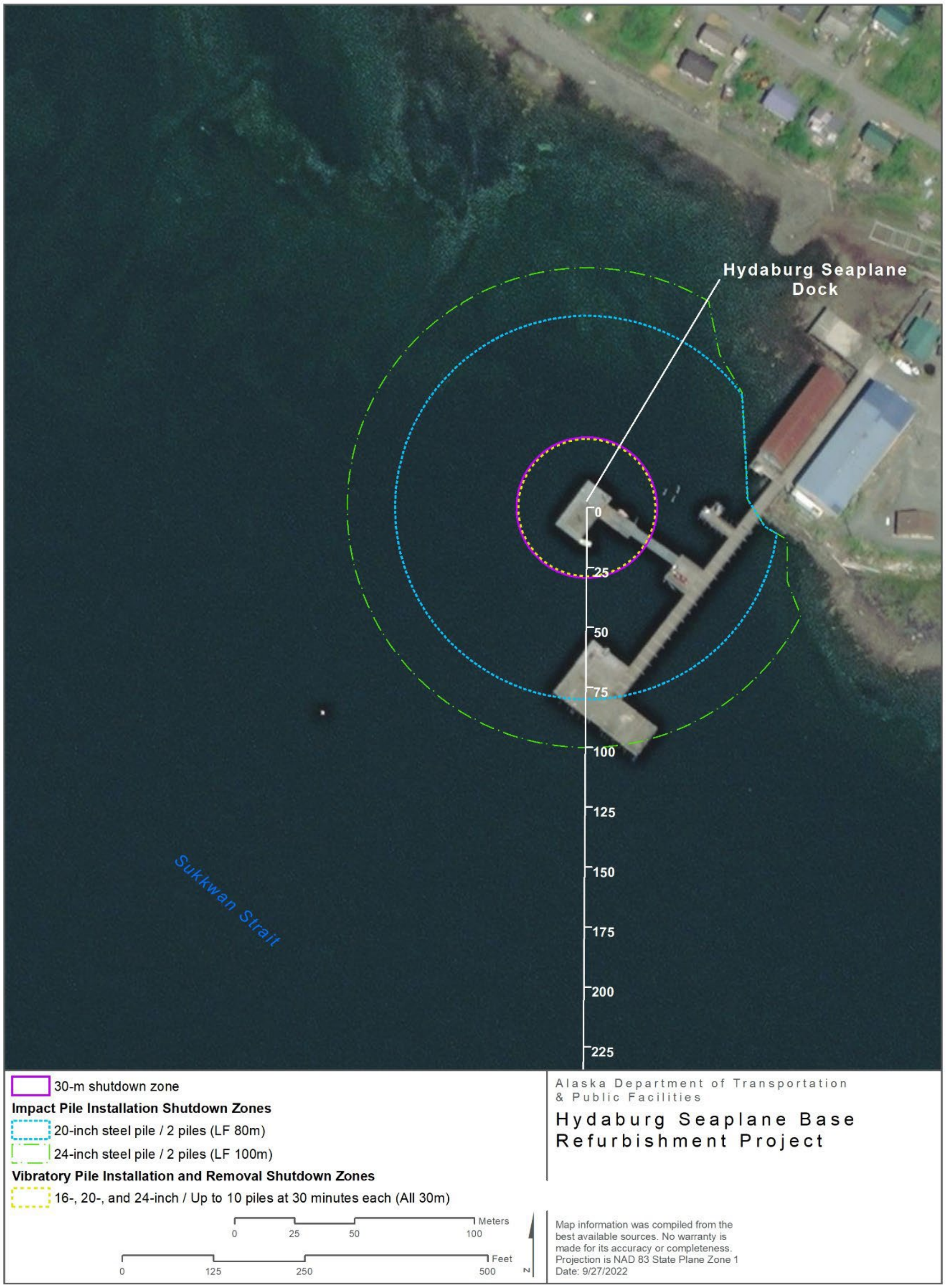

Figure 4. Shutdown Zones for Pile Driving Activities (HDR 2022)

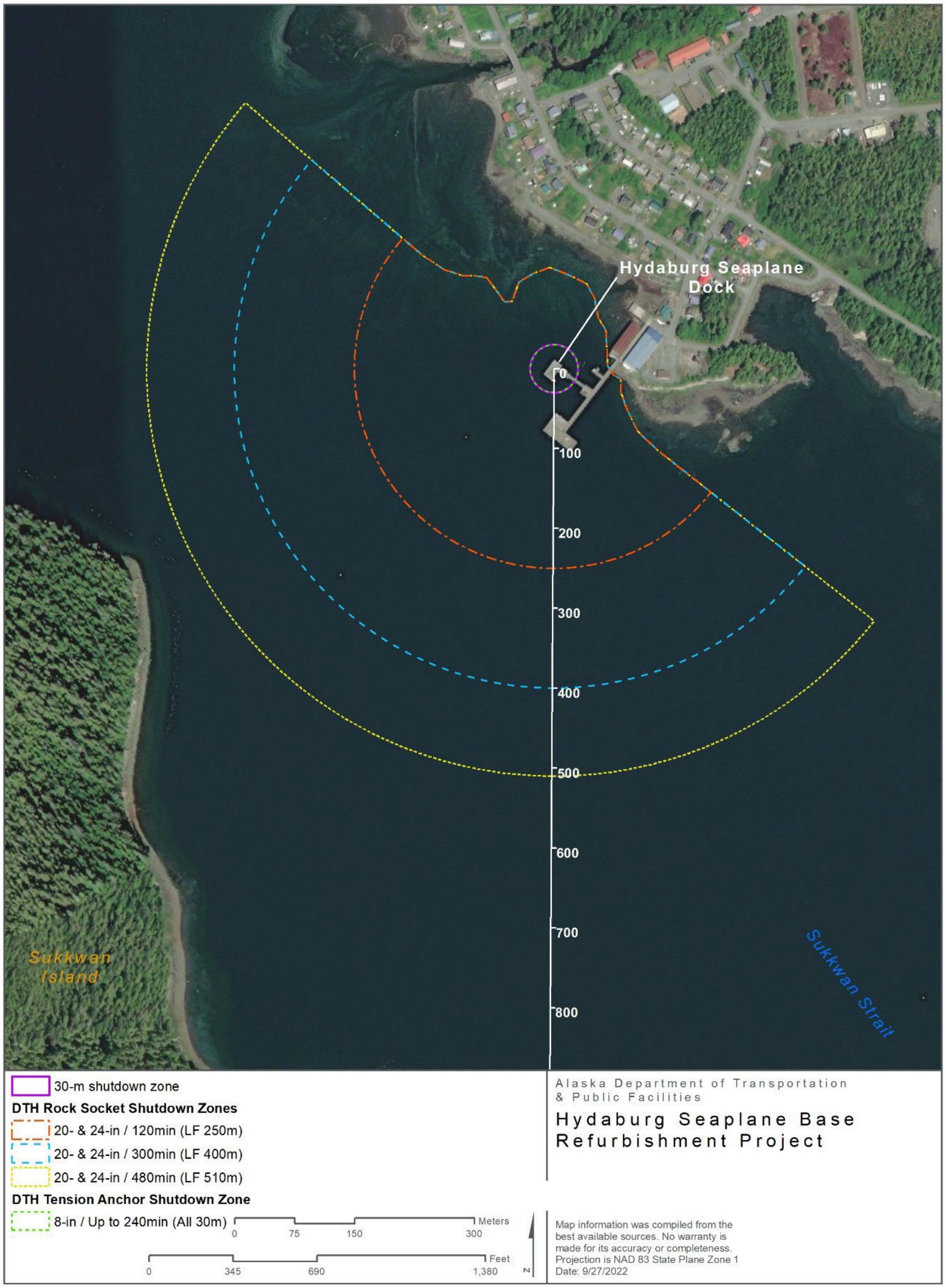

Figure 5. Shutdown Zones for DTH activities (HDR 2022)

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).

We use the following approach to determine whether the proposed action described in Section 2 of this opinion is likely to jeopardize listed or proposed 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 or proposed 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 or proposed 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*; expected impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.

- Analyze the effects of the proposed action. Identify the listed or proposed 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 or proposed 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 or proposed 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 or proposed 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 6. Although critical habitat has been designated for the Mexico DPS of humpback whale, there is no critical habitat for these populations in the action area. Therefore, this critical habitat is not considered further in this opinion.

Although the sunflower sea star is not currently listed under the ESA, NMFS has proposed listing the species as threatened. ADOT requested that we include a conference opinion under ESA section 7(a)(4), analyzing effects of the action on the sunflower sea star in case the species is listed prior to completion of the proposed action.

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

Species	Status	Listing	Critical Habitat
Humpback Whale, Mexico DPS *(Megaptera novaeangliae)*	Threatened	NMFS 2016, 81 FR 62260	NMFS 2021 86 FR 21082 None in the action area
Sunflower Sea Star *(Pycnopodia helianthoides)*	Proposed	N/A	N/A

4.1 Climate Change

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

https://www.ipcc.ch/reports/
https://climate.nasa.gov/evidence/
http://nsidc.org/arcticseaicenews/
https://arctic.noaa.gov/Report-Card

The listed and proposed species 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 listed and proposed species 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. 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. Finally, we provide an overview of how these physical changes translate to biological effects.

4.1.1 Physical Effects

4.1.1.1 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 (Watson and Albritton 2001; Oreskes 2004). The Intergovernmental Panel on Climate Change (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).

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[2] (Serreze and Barry 2011; Overland 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 6 years[3].

4.1.1.2 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 2000 m (6,561 ft) 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 6) (Thoman and Walsh 2019).

[1] NOAA National Centers for Environmental Information webpage. Assessing the global climate in 2019. Available from https://www.ncei.noaa.gov/news/global-climate-201912, accessed November 10, 2020.
[2] NASA wepbage. State of the Climate: How the World Warmed in 2019. Available at https://www.carbonbrief.org/state-of-the-climate-how-the-world-warmed-in-2019, accessed January 20, 2020.
[3] NOAA National Centers for Environmental Information webpage. Assessing the U.S. Climate in 2019. Available at https://www.ncei.noaa.gov/news/national-climate-201912, accessed November 10, 2020.

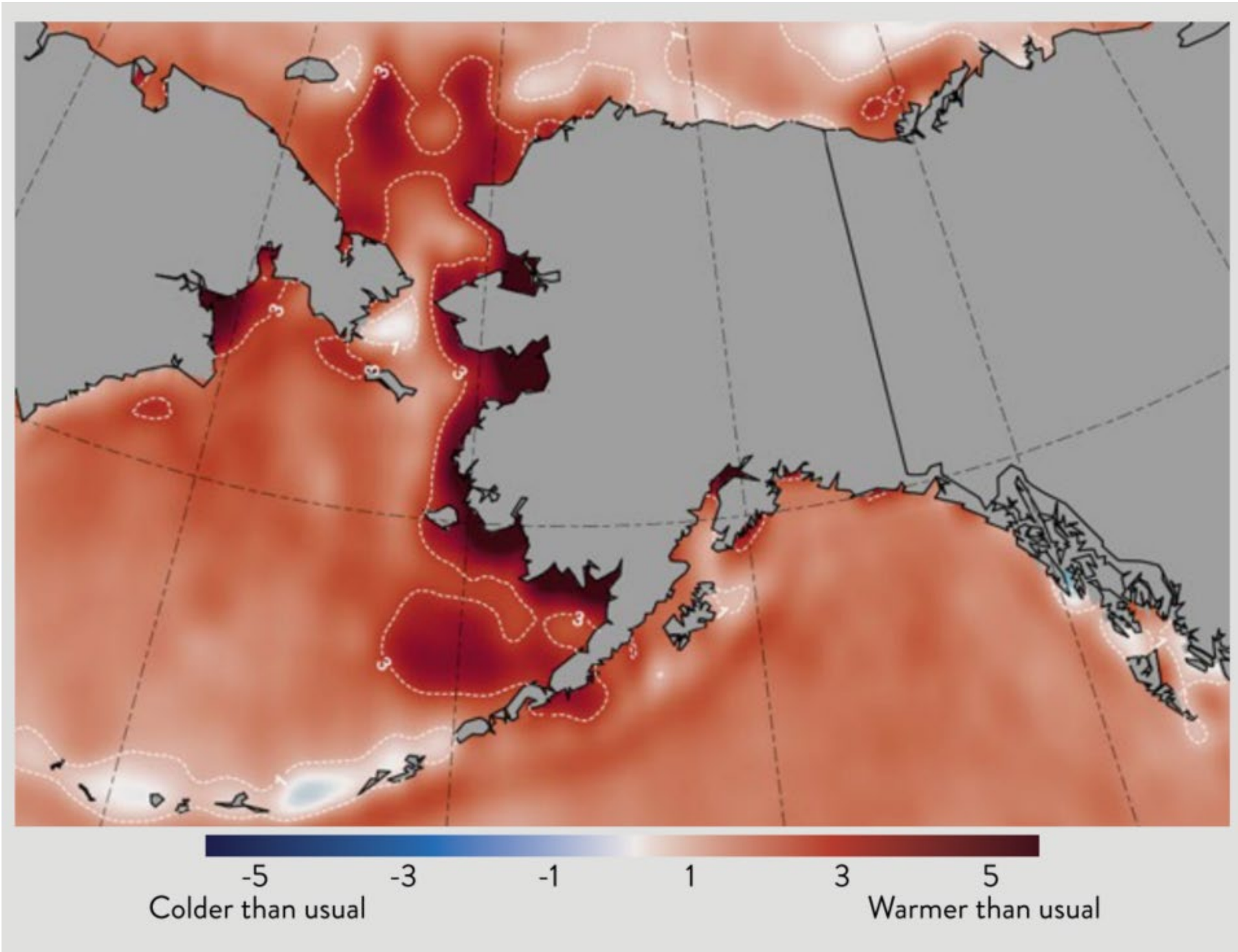

Figure 6. Arctic summer sea surface temperatures, 2019 (Thoman and Walsh 2019).

Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st 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 7). 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 7). 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[4].

Wang and Overland (2009) estimated that the Arctic will become essentially ice-free (i.e., sea ice

[4] National Snow and Ice Data Center. Monthly Archives: October 2019. Available at: http://nsidc.org/arcticseaicenews/2019/10/, accessed November 25, 2020.

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 5 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).

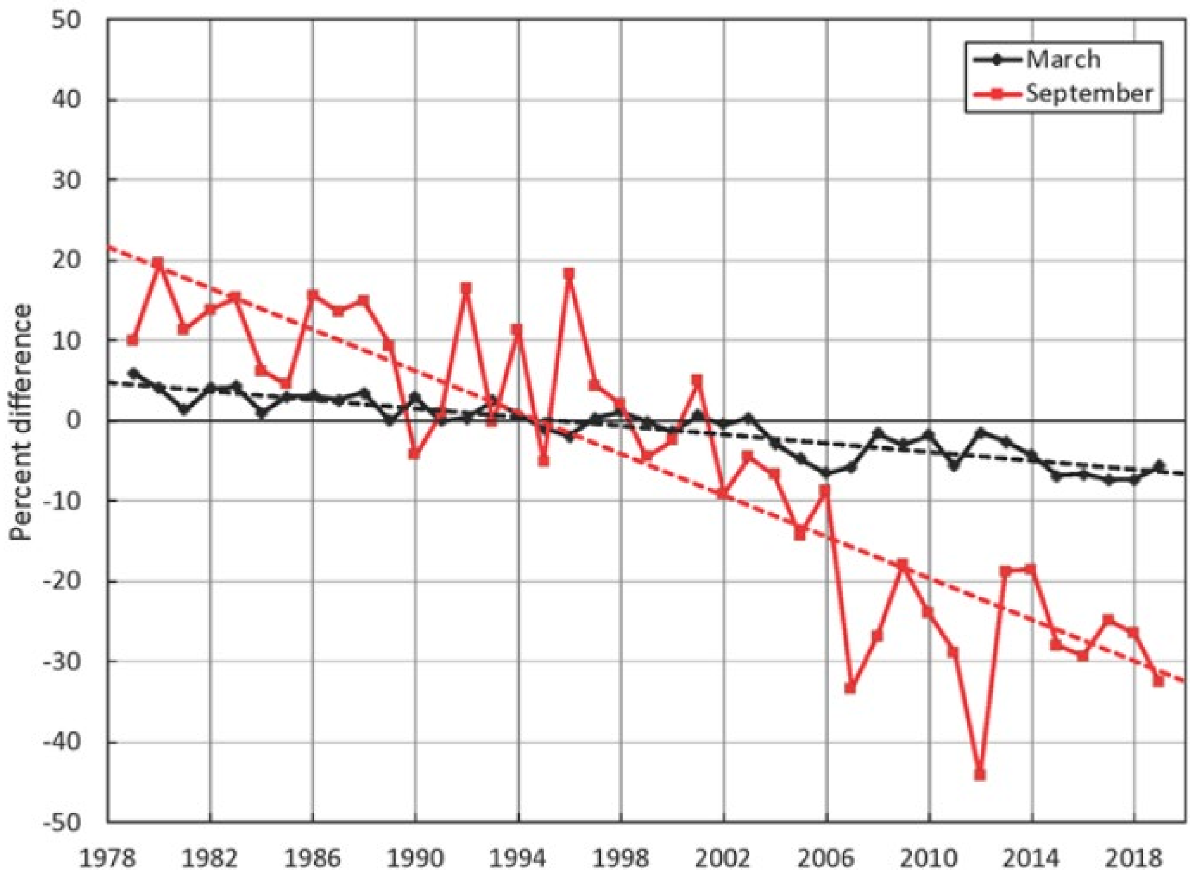

Figure 7. Arctic ice extent declines in September (red) and in March (black). The value for each year is the difference in percent in ice extent relative to the mean values for 1981-2010. Both trends are significant at the 99% confidence level. The slopes of the lines indicate losses of -2.7 for the maximum ice extent and -12.9 percent for the minimum ice extent, per decade.

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 3). 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 vs 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).

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. 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[5] 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).

[5] NOAA Fisheries, Alaska Fisheries Science Center website. Available at https://apps-afsc.fisheries.noaa.gov/REFM/stocks/Historic_Assess.htm, accessed December 2, 2020.

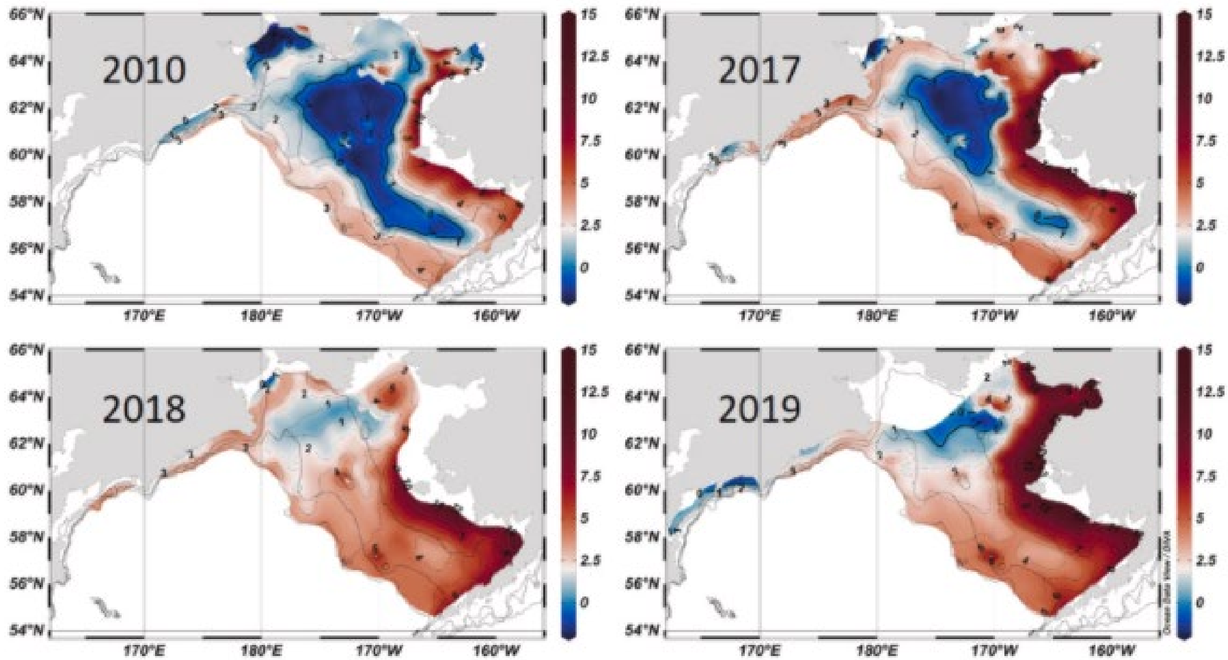

Figure 8. Bottom temperatures from summer oceanographic surveys. Graphic display of the shrinkage of the cold pool over time. From (Eisner et al. 2020).

4.1.1.3 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[6].

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).

[6] NOAA Global Monitoring Laboratory website. Trends in Atmospheric Carbon Dioxide. Available at https://www.esrl.noaa.gov/gmd/ccgg/trends/, accessed November 10, 2020.

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 conditions (Fabry et al. 2008; Lischka and Riebesell 2012)

4.1.2 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; Burek et al. 2008; Doney et al. 2012; Huntington et al. 2020). The physical effects on the environment described above have impacted, are impacting, and will continue to impact marine species in a variety of ways (IPCC 2014), such as:

- Shifting abundances
- Changes in distribution
- Changes in timing of migration
- Changes in periodic life cycles of species.
- Some of the biological consequences of the changing Arctic conditions are shown in Table 5.

Table 4. A summary of possible direct and indirect health effects for Arctic marine mammals related to climate change, adapted from (Burek et al. 2008)

Effect	Result
Direct	
Increase in ocean temperature	Changes in distribution and range (fish, whales) Increase in harmful algal blooms (all affected) Loss of suitable habitat Change in prey base
Loss of sea ice platform (seals)	Reduction of suitable habitat for feeding, resting, molting, breeding Movement, distribution, life history may be affected
Changes in weather	Reduction in snow on sea ice, loss of suitable lair habitat for ringed seals
Ocean acidification	Changes in prey base (all affected)
Indirect	
Changes in infectious disease transmission (changes in host–pathogen associations due to altered pathogen transmission or host resistance)	Increased host density due to reduced habitat, increasing density-dependent diseases. Epidemic disease due to host or vector range expansion. Increased survival of pathogens in the environment. Interactions between diseases, loss of body condition, and increased immunosuppressive contaminants, resulting in increased susceptibility to endemic or epidemic disease.

Effect	Result
Alterations in the predator–prey relationship	Affect body condition and, potentially, immune function.
Changes in toxicant pathways (harmful algal blooms, variation in long-range transport, biotransport, runoff, increased use of the Arctic)	Mortality events from biotoxins Toxic effects of contaminants on immune function, reproduction, skin, endocrine systems, etc.
Other negative anthropogenic impacts related to longer open water period	Increased likelihood of ship strikes, fisheries interactions, acoustic injury Chemical and pathogen pollution due to shipping or aquaculture practices. Introduction of nonnative 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).

4.2 Status of Listed Species 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. The opinion also examines the condition of critical habitat throughout the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

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. For designated critical habitat, we present a summary of the critical habitat designation, the geographical area of the designation, and any physical or biological features essential to the conservation of the species, as well as any relevant threats and management considerations. That is, we rely on the status of critical habitat and its function as a whole to determine whether an action's effects are likely to diminish the value of critical habitat as a whole for the conservation of listed species.

4.2.1 Mexico DPS Humpback Whales

Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the Northern Hemisphere and from tropical to near-ice-edge waters in the Southern Hemisphere. Additional information on humpback whale biology and natural history is available at:

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

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

4.2.1.1 Status and Population Structure

In 1970, the humpback whale was listed under the Endangered Species Conservation Act (ESCA) as endangered worldwide (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. Humpback whales are also considered "depleted" under the MMPA.

Following the cessation of commercial whaling, humpback whale numbers increased. NMFS conducted a global status review (Bettridge, Baker et al. 2015) and published a final rule recognizing 14 DPSs on September 8, 2016 (81 FR 62259). Four of these DPSs 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 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 Southeast Alaska summer feeding area are comprised of approximately 98 percent Hawaii DPS individuals and 2 percent Mexico DPS individuals.

4.2.1.2 Distribution

Relatively high densities of humpback whales occur throughout much of Southeast Alaska and northern British Columbia, particularly during the summer months. The abundance estimate for humpback whales in Southeast Alaska is estimated to be 5,890 (CV= 0.08) animals, which includes whales from the unlisted Hawaii DPS (98 percent) and threatened Mexico DPS (2 percent; Wade 2021).

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 summer 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 Bering Sea, and along the Aleutian Islands (Wild, Riley et al. 2023). 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).

Although migration timing varies among individuals, most whales depart for Hawaii or Mexico in fall or winter and begin returning to Southeast Alaska in spring, with continued returns through the summer and a peak occurrence in Southeast Alaska during late summer to early fall. However, there are significant overlaps in departures and returns (Baker, Herman et al. 1985, Straley 1990).

4.2.1.3 Presence in the Action Area

Relatively high densities of humpback whales occur throughout much of Southeast Alaska and northern British Columbia. Southeast Alaska was identified as a biologically important area (BIA) for seasonal feeding due to the high density of animals from March-November (Ferguson, Curtice et al. 2015). The second version of BIAs split the previous Southeast BIA with three seasonal occurrences into 10 BIAs and 2 Watch List areas, each with their own temporal delineation (Wild, Riley et al. 2023).

Project vessels deployed from Juneau and/or Seattle are expected to transit through multiple Southeast BIAs. (Figure 6).

No systematic studies have documented humpback whale abundance near Hydaburg. Figure 6 shows the Southeast Alaska BIAs, with Hydaburg located in the area with lowest data support (Wild, Riley et al. 2023). Anecdotal information from local residents suggests that humpback whales' utilization of the area is intermittent year-round. Their abundance, distribution, and occurrence are dependent on and fluctuate with fish prey. Local residents estimate that one to two humpback whales may be present in the Sukkwan Strait on a weekly basis. Elsewhere in Southeast Alaska, marine mammal monitoring for projects in Tongass Narrows, Ketchikan, Alaska, indicates that humpback whales are present in that area most regularly from May through October and may occur in lower numbers in winter (HDR 2022).

