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

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion for Construction of the Tongass Narrows Project (Gravina Access)

NMFS Consultation Number: AKRO-2023-00339
DOI: https://doi.org/10.25923/xfcf-r863

Action Agencies:
Alaska Department of Transportation and Public Facilities (ADOT&PF) on behalf of the Federal Highway Administration (FHA)

National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division (OPR)

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Humpback whale (*Megaptera novaeangliae*) Mexico DPS	Threatened	Yes	No	No
Fin whale (*Balaenoptera physalus*)	Endangered	Yes	No	N/A

Consultation Conducted By: National Marine Fisheries Service

Issued By:
Jonathan M. Kurland
Regional Administrator

Date: August 30, 2023

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Terms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
AKR	Alaska Region NMFS
BA	Biological Assessment
CFR	Code of Federal Regulations
COK	City of Ketchikan
CV	Coefficient of variation
dB	Decibels
DPS	Distinct Population Segment
DQA	Data Quality Act
DTH	Down-the-hole
ECSA	Endangered Species Conservation Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act of 1973
ft	feet
FR	*Federal Register*
GPS	Global Positioning System
HMCP	Hazardous Material Control Plan
hr	hour(s)
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
kHz	kilohertz
km	kilometer(s)
lb	pound(s)
L_E	cumulative sound exposure level
LOA	Length overall
m	meter(s)
min	minute(s)
MMPA	Marine Mammal Protection Act
µPa	microPascals
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
OMAO	Office of Marine and Aviation Operations
OPR	NMFS Office of Protected Resources, Permits and Conservation Division
PRD	Protected Resources Division, Alaska NMFS
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
rms	root mean square
RPM	Reasonable and Prudent Measures

SAR	marine mammal stock assessment reports
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level
SPCC	Spill Prevention, Control, and Countermeasure Plan
SPL	Sound Pressure Level
SPL_{PK}	Peak Sound Pressure Level
SSV	Sound Source Verification
TL	Transmission Loss
TTS	Temporary Threshold Shift
UME	Unusual Mortality Event
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WQCP	Water Quality Control Plan

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 or critical habitat, 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 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 40753-64).

For the actions described in this document, the action agencies are the Federal Highway Administration (FHA) and the NMFS Office of Protected Resources Permits and Conservation Division (OPR). The environmental review, consultation, and other actions required of the FHA by applicable federal environmental laws for this project are being carried out by the ADOT&PF pursuant to 23 U.S.C. § 326 and a Memorandum of Understanding executed by FHA and ADOT&PF.

FHA proposes to continue to fund construction to improve access to developable land on Gravina Island, improve access to the Ketchikan International Airport, and facilitate economic development in the Ketchikan Gateway Borough (specifically on Gravina Island).

OPR proposes to authorize Marine Mammal Protection Act (MMPA) Level A take (i.e., take by injury) of Steller sea lion (*Eumetopias jubatus*), harbor seal (*Phoca vitulina*), harbor porpoise

(*Phocoena phocoena*), and Dall's porpoise (*Phocoenoides dalli*), and Level B take (i.e., take by harassment) of eleven marine mammal species: Steller sea lion, harbor seal, harbor porpoise, Dall's porpoise, killer whale (*Orcinus orca*), humpback whale (*Megaptera novaeangliae)*, minke whale (*Balaenoptera acutorostrata*), fin whale (*Balaenoptera physalus*), gray whale (*Eschrichtius robustus*), northern elephant seal (*Mirounga angustirostris*), and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), in conjunction with the action.

With this consultation, FHA and OPR request authorization under the ESA for Level B take of two ESA-listed stocks: threatened Mexico DPS humpback whales and endangered fin whales. All Steller sea lions in the action area are assumed to be from the delisted eastern DPS and are therefore not considered in this opinion.

The consulting agency for this proposal is NMFS's Alaska Region (AKR). This document represents NMFS's biological opinion (opinion) on the effects of the proposed construction activities on endangered and threatened species and designated critical habitat.

The biological opinion and incidental take statement (ITS) were prepared by NMFS AKR in accordance with section 7(b) of the ESA of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402.