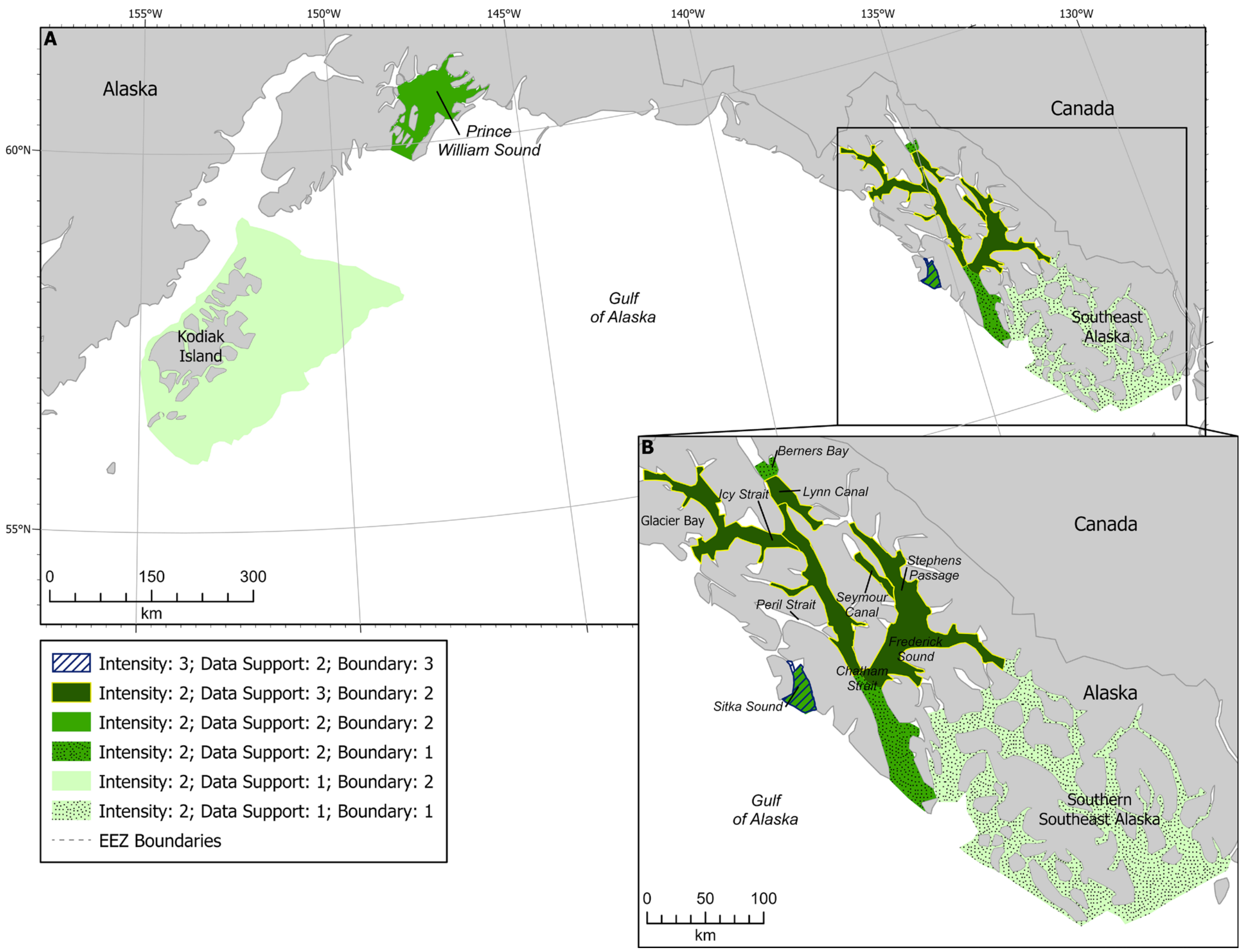

Figure 9. Humpback Whale Biologically Important Areas in the Gulf of Alaska and Southeast Alaska.

4.2.1.4 Foraging 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, Calambokidis et al. 2008, Simon, Johnson 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, DeMaster et al. 1999, Straley, Moran 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).

4.2.1.5 Reproduction

Humpbacks in the Northern Hemisphere give birth and presumably mate on low-latitude wintering grounds from January to March. Females attain sexual maturity at five years old 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, DeMaster et al. 1999).

4.2.1.6 Hearing, Vocalization, 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, Perkins et al. 1970, Thompson, Cummings et al. 1986). Source levels average 155 dB and range from 144 to 174 dB (Thompson, Winn 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, Cummings et al. 1986). These sounds are attractive and appear to rally animals to the feeding activity (D'Vincent, Nilson et al. 1985, Sharpe and Dill 1997).

4.2.1.7 Threats

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, Calambokidis 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, Quakenbush 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 whale and was ultimately responsible for humpback whales being listed as an endangered species. In 1965, the International Whaling Commission banned commercial hunting of humpback whales in the Pacific Ocean, and, as a result, this threat has largely been curtailed. No commercial whaling occurs within the range of Mexico DPS humpbacks, and Alaskan subsistence hunters are not authorized to take humpback whales.

Vessel strike is one of the main threats and sources of harmful anthropogenic impacts to humpback whales in Alaska. Neilson, Gabriele et al. (2012) summarized 108 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, Young et al. 2022). Most ship strikes of humpback whales are reported in Southeast Alaska (Helker, Muto et al. 2019), where high vessel traffic overlaps with whale presence.

Commercial fisheries pose a threat to marine mammal stocks. Reductions in seasonal availability and distribution of fish can cause cumulative effects on many species that depend on reliable sources of prey for survival.

Fishing gear entanglement is a major 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. Bettridge, Baker 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; however, the frequency of these interactions does not appear to have a significant adverse consequence for humpback whale populations. Most entanglements occur between early June and early September, when humpbacks are foraging in nearshore Alaska waters. A photographic study of humpback whales in southeastern Alaska found at least 53 percent of individuals showed some kind of scarring from fishing gear entanglement (Neilson, Gabriele et al. 2005). 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, Young et al. 2022).

Aquaculture operations may pose an entanglement risk to humpback whales (Price, Keane et al. 2017). Humpback whales in Southeast Alaska have been observed feeding around and near salmon aquaculture facilities (Chenoweth, Straley et al. 2017). In June 2018, NMFS received a report of a humpback whale damaging a floating salmon net pen near Ketchikan. The encounter did not result in an entanglement, but illustrates the potential for interactions. The aquaculture industry is growing in Alaska, increasing the potential for marine mammal entanglements.

4.2.2 Sunflower Sea Stars

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

4.2.2.1 Population Structure and Status

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

Recent counts in some areas of Alaska showed a big increase in 2022 (Heather Coletti, Dan Esler et al. 2023).

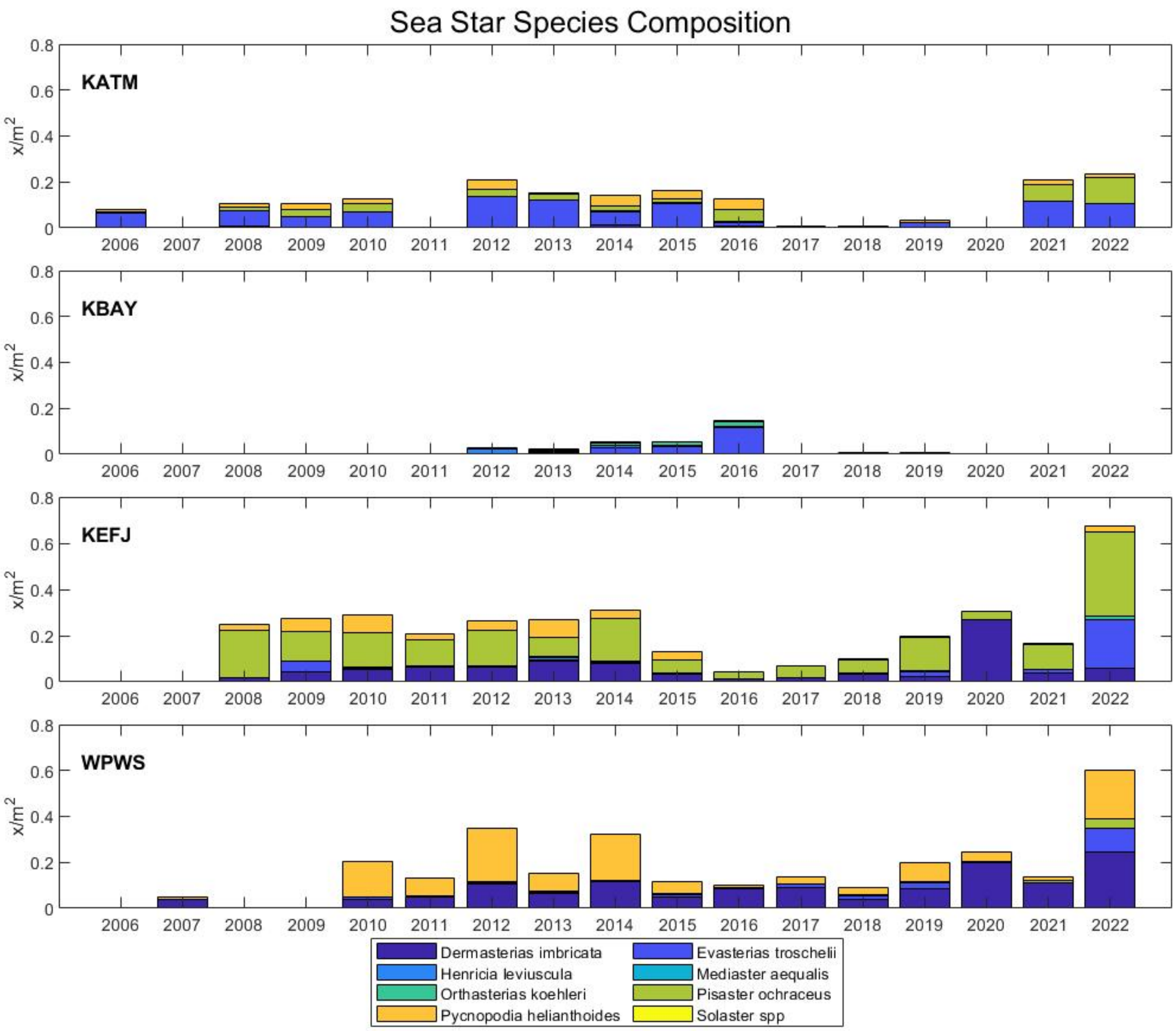

Figure 10. Sea Star densities in Katmai (KATM), Kachemak Bay (KBAY), Kenai Fjords (KEFJ), and western Prince William Sound (WPWS) from 2006-2022. Sunflower sea stars *(P. helianthoides)* shown in orange (Heather Coletti, Dan Esler et al. 2023).

4.2.2.2 Distribution and Habitat Use

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

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

4.2.2.3 Threats to the Species

Brief descriptions of threats to sunflower sea stars follow. More detailed information can be found in the draft ESA Status Review report for the species (Lowry, Wright et al. 2022)

Sea Star Wasting Syndrome (SSWS)

Sea star wasting syndrome is the primary threat identified to the sunflower sea star in the proposed threatened listing rule (50 CFR 16212). Beginning in 2013, SSWS caused ~72-100percent declines in locally monitored populations of *P. helianthoides* across its range. The global *P. helianthoides* population declined by an estimated 90.6percent due to SSWS (Gravem, Heady et al. 2021, Lowry 2022). Recent laboratory studies suggest that *P. helianthoides* die as quickly as 2-4 days after exposure to SSWS (A. Gehman, pers. comm.).

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

Bycatch/Overexploitation

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

Pollution/Discharge

The Status Review Team was concerned about the impacts that pollutants and contaminants might have on the ecosystems upon which *P. helianthoides* depend, in particular the food that they eat (Lowry 2022). Pollutants could potentially weaken the microbiome or immune response of the sunflower sea star, leading to mortality (Aquino, Besemer et al. 2021, McCracken, Christensen et al. 2023).

Coastal Development

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

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 expected 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).

This section discusses the environmental baseline, focusing on existing anthropogenic and natural activities within and near the action area and their influences on listed species may be adversely affected by the proposed action. Species that may be affected by the proposed action include Mexico DPS humpback whales. Although some of the activities discussed below are outside the action area, they may still have an influence on listed species or their habitat in the action area.

5.1 Climate Change

Hydaburg is located along the Sukkwan Strait on the southwest side of Prince of Wales Island. A series of passes and straits leads to the open Pacific Ocean; however, Hydaburg is tucked in a relatively calm and secluded area. Sukkwan Strait is generally characterized by semidiurnal tides with mean tidal ranges of around 5 meters (16 feet). Freshwater inputs to Sukkwan Strait include multiple anadromous streams: Hydaburg River, Saltery Creek, and two streams originating from unnamed lakes. The bathymetry of the bay is variable depending on location and proximity to shore, islands, or rocks. Depths approach approximately 76 meters (250 feet) within Sukkwan Strait and up to 37 meters (120 feet) in South Pass.

All areas of the action area are being affected by climate change. Although the species living in the Arctic successfully adapted to changes in the climate in the past, the current rate of change is accelerated (Simmonds and Eliott. 2009). As described in Section 4.1, effects to Arctic ecosystems are very pronounced, wide-spread, and well documented. While a changing climate may create opportunities for range expansion for some species, the life cycles and physiological requirements of many specialized polar species are closely linked to the annual cycles of sea ice and photoperiod and they may be less adaptable (Doney, Fabry et al. 2009, Wassmann, Duarte et al. 2011). Because the rate of change is occurring so quickly, the changes may exceed species' ability to adapt.

Indirect threats associated with climate change include increased human activity as a result of regional warming. 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.

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, but the impact on recruitment of important prey of humpback whales is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years, but the distribution and recruitment of other fish (e.g., osmerids) could be negatively affected (NMFS 2008).

5.2 Natural Catastrophic Changes

Humpback whales inhabit regions of known seismic and volcanic activity and tsunami events. Earthquakes, volcanic eruptions, landslides, and tsunamis can alter the physical environment instantaneously. Catastrophic events are infrequent but have the potential to impact marine mammals by: decreasing prey abundance as a result of direct mortality; rendering habitat unsuitable (or more suitable) for marine mammals and prey species; directly removing (or creating) habitat; and, degrading habitat quality (e.g., volcanic ash outfall could affect siltation and water chemistry; NMFS 2016).

5.3 Biotoxins

As temperatures in the Arctic waters warm and sea ice diminishes, marine mammal health may be compromised through nutritional and physiological stress, toxins from harmful algal blooms, and exposure to new pathogens. An unprecedented harmful algal bloom extended from the Aleutian Islands to southern California as a result of the Pacific marine heatwave causing mass strandings of marine mammals (Cavole, Demko et al. 2016). Fey, Siepielski et al. (2015) found that across all animal taxa biotoxicity from harmful algal blooms was one of the events most often associated with mass mortality events. Two of the most common biotoxins along the West Coast of the Pacific are the neurotoxins domoic acid and saxitoxin (Lefebvre, Quakenbush et al. 2016). Although these toxins can cause death, they can also cause sublethal effects including reproductive failure and chronic neurological disease (Broadwater, Van Dolah et al. 2018).

Domoic acid was first recognized as a threat to marine mammal health in 1998 when hundreds of California sea lions (*Zalophus californianus*) died along beaches in central California or exhibited signs of neuroexcitotoxicity including seizures, head weaving, and ataxia (Scholin, Gulland et al. 2000). Along the west coast of the United States and Canada, a coastwide bloom of the toxigenic diatom *Pseudo-nitzschia* in spring 2015 resulted in the largest recorded outbreak of domoic acid. Record-breaking concentrations of the marine neurotoxin caused unprecedented widespread closures of commercial and recreational shellfish and finfish fisheries and contributed to the stranding of numerous marine mammals along the U.S. west coast (McCabe, Hickey et al. 2016).

Lefebvre, Quakenbush et al. (2016) examined 13 species of marine mammals from Alaska including humpback whales, bowhead whales, beluga whales, harbor porpoises, northern fur seals, Steller sea lions, harbor seals, ringed seals, bearded seals, spotted seals, ribbon seals, Pacific walruses, and northern sea otters (Figure 20). Domoic acid was detected in all 13 species examined and had the greatest prevalence in bowhead whales (68percent) and harbor seals (67percent). Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales (50percent) and bowhead whales (32percent) and 5percent of the animals tested had both toxins present (Lefebvre, Quakenbush et al. 2016). It is not known if exposure to multiple toxins result in additive or synergistic effects or perhaps suppress immunity to make animals more vulnerable to secondary stressors (Broadwater, Van Dolah et al. 2018).

Figure 11. Algal toxins detected in 13 species of marine mammals from southeast Alaska to the Arctic from 2004 to 2013 (Lefebvre, Quakenbush et al. 2016).

5.4 Vessel Traffic

Hydaburg is the largest Haida village in Alaska, and has a city owned dock and small boat harbor. Many residents maintain a subsistence and commercial fishing lifestyle. The action area experiences moderate levels of commercial fishing vessels and recreational marine vessel traffic during the summer season.

Ongoing vessel activities near Hydaburg, as well as land-based industrial and commercial activities, result in elevated in-air and underwater acoustic conditions in the action area. Background sound levels likely vary seasonally, with elevated levels during summer when the commercial and fishing industries are at their peaks. Hydaburg has no cruise ship or ferry facilities, so only commercial and fishing vessels visit Hydaburg regularly (HDR 2022).

Ship strikes can cause major wounds or death 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, Gabriele 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, Gabriele 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, Helker et al. 2020), and 18 humpbacks were reported struck by vessels between 2016 and 2020 (Freed, Young et al. 2022) in Alaskan waters.

Vessel traffic in the action area- and the surrounding area- poses varying levels of threat to humpback whales, depending on the type and intensity of the vessel activity and its degree of spatial and temporal overlap with habitats. The presence, movements, and sound of ships in the vicinity of humpback whales may cause them to abandon foraging areas.

5.5 Fisheries

Commercial, recreational, and subsistence fishing occurs in the Southeast Alaska region. Subsistence fisheries include salmon, halibut, herring spawn-on-kelp, shellfish, and groundfish. Eulachon, Dolly Varden, trout, and smelt are also taken for subsistence purposes. Sport fishers have year-round opportunities to catch all five species of Pacific salmon, halibut, lingcod, and rockfish; sockeye salmon in particular is an important subsistence species for Hydaburg residents. Salmon, herring, groundfish, and shellfish species are all commercially fished in the area.

The Haida Wild Alaska Seafood Plant was built in 2017 to prioritize economic development in Hydaburg and provide support services for local and visiting fishermen.

The NMFS Alaska Marine Mammal Stranding Network database has records of 224 large whale entanglements between 2000 and 2020.[7] Of these, 64 percent were humpback whales from Southeast Alaska. Most of these whales were entangled with gear between the beginning of June and the beginning of September, when they were on their nearshore foraging grounds in Alaska waters. Between 2000 and 2020, 20 percent of humpback entanglements in Southeast Alaska were with pot gear, 30 percent with gillnet gear, and less than 1 percent were associated with longline gear. Humpback whales have been reported as entangled in the action area or near the action area in recent years, including two near Ketchikan in 2011 and one near Gravina Island in 2019.

5.6 Pollution

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

Marine water quality in the action area can be affected by discharges from treated sewer system outflows, vessels operating in marine waters, and sediment runoff from paved surfaces and disturbed areas. Large fuel spills are also possible from large vessel groundings or barges transporting fuel.

5.7 Coastal Zone Development

Coastal zone development results in some loss and alteration of nearshore marine species habitat and changes in habitat quality. Increased development may prevent marine mammals from reaching or using important feeding, breeding, and resting areas. The project action area is adjacent to a previously industrialized area. The shoreline immediately adjacent to the project site has been previously disturbed and developed. The seaplane base is a currently existing facility that is proposed to be refurbished during this project.

5.8 Stressors on Sunflower Sea Stars

SSWS is the primary threat and stressor to sunflower sea stars across their range. SSWS is thought to be exacerbated by warming ocean temperatures and other climate change related characteristics. Other potential stressors in the action area include pollution, bycatch/overexploitation, and coastal development activities.

5.8.1 Sea Star Wasting Syndrome

A SSWS pandemic occurred across the range of the sunflower sea star from 2013-2017. SSWS is known to occur in sunflower sea stars and other species at smaller geographic and temporal scales, and is expected to occur in the future. But the magnitude of future outbreaks is unknown. The pathogen that caused the 2013-2017 is unknown. As stated above, the draft 2022 Status

[7] NMFS Alaska Marine Mammal Stranding Network database, accessed November 5, 2020.

Review Report for this species identified SSWS as the factor of greatest concern for the species throughout its range, including in the action area.

5.8.2 Climate Change

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

5.8.3 Pollution

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

5.8.4 Bycatch/Overexploitation

Sunflower sea stars are caught as bycatch in pot gear in the action area. Most of these are likely returned to the marine environment without serious injury. Handling stress in sea stars is not well understood, but is not likely to be significantly impacting the species in the action area. We note that the Alaska Sealife Center successfully keeps sunflower sea stars in their touch tank exhibit. Some sunflower sea stars may be collected by the public, but these numbers are expected to be small and may not result in significant stress if the animals are quickly returned to the marine environment.

5.9 Prior Section 7 Consultations

There have been no recent formal Section 7 consultations conducted for projects in the Hydaburg area. Since 2017, two informal Section 7 consultations have occurred in or near the HSF project area (Table 4), with one being a consultation for repair activities at HSF. The most common stressor among these consultations was acoustic disturbance.

Table 5. Recent informal Section 7 consultations near the Hydaburg Seaplane Facility.

Title	ID
M7 Hiilangaay Hydroelectric Dock	AKRO-2019-00029
Sukkwan Strait Seaplane Facility Repair	AKRO-2021-02066

The records are linked in the Environmental Consultation Organizer (ECO) at https://appscloud.fisheries.noaa.gov/suite/sites/eco/page/home

5.10 Environmental Baseline Summary

Several of the activities described in the Environmental Baseline have adversely affected listed species that occur in the action area:

- There are insufficient data to make reliable estimations of the impact of climate change on marine mammals considered in this opinion. Although the effects of climate change and other large-scale environmental phenomena on humpback whales 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.
- Vessel traffic in the action area poses varying levels of threat to listed marine mammals, depending on the type and intensity of the activity and its degree of spatial and temporal overlap with marine mammals. The presence, movements, and sound of ships in the vicinity of some species may cause them to abandon foraging areas.
- Commercial fisheries may have reduced prey availability for humpback whales.
- Humpback whales have been impacted by entanglement.
- The proposed project is in an area of moderate human use and some existing habitat alteration for both the sunflower sea star and prey species for the humpback whale.
- Some sunflower sea stars are caught as bycatch in commercial fishing gear and are thought to be typically released unharmed.
- SSWS dramatically decreased the numbers of sunflower sea stars throughout its range, including in the action area, where they are thought to have declined by <60percent?>.
- Climate change is thought to have exacerbated SSWS, which was the cause of a range wide die-off of sunflower sea stars.

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 gives the benefit of the doubt to the listed species by minimizing the likelihood of false negative conclusions (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 and designated critical habitat.

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 Biological Assessment; the IHA application; the proposed notice for issuing the IHA; personal communications with PR1, the non-federal designee, and others; and other available literature as referenced in this opinion, our analysis recognizes that the HSF project may cause these primary stressors:

1. in-water sound fields produced by impulsive and non-impulsive noise sources related to pile driving activities including vibratory pile driving, impact pile driving, and down-the-hole drilling;
2. vessel strike and disturbance;
3. disturbance to prey and/or habitat including seafloor disturbance from pile driving activities and placement of equipment or anchors, turbidity and sedimentation; and
4. pollution from unauthorized spills.

6.1.1 Minor Stressors on ESA-Listed or Proposed Species and Critical Habitat

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 humpback whales or the proposed sunflower sea stars.

6.1.1.1 Vessel strike

As discussed in the Environmental Baseline section, Sukkwan Strait and the surrounding area experiences moderate levels of vessel traffic year-round, with a seasonal summer increase. Vessel traffic is primarily from commercial fishing vessels, recreational vessels, barges, and freight vessels.

There may be a temporary, localized, and small increase in vessel traffic during construction. The contractor is expected to mobilize two barges: one with a crane mounted on it and a staging/work barge that will be moved into place with a tugboat. Additional barges and tugs may be used to deliver equipment as needed. The number of vessels and trips required will be limited to reduce costs and limit potential impacts on marine mammals. All vessels associated with the project will follow well-established, frequently used navigation lanes throughout Southeast Alaska and within the action area. Within the action area, project-related vessels will not exceed 10 knots and will typically be travelling at less than 5 knots as they navigate the constrained area of Sukkwan Strait and the areas adjacent to Hydaburg.

The possibility of vessel strike associated with the proposed action is extremely unlikely. Between 2014 and 2018 the minimum mean annual mortality and serious injury rate due to ship strikes reported in Alaska for humpback whales was 2.6 whales (Muto et al. 2021). These incidents account for a very small fraction of the total humpback whale population (Laist, Knowlton et al. 2001).

Vessel operations for construction occur at relatively low speed limits (5 knots). Once vessels get to the construction site, they will be moving very slowly for very short distances. Due to the common presence of commercial and recreational vessels in the action area and the relatively small number of vessel transits during the duration of the project, the use of slow-moving tugboats and barges and skiff transits associated with construction of the project is not expected to measurably affect humpback whales or sunflower sea stars.

Vessel strike conclusion

Vessel disturbance or strikes of Mexico DPS humpback whales are not expected as a result of the proposed action because: 1) vessel traffic associated with the project is minimal; 2) relatively few humpback whales use Sukkwan Strait; 3) only 2 percent of humpback whales that occur in the area are from the listed Mexico DPS; 4) all vessels, including vessels used in construction of the HSF, are limited to a speed of 10 knots or less; and 5) vessels must adhere to the Alaska Humpback Whale Approach Regulations when transiting to and from the project site (see 50 CFR §§ 216.18, 223.214 and 224.103(b)) that prohibit approaching within 100 yards of humpback whales. All of these factors limit the risk of strike; therefore, we conclude that a strike between a project vessel and a listed humpback whale is extremely unlikely to occur.

6.1.1.2 Vessel noise

Project vessels are likely to generate underwater sound levels exceeding the non-impulsive 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 145–170 dB rms, and will drop to a received level of 120 dB within 2,154 meters (or less) of the source (Richardson, Greene Jr et al. 1995, Blackwell and Greene 2003, Ireland and Bisson 2016).

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 humpback whales. In addition, because vessels will be in transit, 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 provide a gradual and prolonged onset of vessel sound before the received sound level exceeds 120 dB Furthermore, vessel noise associated with construction will be minimal because most work will be conducted from anchored barges and work platforms. Propeller cavitation, the predominant contributor to vessel underwater sound, is unlikely to occur when vessels are anchored.

A startle response to vessels that are underway 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, Bain 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, Carson et al. 1994). 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, Bisi et al. 2007).

Marine mammals that frequent the project area are very likely habituated to vessel disturbance due to the common presence of ferries, cruise ships, fishing vessels, barges, tugboats, and other commercial and recreational vessels that use the harbor. If animals do respond to project vessel noise, they may exhibit slight deflection from the source, engage in low-level avoidance behavior, or short-term vigilance behavior; however, these behaviors are not likely to result in adverse consequences for the animals. The nature and duration of response is not expected to disrupt to a measurable degree important behavioral patterns such as feeding or resting.