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

1.1 Background

This opinion considers the effects of the construction of the remainder of the Tongass Narrows Project in the City of Ketchikan in Southeast Alaska. The full Tongass Narrows Project includes six project components, two of which have been completed under a previous biological opinion (ECO# AKRO-2019-03432) and four considered in this biological opinion. NMFS AKR is conducting this new consultation for the remaining four components because: 1) OPR is issuing a new IHA for the remainder of the project; 2) ADOT&PF requests authorization of take for fin whales that were recently observed near the action area; 3) to incorporate new estimates of abundance of Mexico DPS humpback whales in the action area; 4) to update mitigation measures with new sound source information; and 5) to incorporate changes to the project design, methods, and number of piles to be installed. This opinion replaces the original opinion prepared for this project. The two completed project components are 1) improvements to the Gravina Island ferry layup dock facility; and 2) construction of a new Gravina Island heavy freight mooring facility. The four remaining components considered in this opinion are as follows:

1. Revilla New Berth: new airport shuttle ferry berth and upland improvements on Revillagigedo Island
2. Gravina New Berth: new airport shuttle ferry berth and related terminal improvements on Gravina Island
3. Revilla Refurbish: refurbish existing Revillagigedo Island ferry berth facility
4. Gravina Refurbish: refurbish existing Gravina Island ferry berth facility

This project is intended to (1) improve access to developable land on Gravina Island; (2)

improve access to the Ketchikan International Airport; (3) facilitate economic development in the Ketchikan Gateway Borough (specifically on Gravina Island); and (4) provide backup berthing facilities for the existing ferry berths.

The action may affect the threatened Mexico Distinct Population Segment (DPS) of humpback whale and endangered fin whale. Critical habitat was designated for the Mexico DPS of humpback whale (86 FR 21082, April 21, 2021), but there is no critical habitat in Southeast Alaska. Critical habitat has not been designated for fin whale.

This biological opinion is based on information provided during the original consultation (see Section 1 of NMFS 2019), information provided by HDR in the January 2023 IHA application (HDR 2023), monitoring reports provided by ADOT&PF, a site-specific sound source verification report conducted during earlier phases of the project (Reyff and Ambaskar 2023), the proposed rule for the IHA (88 FR 46746, July 20, 2023), updated project proposals; email and telephone conversations among NMFS AKR, NMFS OPR; and ADOT&PF, and other sources of information. Although HDR prepared the IHA application for this consultation, they did not participate directly in the consultation. The IHA application was used *in lieu* of a biological assessment. A complete record of this consultation is on file at NMFS's Juneau, Alaska office.

1.2 Consultation History

This history of consultations on this project and summary of communication with OPR and ADOT&PF regarding this consultation is summarized as follows:

September 5, 2018: Completed initial consultation for this project under ECO# AKRO-2018-01287.
February 6, 2019: Completed reinitiated consultation with ADOT&PF, ECO# ARKO-2019-03432.
January 7, 2020: OPR issued two consecutive IHAs for this project.
January 24, 2023: ADOT&PF submitted an application to OPR for a new IHA to complete the remainder of the project.
April 19, 2023: AKR informed the Alaska Department of Fish and Game that we would be consulting on this project and were given 30 days to provide input.
May 2, 2023: ADOT&PF requested initiation of consultation under Section 7 of the ESA with AKR to construct the remaining four components of the project.
May 2, 2023: ADOT&PF requested a halt to the consultation to await new sound source level information.
May 24, 2023: ADOT&PF submitted a sound source verification report for down-the-hole (DTH) drilling activities and asked that sound source levels and transmission losses be re-evaluated.
June 23, 2023: All parties agreed to new transmission loss values and revised harassment zone sizes.
July 18, 2023: OPR requested initiation of consultation under Section 7 of the ESA with AKR on issuance of a new IHA for the project.
July 18, 2023: AKR deemed the application package sufficient and initiated a new consultation for this project with OPR and ADOT&PF under ECO# AKRO-2023-00339.
July 20, 2023: OPR published a notice in the *Federal Register* of the proposed IHA to be issued for the remained of this project.