In summary, some marine mammals 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 marine mammals from vessel noise will be temporary and the effects to humpback whales and sunflower sea stars from vessel noise will be extremely small.

6.1.1.3 Disturbance to seafloor, habitat and/or prey resources related to marine mammals and sunflower sea stars

The proposed action will have temporary impacts on water quality (increases in turbidity levels) and on prey species distribution. Pile driving may cause temporary and localized turbidity through sediment disturbance. Turbidity plumes during pile installation and removal will be localized around the pile. Due to temporary, localized, and low levels of turbidity increases, it is not expected that turbidity would result in immediate or long-term effects to the Mexico DPS humpback whale, sunflower sea stars, or their prey.

Construction activities will produce non-impulsive (i.e., vibratory pile removal and DTH) and impulsive (i.e., impact driving and DTH) 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 pile driving on fish, although several are based on studies related to large, multiyear bridge construction projects (e.g., Scholik and Yan 2001, Scholik and Yan 2002, Popper and Hastings 2009). Impulsive sounds at received levels of 160 dB may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson, Skalski et al. 1992, Skalski, Pearson et al. 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality, typically due to near-field particle motion rather than sound waves.

The most likely impact to fish from pile driving and drilling activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving 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 pile driving within the action area relative to known feeding areas for humpback whales. In general, we expect fish will be capable of moving away from project activities to avoid exposure to noise. We expect the area in which stress, injury, TTS, or changes in balance of prey species may occur will be limited to a few meters directly around the pile driving and drilling operations. We consider potential adverse impacts to prey resources from pile-driving and drilling 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, Sze et al. 1996, Wiese 1996); however, any effects of pile driving and drilling 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, Day 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 insignificant as compared to the naturally occurring reproductive and mortality rates of these species.

Construction activities will temporarily increase in-water noise and may adversely affect prey in the action area. Adverse effects on prey species populations during project construction will be short-term, based on the short duration of the project. After pile driving activities are completed, habitat use and function are expected to return to similar pre-construction levels and fish are expected to repopulate the area.

An Erosion and Sediment Control Plan, and other best management practices will be implemented during construction to prevent contaminants from entering the marine environment. Construction will be conducted in accordance with Clean Water Act Sections 404 and 401 regulations to minimize potential construction-related impacts on water quality. As stated in Section 4.2.2.2, sunflower sea stars occur in a wide range of intertidal and subtidal habitats from northern Baja California, Mexico to the central Aleutian Islands, Alaska. Any impacts to sunflower sea star habitat are expected to be limited and temporary.

Given the numbers of fish and other prey species in the vicinity, the short-term nature of effects on fish species, and the mitigation measures to protect fish and marine mammals during construction, the proposed action is not expected to have measurable effects on the distribution or abundance of potential marine mammal prey species. Any behavioral avoidance by fish of the disturbed area would still leave sufficiently large areas of fish and marine mammal foraging habitat outside Sukkwan Strait.

The surrounding area is not a significant foraging ground for humpback whales. There are no known aggregations of forage fish important to humpback whales in the project vicinity that will be impacted by the action. Implementation of the mitigation measures described in Section 2.2 of this opinion will avoid or minimize effects to prey resources. In summary, the effects of disturbance to the seafloor, habitat, and prey resources resulting from the HSF project activities are expected to have a negligible impact on Mexico DPS humpback whales or sunflower sea stars.

6.1.1.4 Pollution

While there is potential for an oil or pollutant spill from activities associated with the project, 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.

Construction 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 humpback whales will be immeasurably small. Therefore, we conclude that the effects from this stressor on humpback whales and sunflower sea stars are immeasurably small.

6.1.1.5 Other Minor Stressors on Sunflower Sea Stars

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

Activities impacting the benthic environment due to pile driving and removal may interact with sunflower sea stars on the sea floor or on the pilings that will be removed. Pilings could potentially come in contact with sea stars, or sunflower sea stars could be brought to the surface on pilings when they are removed from the water.

These activities have the potential to directly impact (e.g., harm, wound, kill, collect) sunflower sea stars, but pile installation activities are highly unlikely in impact sea stars, and the impact associated with transferring sea stars during pile removal is negligible.

The best available information indicates that sunflower sea stars are not sensitive to underwater sounds, and we therefore do not expect this stressor to affect them.

6.1.2 Major Stressors on Humpback Whales

Underwater noise from pile driving activities is likely to adversely affect Mexico DPS humpback whales. This stressor will be analyzed further in the *Exposure Analysis* and *Response Analysis.*

6.1.2.1 Description of Sound Sources

The marine soundscape is comprised of both ambient (naturally-produced) and anthropogenic sounds. The sound level of an area is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (e.g., waves, wind, precipitation, earthquakes, ice, atmospheric sound), biological (e.g., sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (e.g., vessels, dredging, aircraft, construction).

Natural sound sources at any given location and time comprise "ambient" sound, while the sum of ambient sounds and typical anthropogenic sound comprises the "background" sound. Received levels of ambient and background sound depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Ambient sound levels at a given frequency and location can vary by 10-20 dB (over three-fold) from day to day (Richardson, Greene Jr et al. 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could adversely affect marine mammals.

In-water construction activities associated with the project include vibratory pile removal and installation, impact pile driving, and DTH pile installation. The sounds produced by these activities fall into one of two general sound types: impulsive and non-impulsive. Impulsive sounds (e.g., explosions, gunshots, sonic booms, impact pile driving) are typically transient, brief (less than one second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI (American National Standards Institute) 1986, NIOSH (National Institute for Occupational Safety and Health) 1998, ANSI (American National Standards Institute) 2005, NMFS 2018). Non-impulsive sounds (e.g., aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems) can be broadband, narrowband or tonal, brief or prolonged (non-impulsive or intermittent), and typically do not have the high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995, NIOSH (National Institute for Occupational Safety and Health) 1998, NMFS 2018). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g., Ward 1997 in Southall et al. 2007).

Impact hammers operate by repeatedly dropping a heavy piston onto a pile to drive the pile into the substrate. Sound generated by impact hammers is characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper 2005). Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push them into the sediment. Vibratory hammers produce significantly less sound than impact hammers. Peak sound pressure levels (SPLs) may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Oestman, Buehler et al. 2009). Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (Nedwell and Edwards 2002, Carlson, Woodruff et al. 2005).

A DTH hammer drill is used to place hollow steel piles or casings by drilling. A DTH hammer drill is a drill bit that drills through the bedrock using a pulse mechanism that functions at the bottom of the hole. This pulsing bit breaks up rock to allow removal of debris and insertion of the pile. The head extends so that the drilling takes place below the pile. The pulsing sounds produced by DTH hammer drills were previously thought to be non-impulsive. However, recent sound source verification (SSV) monitoring has shown that DTH hammer drill can create sound that can be considered impulsive (Denes, Vallarta et al. 2019). Therefore, NMFS characterizes sound from DTH pile installation as being impulsive when evaluating potential Level A harassment (i.e., injury) impacts and as being non-impulsive when assessing potential Level B harassment (i.e., behavior) effects.

6.1.2.2 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 behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels,[8] expressed in root mean square[9] (rms), from broadband sounds that cause behavioral disturbance, 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, 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 5.

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[8] 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.

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

Table 6. Underwater marine mammal hearing groups.

Hearing Group	ESA-listed Marine Mammals In the Project Area	Generalized Hearing Range[1]
Low-frequency (LF) cetaceans *(Baleen whales)*	humpback whales	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans *(dolphins, toothed whales, beaked whales)*	None	150 Hz to 160 kHz
High-frequency (HF) cetaceans *(true porpoises)*	None	275 Hz to 160 kHz
Phocid pinnipeds (PW) *(true seals)*	None	50 Hz to 86 kHz
Otariid pinnipeds (OW) *(sea lions and fur seals)*	None	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).

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.

Level A harassment radii can be calculated using the optional user spreadsheet[10] associated with NMFS Acoustic Guidance, or through modeling.

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

Table 7. PTS Onset Acoustic Thresholds for Level A Harassment.

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
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.

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 constitutes an incidental "take" under the ESA and must be authorized by the ITS (Section 10 of this opinion) (except that take is not prohibited for species proposed for listing under the ESA, or for threatened species that do not have ESA section 4(d) regulations).

As described in Section 6.2, we expect that exposures to humpback whales from noise associated with the proposed action may result in disturbance (Level B harassment). No serious injury or mortalities are expected as a result of this project.

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 estimate the number of individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent.

As discussed in Section 2.1.2 above, ADOT proposed mitigation measures that should avoid or minimize exposure of Mexico DPS humpback whales and sunflower sea stars to one or more stressors from the proposed action.

6.2.1 Exposure to noise from pile driving activities

NMFS expects that humpback whales will be exposed to underwater noise from pile driving activities (including vibratory pile removal, impact and vibratory pile driving, and DTH). Possible responses by Mexico DPS humpback whales to the sound produced by pile driving activities include:

- Physical Responses
  - Temporary or permanent hearing impairment (threshold shifts)
  - Non-auditory physiological effects
- Behavioral responses

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

6.2.1.1 Distances to Level A and Level B sound thresholds

Here, we describe operational and environmental parameters of the activity that are used in estimating the area ensonified above the acoustic thresholds, including source levels and the transmission loss coefficient.

The sound field in the project area is the existing background noise plus additional construction noise from the proposed project. Marine mammals are expected to be affected via sound generated by the primary components of the project (*i.e.,* impact pile driving, vibratory pile driving and removal, and DTH).

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles (material and diameter), hammer type, and the physical environment (*e.g.*, sediment type) in which the activity takes place.

Table 8. Summary of In-Water Pile Driving Proxy Levels (10 m).

Pile Type	Installation Method	Peak SPL (dB re 1 µPa)	RMS SPL (dB re 1 µPa)	SEL_{ss} (dB re 1 μPa^2 sec)	Reference (levels)
16-inch steel piles	Vibratory hammer	NA	158	NA	CALTRANS (2020)
20-inch steel piles	Vibratory hammer	NA	161	NA	Navy (2015)
24-inch steel piles	Vibratory hammer	NA	161	NA	Navy (2015)
20-inch steel piles	Impact hammer	208	187	176	CALTRANS (2020)
24-inch steel piles	Impact hammer	208	193	178	CALTRANS (2020)
8-inch tension anchors	DTH system	170	156	144	Reyff and Heyvaert (2019); Reyff (2020)
20-inch rock sockets	DTH system	184	167	159	Heyvaert and Reyff (2021)
24-inch rock sockets	DTH system	184	167	159	Heyvaert and Reyff (2021)

Pile Type	Installation Method	Peak SPL (dB re 1 µPa)	RMS SPL (dB re 1 µPa)	SEL_{ss} (dB re 1 µPa ^{2} sec)	Reference (levels)
Notes: NMFS conservatively assumes that noise levels during vibratory pile removal are the same as those during installation for the same type and size pile; all SPLs are unattenuated and represent the SPL referenced at a distance of 10 m from the source; NA = Not applicable; dB re 1 µPa = decibels (dB) referenced to a pressure of 1 micropascal					

All Level B harassment isopleths are reported in Table 7 considering RMS SPLs and the default TL coefficient for practical spreading loss (*i.e.*, 15*Log10(range)). Land forms (including causeways, breakwaters, islands, and other land masses) impede the transmission of underwater sound and create shadows behind them where sound from construction is not audible. At Hydaburg, Level B harassment isopleths from the project will be blocked by Sukkwan Island, Spook Island, Mushroom Island, and the coastline along Prince of Wales Island both southeast and northwest of the project site. The maximum distance that a harassment isopleth can extend due to these land masses is 5,162 m.

The ensonified area associated with Level A harassment is technically challenging to predict due to the need to account for a duration component. Therefore, NMFS developed an optional User Spreadsheet tool to accompany the Technical Guidance (NMFS 2018) that can be used to relatively simply predict an isopleth distance for use in conjunction with marine mammal density or occurrence to help predict potential exposure. We note that because of some of the assumptions included in the methods underlying this optional tool, we expect that the resulting isopleth estimates are typically going to be overestimates of some degree, which may result in an overestimate of potential take by Level A harassment. However, this optional tool offers the best way to estimate isopleth distances when more sophisticated modeling methods are not available or practical. For stationary sources (such as from impact pile driving, vibratory pile driving, and DTH), the optional User Spreadsheet tool predicts the distance at which, if a marine mammal remained at that distance for the duration of the activity, it would be expected to incur PTS. Inputs used in the optional User Spreadsheet tool are reported in Table 7 and the resulting estimated isopleths are reported in Table 8.

Table 9. NMFS User Spreadsheet Inputs.

	Vibratory Pile Driving				Impact Pile Driving		DTH	
	16-inch Steel Piles	20-inch Steel Piles	24-inch Steel Piles		20-inch Steel Piles	24-inch Steel Piles	20- and 24-inch Rock Socket	8-inch Tension Anchor
	Removal	Installation / Removal	Installation	Removal	Installation	Installation	Installation	Installation
Spreadsheet Tab Used	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	E.1) Impact pile driving	E.1) Impact pile driving	E.2) DTH Systems	A.1) DTH Systems
Source Level (SPL)	158 dB RMS	161 dB RMS	161 dB RMS	161 dB RMS	176 dB SEL	178 dB SEL	159 dB RMS	144 dB RMS
Transmission Loss Coefficient	15	15	15	15	15	15	15	15
Weighting Factor Adjustment (kHz)	2.5	2.5	2.5	2.5	2	2	2	2
Time to install / remove single pile (minutes)	30	15 / 30[1]	15 / 30[1]	30	--	--	60 - 480[2]	60 - 240[2]
Number of strikes per pile	--	--	--	--	50	50	15	15
Piles per day	2	2 / 10[1]	2 / 10[1]	2	1 / 2[1]	1 / 2[1]	1	1
Distance of sound pressure level measurement (m)	10	10	10	10	10	10	10	10

[1] A maximum scenario was calculated for this activity
[2] A range of scenarios was calculated for this activity

Table 10. Distances to Level A Harassment, and Distances and Areas of Level B Harassment Thresholds Per Pile Type and Installation Method.

Activity	Pile Size	Minutes (min) or strikes per pile	Piles per day	Level A harassment distance (m)	Level B harassment distance (m) all hearing groups	Level B harassment area (km^2) all hearing groups
Vibratory Installation	20- and 24-inch	15 min	2	5	5,412[3]	4.34[4]
		30[1] min	10[1]	20		
Vibratory Removal	16-inch	30 min	2	5	3,415	3.90
	24-inch	30 min	2	7	5,412[3]	4.34[4]
Impact Installation	20-inch	50 strikes	1	47	1,585	2.14
		50[1] strikes	2[1]	74		
	24-inch	50 strikes	1	63	631	0.65
		50[1] strikes	2[1]	100		
DTH (Rock Socket)[2]	20- and 24-inch	60 min	1	359	13,594[3]	4.34[4]
		120 min	1	569		
		180 min	1	746		
		240 min	1	903		
		300 min	1	1,048		
		360 min	1	1,184		
		420 min	1	1,312		
		480 min	1	1,434		
DTH (Tension Anchor)[2]	8-inch	60 min	1	36	2,512	3.07
		120 min	1	57		
		180 min	1	75		
		240 min	1	91		
		300 min	1	105		
		360 min	1	119		
		420 min	1	132		
		480 min	1	144		

[1] A maximum scenario was calculated for this activity
[2] A range of scenarios was calculated for this activity
[3] Harassment distances will be truncated where appropriate to account for land masses, to a maximum distance of 5,162 m
[4] Harassment areas are truncated where appropriate to account for land masses, to a maximum area of 4.34 km^2

6.2.2 Marine Mammal Occurrence and Exposure Estimates

In this section we provide information about the occurrence of marine mammals, including density or other relevant information that will inform the exposure calculations. We also describe how this information is synthesized to produce a quantitative estimate of exposure that is reasonably likely to occur. Although construction is currently planned to begin in fall 2024, unexpected delays associated with construction can occur. To account for this uncertainty, the following exposure estimates assume that construction will occur during the periods of peak abundance for those species for which abundance varies seasonally.

We have determined that the analysis of DTH systems that NMFS provided in the notice of the proposed IHA is an appropriate assessment of these systems. Therefore, our discussion of exposure here considers only the isopleths estimated following NMFS' analysis, in contrast to isopleths calculated following the DOT&PFs assessment. The notice of the proposed IHA additionally included a discussion of estimated exposure based on the DOT&PF's assessment of DTH systems. Please refer to the notice of the proposed IHA for that information (88 FR 45774, July 17, 2023)

Use of Sukkwan Strait by humpback whales is common, but intermittent and dependent on the presence of prey fish. Based on anecdotal evidence from local residents, the DOT&PF predicts that four groups of two whales, up to eight individuals per week, may be within estimated harassment zones each week during the 4 weeks of the pile installation and removal activities, for a total of 32 exposures (8 per week * 4 weeks = 32 total exposures) (HDR 2022). Wade (2021) estimated that approximately 2.4 percent of humpback whales in southeast Alaska are members of the Mexico DPS, while all others are members of the Hawaii DPS. Therefore, the DOT&PF estimated that 1 of the exposures (32 whales * 0.024 = 0.77 rounded up to 1) will be of Mexico DPS individuals and 31 exposures will be of Hawaii DPS individuals.

Due to the long duration of DTH piling that is expected, and the potential for humpback whales to enter the Level A harassment zones from around obstructions or landforms near the project area, the DOT&PF requested that NMFS authorize 4 takes by Level A harassment (equivalent to two groups of two individuals) of humpback whales. Due to the small percentage of humpback whales that may belong to the Mexico DPS in southeast Alaska, the DOT&PF assumes that all takes by Level A harassment will be attributed to Hawaii DPS whales.

The largest Level A harassment zone for humpback whales is 1,435 m (Table 10), which is larger than what the DOT&PF analyzed. The largest practicable shutdown zone that the DOT&PF states it can implement for humpback whales during this project is 1,000 m. To account for this difference and the increased possibility of humpback whales occurring outside of the shutdown zone and in the Level A harassment zone long enough to incur PTS, NMFS PR1 added additional takes by Level A harassment, compared with the DOT&PF's request.

In the proposed IHA, NMFS PR1 calculated additional takes by Level A harassment by determining the ratio of the largest Level A harassment area for 20- and 24-inch (50.8- and 60.96-cm) DTH activities (*i.e.*, 2.01 km^2 for a Level A harassment distance of 1,435 m) minus the area of the shutdown zone for humpback whales (*i.e.*, 1.34 km^2 for a shutdown zone distance of 1,000 m) to the area of the Level B harassment isopleth (4.34 km^2 for a Level B harassment distance of 5,162 m) (*i.e.*, $(2.01 km^2 – 1.34 km^2) / 4.34 km^2 = 0.15$). We then multiplied this ratio by the total number of estimated humpback whales exposures to determine additional take by Level A harassment (*i.e.*, 0.15 * 32 exposures = 4.80 takes, rounded up to 5 takes). The total take by Level A harassment was then calculated as the take originally requested by the DOT&PF plus the additional take calculated by NMFS (*i.e.*, 4 + 5), for a total of 9 takes by Level A harassment. Takes by Level B harassment were calculated as the number of estimated humpback whale exposures minus the amount of take by Level A harassment (*i.e.*, 32 – 9). Therefore, in the MMPA permit (the IHA) NMFS PR1 proposed to authorize 9 takes by Level A harassment and 23 takes by Level B harassment for humpback whales, for a total of 32 takes. NMFS PRD agrees with this estimate. Given that approximately 2.4 percent of humpback whales in southeast Alaska are members of the Mexico DPS, NMFS assumes that no level A takes will occur (9* 2.4 percent = 0.216) and only one of the takes by Level B harassment may be attributed to a humpback whale from the Mexico DPS (32 * 2.4 percent = 0.77, rounded up to 1 take).

6.2.3 Sunflower Sea Star Occurrence and Exposure Estimates

Prior to the Sea Star Wasting Syndrome (SSWS) pandemic, abundance varied geographically in Alaska: They were reported as quite common in western Prince William Sound (average 0.233/m2) (Konar et al.2019). Post-pandemic densities are much lower, and range from 0 to 0.04/m 2 at the sites that once had the highest density (western Prince William Sound)(Traiger et al. 2022). Using a density of 0.04 sea stars per square meter, and a pile size of 24 inches (0.3m), we arrive at the exposure estimate of sea stars to pile installation being approximately 1 sea star for every 83 piles installed. This project will install 18 piles total, some less than 24 inches.

However, pile removal is more concerning. During a recent survey in October 2023 at the Auke Bay Ferry Terminal, ADOT identified two piles, each with potentially 3 sunflower sea stars.

In light of this new information, NMFS expects 15 sunflower sea stars will be exposed to stressors associated with pile removal (3 sunflower sea star x 5 piles being removed).

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. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

For sunflower sea stars, physical responses would be lethal response to pile driving, and the expected non-response to being relocated to the water if they come up on a removed pile.

Loud underwater noise can result in physical effects on the marine environment that can affect other marine organisms. Possible responses by Mexico DPS humpback whales to the impulsive and non-impulsive sound produced by pile installation and removal and vessel noise include:

- Physical Response
    - Temporary or permanent hearing impairment (threshold shifts)
    - Non-auditory physiological effects

- Behavioral responses
    - Auditory interference (masking)
    - Tolerance or habituation
    - Change in dive, respiration, or feeding behavior
    - Change in vocalizations
    - Avoidance or displacement
    - Vigilance
    - Startle or fleeing/flight

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

With proper implementation of the mitigation measures and shutdown procedures described in Section 2.2, we do not expect that any Mexico DPS humpback whales will be exposed to noise levels loud enough, long enough, or at distances close enough for the proposed action to cause Level A harassment. We expect no more than 1 exposure of Mexico DPS humpback whales to noise levels sufficient to cause Level B harassment, as described in Section 6.2.2. All level B instances of take are expected to occur at received levels greater than 120 dB or 160 dB for non-impulsive and impulsive noise sources, respectively.

The introduction of anthropogenic noise into the aquatic environment from pile driving activities is the primary means by which marine mammals may be harassed from ADOT's specified activity. In general, animals exposed to natural or anthropogenic sound may experience physical and physiological effects, ranging in magnitude from none to severe (Southall, Bowles et al. 2007). In general, exposure to pile driving and removal noise 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). 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. The effects of pile driving and removal noise on marine mammals are dependent on several factors, including, but not limited to, sound type (e.g., impulsive vs. non-impulsive), the species, age and sex class (e.g., adult male vs. mom with calf), duration of exposure, the distance between the pile and the animal, received levels, behavior at time of exposure, and previous history with exposure (Wartzok, Popper et al. 2003, Southall, Bowles et al. 2007). Here we discuss physical auditory effects (threshold shifts) followed by behavioral effects.

6.3.1 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 in your ears after a loud rock concert), or permanent (such as the loss of the ability to hear certain frequencies or partial or complete deafness). The amount of threshold shift is customarily expressed in dB. As described in NMFS (2018), there are numerous factors to consider when examining the consequence of TS, including, but not limited to: 1) the signal temporal pattern (e.g., impulsive or non-impulsive), 2) likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS, 3) the magnitude of the TS, 4) time to recovery (seconds to minutes or hours to days), 5) the frequency range of the exposure (i.e., spectral content), 6) 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; e.g., Kastelein, Hoek et al. 2014), and 7) the overlap between the animal and the sound source (e.g., spatial, temporal, and spectral).

6.3.1.1 Temporary Threshold Shift (TTS)

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 or hours to days (in cases of strong TTS). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the sound ends. Few data exist on the sound levels and durations necessary to elicit mild TTS in marine mammals, and none of the published data describes TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in (Southall, Bowles et al. 2007).

For low-frequency cetaceans, no behavioral or auditory evoked potential threshold data exist. Therefore, hearing thresholds were estimated by synthesizing information from anatomical measurements, mathematical models of hearing, and animal vocalization frequencies (NMFS 2018).

Although some Level B exposures may occur during the course of the proposed action, not all instances of Level B take will result in TTS because the estimated noise thresholds for the onset of TTS are conservative. 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.

6.3.1.2 Permanent Threshold Shift (PTS)

When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, while in other cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter 1985). There is no specific evidence that exposure to pulses of sound can cause PTS in any marine mammal. However, given the possibility that mammals close to a sound source can incur TTS, it is possible that some individuals 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).

For the proposed project activities, the calculated distances to the Level A isopleths range from 5 m to 1,434 m (Table 8). The largest practicable shutdown zone that the DOT&PF states it can implement for humpback whales during this project is 1,000 m (See Mitigation Measures in Section 2.1.4). To account for this difference and the increased possibility of humpback whales occurring outside of the shutdown zone and in the Level A harassment zone long enough to incur PTS, NMFS calculated 9 total humpback whale takes by Level A harassment. Given that approximately 2.4 percent of humpback whales in southeast Alaska are members of the Mexico DPS, all Level A takes associated with this project are assumed to be attributed to the Hawaii DPS.

6.3.2 Non-Auditory Physiological Effects

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, internal bubble formation, resonance effects, and other types of organ or tissue damage (Cox, Ragen et al. 2006, Southall, Bowles et al. 2007). Studies examining such effects are limited. In general, little is known about the potential for pile driving 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. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall et al. 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of pile driving, including some odontocetes and some pinnipeds, are especially unlikely to incur auditory impairment or non-auditory physical effects.

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 sufficient 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, Tucker et al. 2003, Lankford, Adams et al. 2005, Crespi, Williams 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, Felten et al. 2002) and, more rarely, studied in wild populations (Romano, Felten et al. 2002). For example, Rolland et al. (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. During the time following September 11, 2001, shipping traffic and associated ocean noise decreased along the northeastern U.S. This decrease in ocean noise was associated with a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased noise levels, although not acutely injurious, can produce stress (Rolland, Parks 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)

We expect a small number of humpback whales (no more than 32 individuals) may experience TTS and may experience non-auditory physiological effects from project activities. Of the affected whales, we expect that no more than one humpback whale from the ESA-listed Mexico DPS may experience mild stress responses in reaction to project activities within the Level B zone. However, we expect most humpback whales would leave the ensonified areas to avoid excessive noise and avoid stress. If humpbacks are not displaced and remain in a stressful environment (i.e., within the harassment zone of pile driving activities), we expect the stress response will dissipate shortly after the cessation of pile driving activities. However, in any of the above scenarios, we do not expect significant or long-term harm to individuals from a stress response because of this action.

6.3.3 Behavioral Responses

Behavioral responses are influenced by an animal's assessment of whether a potential stressor poses a threat or risk. Since sea stars do not measurably exhibit behavioral responses, this section will focus on humpback whales. Behavioral responses may include: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses.

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, Carder et al. 1997, Finneran, Dear et al. 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices, but also including pile driving) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002, Wartzok, Popper et al. 2003, Thorson and Reyff 2006, Nowacek, Thorne et al. 2007). Responses to non-impulsive sound, such as vibratory pile installation, have not been documented as fully as responses to pulsed sounds.

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 (such as those thought to cause beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- 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), and is difficult to predict (Southall et al. 2007).

6.3.3.1 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. While masking of other sounds is not expected to cause any physiological effects, it may well result in effects that impact animals in other ways. A reduced ability to detect approaching predators due to masking may result in increased predation rates. A reduced ability to detect food may result in reduced feeding efficiency, and associated energetic consequences.

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, Ellison et al. 2009) and cause increased stress levels (Foote, Osborne et al. 2004, Holt, Noren 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. 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, pile driving, and dredging activities, contribute to the elevated ambient sound levels, thus intensifying masking.

Noise from pile driving activities is relatively short-term. It is possible that pile driving noise or vessel noise resulting from this proposed action may mask acoustic signals important to Mexico DPS humpback whales, but the limited affected area and infrequent occurrence of humpback whales in the action area would result in insignificant impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory pile driving, and which have already been taken into account in the *Exposure Analysis*.

The HSF project will occur in a moderately busy area, where vessel sounds and dock activity already occur. Pile driving will increase the noise levels, but as explained in section 6.2.1, the pattern of pile driving will be episodic; there will be significant amounts of time when pile driving is not occurring.

6.3.4 Response Analysis Summary

Humpback whales' probable responses to pile installation and removal include TTS, increased stress, and/or short-term behavioral disturbance reactions such as changes in activity and vocalizations, masking, avoidance or displacement, or habituation. These reactions and behavioral changes are expected to be temporary and subside quickly when the exposures cease. The primary mechanism by which these behavioral changes may affect the fitness of individual animals is through the animals' energy budget, time budget, or both (the two are related because foraging requires time). Large whales such as humpbacks have the ability to store substantial amounts of energy, which allows them to survive for months on stored energy during migration and while in their wintering areas, and their feeding patterns allow them to acquire energy at high rates. Sukkwan Strait has not been identified as important foraging habitat for humpback whales, and the proposed activities are not expected to displace foraging whales. Because humpbacks are not expected to be feeding in the action area, there is little incentive for them to remain in the action area while the disturbance is occurring and we expect most whales would leave the area during pile driving activities if they were disturbed. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to reduce the energy budgets of humpback whales, and their probable exposure to noise sources are not likely to reduce their fitness.

Sunflower sea stars responses to pile installation are expected to be fatal if the sea star is directly under the pile, and no response is expected of sea stars adjacent to the pile. There are no expected responses from sea stars as a result of being removed from a pile to which they are adhered, and subsequently relocated to the marine environment nearby.

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.

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 5 of this Opinion). Some continuing non-Federal activities are reasonably 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).

Reasonably foreseeable future state, local, or private actions are hard to predict, but the main actions include activities that relate to vessel traffic and commercial fishing.

Hydaburg is located on the southwest coast of Prince of Wales Island, 45 air miles northwest of Ketchikan. It lies 36 road miles west of Hollis, site of the state ferry landing. Hydaburg has a population of 376 and is the largest Haida village in Alaska. Residents maintain a subsistence and commercial fishing lifestyle. The Haida Wild Alaska Seafood plant was developed in 2017 to process primarily troll-caught salmon. Depending on the volume of salmon that trollers offload at the plant, fish are either flown to Seattle from HSF, or get shipped on a freezer container by ferry to Ketchikan and from there to Seattle.

Vessel traffic is expected to continue in the area. It is unknown whether overall vessel traffic or shipping will increase in the future, as this depends largely on economics, tourism, and other factors, but it is unlikely to decrease significantly. As a result, there will be continued risk to marine mammals of ship strikes, exposure to vessel noise and presence, and small spills.

Fishing, a major industry in southeast Alaska, is expected to continue in the area. As a result, there will be continued risk to marine mammals of prey competition, ship strikes, harassment, and entanglement in fishing gear. NMFS assumes that ADFG 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.

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 Mexico DPS Humpback Whale Risk Analysis

Based on the results of the exposure and response analyses, we expect a maximum of 32 instances of Level B harassment of humpback whales by noise from pile driving activities (impact, vibratory, and DTH), and 2 percent (1 individual) of those instances of harassment of humpback whales are expected to affect whales from the threatened Mexico DPS. Exposure to vessel noise from transit and potential for vessel strike may occur, but adverse effects from vessel disturbance and noise are likely to be negligible due to the small marginal increase in such activities relative to the environmental baseline and the transitory nature of vessels. Adverse effects from vessel strike are considered extremely unlikely because of the few additional vessels introduced by the action, slow speeds within Sukkwan Strait, and the unlikelihood of these type of interactions. Disturbance to seafloor, habitat, and prey resources are not expected to adversely affect humpback whales because these disturbances are temporary, and the action area is not important habitat to humpback whales for foraging, migrating, breeding, or other essential life functions. Mitigation measures and adherence to Clean Water Act regulations are expected to minimize the risk of exposure of humpback whales to the potential introduction of pollutants into the action area.

As discussed in the *Proposed Action* and *Status of the Species* sections, this action does not overlap in space or time with humpback whale breeding. Some Mexico DPS humpback whales feed in Southeast Alaska in the summer and fall months and migrate to Mexican waters for breeding and calving in the late winter months. As a result, the probable responses to pile driving and removal noise are not likely to reduce the current or expected future reproductive success of Mexico DPS humpback whales or reduce the rates at which they grow, mature, or become reproductively active.

Therefore, these exposures are not likely to reduce the abundance, reproduction rates, or growth rates (or increase variance in one or more of these rates) of the populations those individuals represent. The short duration of sound generation and the implementation of mitigation measures to reduce exposure to high levels of sound reduce the likelihood that exposure would cause a behavioral response that may affect vital functions, or cause TTS or PTS. Additionally, when considered in conjunction with the effects of the proposed action, cumulative effects of future state or private activities in the action area are likely to affect humpback whales at a level comparable to present. The current and recent population trends for humpback whales in Southeast Alaska indicate that these levels of activity are not hindering population growth.

We do not expect the effects of the proposed project activities combined with the existing activities described in the *Environmental Baseline* (Section 5) and the cumulative effects (Section 7) to hinder population growth of Mexico DPS humpback whales. As a result, this project is not likely to appreciably reduce Mexico DPS humpback whales' likelihood of surviving or recovering in the wild.

8.2 Sunflower Sea Star Risk Analysis

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

Effects from exposure to in-air noise, in-water noise, and vessel use are likely negligible due to the lack of expected responses from sea stars to these potential stressors. Effects from disturbance to the benthic environment and pilings where sunflower sea stars may be located are expected to occur at a minor level.

The primary threat to sunflower sea stars identified in the draft Status Review Report (Lowry 2022) and proposed rule to list the sunflower sea star as threatened (88 FR 16212; March 16, 2023), is sea star wasting syndrome (SSWS). Based on our analysis of the action, no aspect of the proposed action is expected to increase the prevalence of SSWS in sunflower sea stars.

The geographic scope of this project is small relative to the entire range of the species. Habitat and prey impacts for the sunflower sea star are extremely small. Due to the limited geographic and temporal scope of the project, we do not expect significant increases in vulnerability to a SSWS pandemic as a result of the proposed action. The number of individuals that will be affected is very small relative to the estimated population of sunflower sea stars (over 600 million) ((Lowry 2022). Based on some evidence of recent recruitment and localized abundance increases, the current coastal construction regime in Alaska does not appear to be limiting sunflower sea star recovery.

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 and conference opinion that the proposed action is not likely to jeopardize the continued existence of Mexico DPS humpback whales or the proposed sunflower sea star.

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 [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)(i) and (ii)). For this consultation, ADOT and PR1 expect that take will be by Level B harassment. NMFS PRD agrees with this expected take based on the analysis in Section 6.

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.

The terms and conditions described below must be implemented in order for take authorization of this Incidental Take Statement to be valid, and are nondiscretionary. ADOT and PR1 have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, ADOT and PR1 must monitor and report on the progress of the action and its impact on the species as specified in the ITS (50 CFR § 402.14(i)(3)). If ADOT or PR1 (1) fails 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) fails 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).

The taking of Mexico DPS humpback whales will be by incidental harassment only. The taking by serious injury or death is prohibited and will result in the modification, suspension, or revocation of the ITS. Table 11 lists the amount and timing of authorized take (incidental take by harassment) for this action. The method for estimating the number of listed species exposed to sound levels expected to result in Level A and Level B harassment is described in Section 6.2.2.

Table 11. Summary of instances of exposure associated with the proposed pile driving/removal resulting in incidental take of ESA-listed species by Level A and Level B harassment.

Species	Proposed Authorized Level A Takes	Proposed Authorized Level B Takes	Expected Temporal Extent of Take
Mexico DPS humpback whale	0	1	September 15, 2024 through September 14, 2025

10.1.1 Amount of Take associated with Sunflower Sea Stars

Based on the estimated density of sunflower sea stars in the action area and recent nearby surveys of sunflower sea stars attached to piles, we expect that 15 sunflower sea stars will be taken (e.g., harm, wound, kill, collect- see Section 6.2.3).

10.2 Effect of the Take

In Section 9 of this opinion, NMFS determined that the level of expected take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species.

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

15 sunflower sea star takes are expected as a result of the proposed action. The current range-wide (*i.e.,* global) population estimate for the sunflower sea star is nearly 600 million individuals, based on a compilation of the best available science and information (Gravem et al. 2021). Take associated with this project accounts for about 0.0000025 percent of the population (1 in 400,000 animals). Take prohibitions have not been proposed for this species at this point.

10.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" 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 2.1.4). We presume that the mitigation measures will be implemented as described in this opinion. The failure to do so will constitute a change to the action that may require reinitiation of consultation pursuant to 50 CFR § 402.16.

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

1. ADOT and PR1 must implement a monitoring program that includes all items described in the mitigation measures section of this opinion (Section 2.1.4) and allows NMFS AKR to evaluate the exposure estimates contained in this opinion and that underlie this ITS.
2. ADOT and PR1 must submit a final report to NMFS AKR that evaluates the mitigation measures and the results of the monitoring program.

10.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, 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 2.1.4 of this opinion. ADOT, PR1 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, ADOT and PR1 must undertake (or require their lessees or permittees to undertake) the following:

1.1 The monitoring zones must be fully observed by NMFS-approved PSOs during all in-water work in order to document observed incidents of harassment as described in the mitigation measures associated with this action.

1.2 If take of any DPS of humpback whales totals 25, ADOT will notify NMFS by email, attn: david.gann@noaa.gov and discuss the need for reinitiation of consultation.

To carry out RPM #2, ADOT and PR1 must undertake (or require their lessees or permittees to undertake) the following:

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.

2.2 Adhere to all monitoring and reporting requirements in the MMMMP and any revisions to the MMMMP described in this biological opinion.

2.3 Submit a project specific report within 90 days of the conclusion of the project that analyzes and summarizes interactions with humpback whales during this project to the Protected Resources Division, NMFS by email to AKR.section7@noaa.gov. This report must also contain information described in the mitigation measures located in Section 2.1.4 of this opinion.

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).

For this proposed action, NMFS suggests the following conservation recommendations:

1. Project vessel crews should participate in the WhaleAlert program to report real-time sightings of whales while transiting in the waters of Southeast Alaska and to minimize the risk of vessel strikes. More information is available at https://www.fisheries.noaa.gov/resource/tool-app/whale-alert.
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. ADOT should ensure that the entities responsible for conducting the sunflower sea star surveys have practice and expertise with the methodology they use to conduct the survey, prior to conducting the actual surveys. In addition, ADOT should invite PRD biologists to the site when a sunflower sea star survey is being conducted or the equipment to do the survey is being tested to enable PRD to better understand the efficacy of the selected methods and equipment.
4. ADOT should publish, or make widely available, a report detailing the methodology used and results of the sunflower sea star surveys conducted as part of this proposed action. Those findings will aid other action agencies and future projects in developing protocols for future surveys, and will increase general understanding of sunflower sea star movements and densities, particularly in the Juneau area.

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

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 ADOT, PR1, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-opinions/. 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

Aalto, E., K. D. Lafferty, S. Sokolow, R. Grewelle, T. Ben-Horin, C. Boch, P. Raimondi, S. Bograd, E. Hazen and M. Jacox (2020). "Models with environmental drivers offer a plausible mechanism for the rapid spread of infectious disease outbreaks in marine organisms." Scientific reports **10**(1): 5975.

ADFG (2023). Letter submitted to NMFS via Regulations.gov on May 15, 2023, during the public comment period for the proposed rule to list the sunflower sea star as threatened under the Endangered Species Act NOAA-NMFS-2021-0130. State of Alaska Comments. 1255 West 8th Street, Juneau, AK 99811. 28 pp.

ANSI (1995). Bioacoustical Terminology (ANSI S3.20-1995). Woodbury, NY, American National Standards Institute, Acoustical Society of America.

ANSI (American National Standards Institute) (1986). "Methods of measurement for impulse noise 3 (ANSI S12.7-1986). 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.".

Aquino, C. A., R. M. Besemer, C. M. DeRito, J. Kocian, I. R. Porter, P. T. Raimondi, J. E. Rede, L. M. Schiebelhut, J. P. Sparks and J. P. Wares (2021). "Evidence that microorganisms at the animal-water interface drive sea star wasting disease." Frontiers in Microbiology **11**: 3278.

Baker, C. S., L. M. Herman, A. Perry, W. S. Lawton, J. M. Straley and J. H. Straley (1985). "Population characteristics and migration of summer and late-season humpback whales (*Megaptera novaeangliae*) in southeastern Alaska." Marine Mammal Science **1**(4): 304-323.

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

Bauer, G. and L. M. Herman (1986). Effects of vessel traffic on the behavior of humpback whales in Hawaii. Honolulu, Hawaii**:** 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. Commer., NOAA, NMFS, SWFSC**:** 263 p.

Blackwell, S. B. and C. R. Greene, Jr (2003). Acoustic measurements in Cook Inlet, Alaska during August 2001. Aptos and Santa Barbara, CA, Greenridge Sciences, Inc.

Broadwater, M. H., F. M. Van Dolah and S. E. Fire (2018). Vulnerabilities of marine mammals to harmful algal blooms. Harmful Algal Blooms: A Compendium Desk Reference. S. E. Shumway, J. M. Burkholder and S. L. Morton. Hoboken, NJ, John Wiley and Sons**:** 191-222.

Carlson, T. J., D. L. Woodruff, G. E. Johnson, N. P. Kohn, G. R. Ploskey, M. A. Wieland and e. al. (2005). Hydroacoustic measurements during pile driving at the Hood Canal Bridge, September through November 2004, Prepared by Battelle Marine Sciences Laboratory for the Washington State Department of Transportation**:** 165 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.

Chenoweth, E. M., J. M. Straley, M. V. McPhee, S. Atkinson and S. Reifenstuhl (2017). "Humpback whales feed on hatchery-released juvenile salmon." Royal Society Open Science **4**: 170180.

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

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.

Clark, C. W., W. T. Ellison, B. L. Southall, L. Hatch, S. M. Van Parijs, A. Frankel and D. Ponirakis (2009). "Acoustic masking in marine ecosystems: intuitions, analysis, and implication." Marine Ecology Progress Series **395**: 201-222.

Cox, T. M., T. Ragen, A. Read, E. Vos, R. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford and L. Crum (2006). Understanding the impacts of anthropogenic sound on beaked whales, Space and Naval Warfare Systems Center, San Diego, CA.

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.

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.

Dean, T. A. and S. C. Jewett (2001). "Habitat-specific recovery of shallow subtidal communities following the Exxon Valdez oil spill." Ecological Applications **11**(5): 1456-1471.

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. S. United States. National Marine Fisheries, C. Alaska Fisheries Science, O. Alaska Regional, R. West Coast and C. Northwest Fisheries Science. Seattle, WA, U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 86 p.

Denes, S. L., J. Vallarta and D. G. Zeddies (2019). Sound source characterization of down-the-hole hammering, Thimble Shoal, Virginia, Technical report by JASCO Applied Sciences for Chesapeake Tunnel Joint Venture.

Doney, S. C., V. J. Fabry, R. A. Feely and J. A. Kleypas (2009). "Ocean Acidification: The Other CO_2 Problem." Annual Review of Marine Science **1**(1): 169-192.

Evans, P. G. H., Q. Carson, P. Fisher, W. Jordan, R. Limer and I. Rees. (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.

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.

Ferguson, M. C., C. Curtice and J. Harrison (2015). "6. Biologically Important Areas for Cetaceans Within U.S. Waters – Gulf of Alaska Region." Aquatic Mammals **41**(1): 65-78.

Fey, S. B., A. M. Siepielski, S. Nusslé, K. Cervantes-Yoshida, J. L. Hwan, E. R. Huber, M. J. Fey, A. Catenazzi and S. M. Carlson (2015). "Recent shifts in the occurrence, cause, and magnitude of animal mass mortality events." Proceedings of the National Academy of Sciences **112**(4): 1083-1088.

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.

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. Seattle, WA, U. S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 116 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., W. Heady, V. Saccomanno, K. Alvstad, A. Gehman, T. Frierson and S. Hamilton (2021). "IUCN Red List Assessment: Sunflower sea star *(Pycnopodia helianthoides)*." IUCN Red List of Threatened Species 2021 20.

Harvell, C., D. Montecino-Latorre, J. Caldwell, J. Burt, K. Bosley, A. Keller, S. Heron, A. Salomon, L. Lee and O. Pontier (2019). "Disease epidemic and a marine heat wave are associated with the continental-scale collapse of a pivotal predator (*Pycnopodia helianthoides*)." Science advances **5**(1): eaau7042.

Hastings, M. C. and A. N. Popper (2005). Effects of sound on fish. Sacramento, CA, Report prepared by Jones and Stokes under contract with California Department of Transportation, No. 43A0139.

HDR (2022). Hydaburg Seaplane Facility Refurbishment Project Biological Assessment.

Heather Coletti, N. P. S., U. S. G. S. Dan Esler, Alaska Science Center, U. o. A. F. Katrin Iken, U. o. A. F. Brenda Konar, U. S. G. S. E. Brenda Ballachey, Alaska Science Center, U. S. G. S. E. James Bodkin, Alaska Science Center, U. S. G. S. George Esslinger, Alaska Science Center, U. S. G. S. Kim Kloecker, Alaska Science Center, N. O. a. A. A. Mandy Lindeberg, U. S. G. S. Dan Monson, Alaska Science Center, U. S. G. S. Brian Robinson, Alaska Science Center, U. S. G. S. Sarah Traiger, Alaska Science Center and U. S. F. a. W. S. Benjamin Weitzman, Marine Mammal Management (2023). Exxon Valdez Oil Spill Trustee Council

Long-Term Research and Monitoring, Mariculture, Education and Outreach

Annual Project Reporting Form.

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. Seattle, WA, U. S. Dept. of Commerce, NOAA, NMFS, Alaska Fisheries Science Center**:** 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.

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

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.

Ireland, D. S. and L. S. Bisson (2016). Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Chukchi Sea, July-October 2015; Draft 90-day report, Report from LGL Alaska Research Associates Inc., Anchorage, AK, and JASCO Applied Sciences, Victoria, BC, for Shell Gulf of Mexico, Houston, TX, NMFS, Silver Spring, MD, and U.S. Fish and Wild. Serv., Anchorage, AK**:** 188 p. + appendices.

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.

Jewett, S. C., R. N. Clark, H. Chenelot, S. Harper and M. K. Hoberg (2015). Field guide to sea stars of the Aleutian Islands. Alaska Sea Grant, University of Alaska Fairbanks. Vol. SG-ED-79.

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): 412-422.

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): 1052-1061.

Konar, B., T. J. Mitchell, K. Iken, H. Coletti, T. Dean, D. Esler, M. Lindeberg, B. Pister and B. Weitzman (2019). "Wasting disease and static environmental variables drive sea star assemblages in the Northern Gulf of Alaska." Journal of Experimental Marine Biology and Ecology **520**: 151209.

Kruse, S. (1991). The interactions between killer whales and boats in Johnstone Strait, B.C. Dolphin Societies - Discoveries and Puzzles. K. Pryor and K. Norris. Berkeley, California, University of California Press.

Kryter, K. D. (1970). The effects of noise on man. New York, Academic Press, Inc.

Kryter, K. D. (1985). The handbook of hearing and the effects of noise, 2nd edition. Orlando, FL, Academic Press.

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. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver, British Columbia.

Lambertsen, R. H. (1992). "Crassicaudosis: a parasitic disease threatening the health and population recovery of large baleen whales." Rev. Sci. Technol., Off. Int. Epizoot. **11**(4): 1131-1141.

Lankford, S., T. Adams, R. Miller and 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.

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.

Lloyd, M. M. and M. H. Pespeni (2018). "Microbiome shifts with onset and progression of Sea Star Wasting Disease revealed through time course sampling." Scientific Reports **8**(1): 16476.

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*). Seattle, WA, U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service**:** 89 p. + appendices.

Lowry, D., Wright, S., Neuman, M., Stevenson, D., Hyde, J., Lindeberg, M., Tolimieri, N., Lonhart, S., Traiger, S., Gustafson, R. (2022). Draft Endangered Species Act status review report: sunflower sea star (*Pynopodia helianthoides*). Final Report to the National Marine Fisheries Service, Office of Protected Resources. October 2022. 89 pp. +App.

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.

McCabe, R. M., B. M. Hickey, R. M. Kudela, K. A. Lefebvre, N. G. Adams, B. D. Bill, F. M. Gulland, R. E. Thomson, W. P. Cochlan and V. L. Trainer (2016). "An unprecedented coastwide toxic algal bloom linked to anomalous ocean conditions." Geophysical Research Letters **43**(19): 10,366-310,376.

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.

McCracken, A. R., B. M. Christensen, D. Munteanu, B. Case, M. Lloyd, K. P. Herbert and M. H. Pespeni (2023). "Microbial dysbiosis precedes signs of sea star wasting disease in wild populations of Pycnopodia helianthoides." Frontiers in Marine Science **10**: 1130912.

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

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.

Nedwell, J. and B. Edwards (2002). Measurements of underwater noise in the Arun River during piling at County Wharf, Littlehampton. Soberton Heath, UK, Report No. 513R0108, Prepared by Subacoustech, Ltd. for David Wilson Homes, Ltd.**:** 28 p.

Neilson, J., C. Gabriele, J. Straley, S. Hills and J. Robbins. (2005). Humpback whale entanglement rates in southeast Alaska. Sixteenth Biennial Conference on the Biology of Marine Mammals. San Diego, California**:** 203-204.

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.

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: 106282.

NIOSH (National Institute for Occupational Safety and Health) (1998). "Criteria for a recommended standard: Occupational noise exposure. United States Department of Health and Human Services, Cincinnati, OH.".

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

NMFS (2016). Recovery plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). Juneau, AK, U.S. Dept. of Commerce, NOAA, National Marine Fisheries Service, Alaska Region, Protected Resources Division.

NMFS (2018). "Manual for Optional User Spreadsheet Tool (Version 2.0) for: 2018 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. Silver Spring, Maryland: Office of Protected Resources, National Marine Fisheries Service.".

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. Silver Spring, MD, U.S. Dept. of Commerce, National Oceanic and Atmospherica Administraiton, National Marine Fisheries Service, Office of Protected Resources**:** 178 p.

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. Washington, D.C., National Research Council, Ocean Study Board, National Academy Press.

Oestman, R., D. Buehler, J. Reyff and R. Rodkin (2009). Technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish, Report prepared by ICF Jones and Stokes and Illingworth and Rodkin for California Department of Transportation (Caltrans)**:** 298 p.

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

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.

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: a special issue of the Marine Fisheries Review." Marine Fisheries Review **61**(1): 1-74.

Popper, A. N. and M. C. Hastings (2009). "The effects of anthropogenic sources of sound on fishes." Journal of Fish Biology **75**(3): 455-489.

Price, C. S., E. Keane, D. Morin, C. Vaccaro, D. Bean and J. A. Morris (2017). Protected species and marine aquaculture interactions. Beaufort, NC, U.S. Dept. Commer., NOAA, National Ocean Service, National Centers for Coastal Ocean Science**:** 85 p.

Richardson, W. J., C. R. Greene Jr, C. I. Malme and D. H. Thomson (1995). Marine mammals and noise. San Diego, CA, Academic Press, Inc.

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 μPa. San Diego, California, Naval Command, Control and Surveillance Center, RDT&E Division.

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. Molecular and Cell Biology of Marine Mammals. C. J. Pfeiffer. Malabar, FL., Krieger Publishing Co.**:** 253-279.

Scholik, A. R. and H. Y. Yan (2001). "Effects of underwater noise on auditory sensitivity of a cyprinid fish." Hearing research **152**(1-2): 17-24.

Scholik, A. R. and H. Y. Yan (2002). "Effects of boat engine noise on the auditory sensitivity of the fathead minnow, Pimephales promelas." Environmental Biology of Fishes **63**(2): 203-209.

Scholin, C. A., F. Gulland, G. J. Doucette, S. Benson, M. Busman, F. P. Chavez, J. Cordaro, R. DeLong, A. De Vogelaere and J. Harvey (2000). "Mortality of sea lions along the central California coast linked to a toxic diatom bloom." Nature **403**(6765): 80-84.

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.

Shivji, M., D. Parker, B. Hartwick, M. Smith and N. Sloan (1983). "Feeding and distribution study of the sunflower sea star *Pycnopodia helianthoides* (Brandt, 1835)." Pacific Science **37**(2): 133-140.

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.

Simmonds, M. P. and W. J. Eliott. (2009). "Climate change and cetaceans: concerns and recent developments." Journal of the Marine Biological Association of the United Kingdom **89**(1): 203-210.

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.

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. (1990). "Fall and winter occurrence of humpback whales (*Megaptera novaeangliae*) in southeastern Alaska." Report of the International Whaling Commission **Special Issue 12**: 319-323.

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.

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. Behavior of Marine Animals: Current Perspectives in Research Vol. 3: Cetaceans. H. E. Winn and B. L. Olla. New York, NY, Plenum Press**:** 403-431.

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, Inc. for the California Department of Transportation: 51 p."

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.

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. Seattle, WA, National Marine Fisheries Service, Alaska Fisheries Science Center.

Ward, W. D. (1997). Effects of high-intensity sound. Encyclopedia of Acoustics, Vol. III. M. J. Crocker. New York, Wiley & Sons**:** 1497-1507.

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.

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

Wild, L. A., H. E. Riley, H. C. Pearson, C. M. Gabriele, J. L. Neilson, A. Szabo, J. Moran, J. M. Straley and S. DeLand (2023). "Biologically Important Areas II for cetaceans within U.S. and adjacent waters–Gulf of Alaska region." Frontiers in Marine Science **10**: 763.

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. 7th Annual Conference on Biological Sonar and Diving Mammals. Stanford Research Institute, Menlo Park**:** 39-52.