A complete history of the IHAs issued for this project is outlined in *Federal Register* notice for the IHA to be authorized by the opinion (88 FR 46746, July 20, 2023).

2 Description of the Proposed Action and Action Area

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02).

This opinion considers the effects of the construction activities by ADOT&PF in Tongass Narrows on listed species in the action area. The purpose of and need for the Tongass Narrows Project is to (1) improve access to developable land on Gravina Island; (2) improve access to the Ketchikan International Airport; (3) facilitate economic development in the Ketchikan Gateway Borough (specifically on Gravina Island); and (4) provide backup berthing facilities for the existing ferry berths. This opinion considers the effects on listed species in the action area incidental to vibratory and impact pile driving and removal, and use of a down-the-hole (DTH) drilling system to install rock sockets and tension anchors.

The proposed construction activities that may affect listed species will take place between August 2023 (pending finalization of the opinion and IHA) and June 2024, but may take up to a year from the date of issuance of the biological opinion and IHA. Construction will require approximately 131 non-consecutive days of in-water work over the span of one year. Construction is planned to occur during daylight hours only with in-water construction occurring seven days per week.

ADOT&PF is making improvements to two existing ferry berths and constructing two new ferry berths on Gravina Island and Revillagigedo Island in Tongass Narrows, near Ketchikan, in southeast Alaska (Figure 1). The project location is 2.6 miles north of downtown Ketchikan adjacent to the Ketchikan International Airport. All project components are located within approximately 0.5 miles of one another within the City of Ketchikan (Figure 1). The action has the potential to affect waters in Tongass Narrows and Clarence Strait to the north (Figure 1).

Figure 1. Project vicinity in Tongass Narrows, Ketchikan, Southeast Alaska (excerpted from HDR (2023)).

2.1 Proposed activities: project components

Repairs and upgrades to the existing ferry facilities will improve access to developable land on Gravina Island, improve access to the Ketchikan International Airport, and facilitate economic development in the Ketchikan Gateway Borough. The new ferry berths provide redundancy to the existing ferry berths to ensure continuity of operations and access to and from Gravina Island in the event that one of the facilities is temporarily out of service.

The four project components are listed in Table 1. The Revilla New Berth and Gravina New Berth are being constructed immediately adjacent to the existing ferry berths on Revilla and Gravina Islands, respectively. Each component is described in more detail below and the construction methods for each component are described in Section 2.2.

Short Component Name	**State Project ID**
Revillagigedo New Berth	SFHWY00085
Gravina New Berth	SFHWY00109
Revillagigedo Refurbish	SFHWY00150
Gravina Refurbish	SFHWY00153

Table 1. List of Tongass Narrows Project and components considered in this biological opinion.

Above-water work would consist of the installation of a concrete or steel platform decking panels, transfer bridges, dock-mounted fenders, pedestrian walkways, gangways, and utility lines. Upland construction activities will consist of new terminal facilities, staging areas, parking lot expansions, new roadways, retaining walls, stairways, and pedestrian walkways. No in-water noise is anticipated in association with above-water and upland construction activities, and no associated take of marine mammals is anticipated from the noise or visual disturbance. Therefore, above-water and upland construction activities are not discussed further in this opinion.

Figure 2. Location of project components (excerpted from HDR (2023)).

2.1.1 Revillagigedo New Berth

The new Revillagigedo Island Airport Shuttle Ferry Berth facility will consist of a 7,400-square-foot pile-supported approach trestle at the shore side of the ferry terminal and a 1,500-square-foot pile-supported approach trestle extension located landside and north of the new approach trestle. A 25-foot by 142-foot steel transfer bridge with vehicle traffic lane and separated pedestrian walkway will extend from the trestle to a new 2,200- square-foot steel float and apron. The steel float will be supported by three guide pile dolphins. Two new stern berth dolphins with fixed hanging fenders and three new floating fender dolphins will be constructed to moor vessels. The new apron will be supported by three new guide pile dolphins. Water depths at the dolphins will reach approximately 60 feet. Some permanent piles originally installed in previous years may need to be removed and reinstalled in the correct locations (Table 2). A plan drawing is provided in Figure 3.

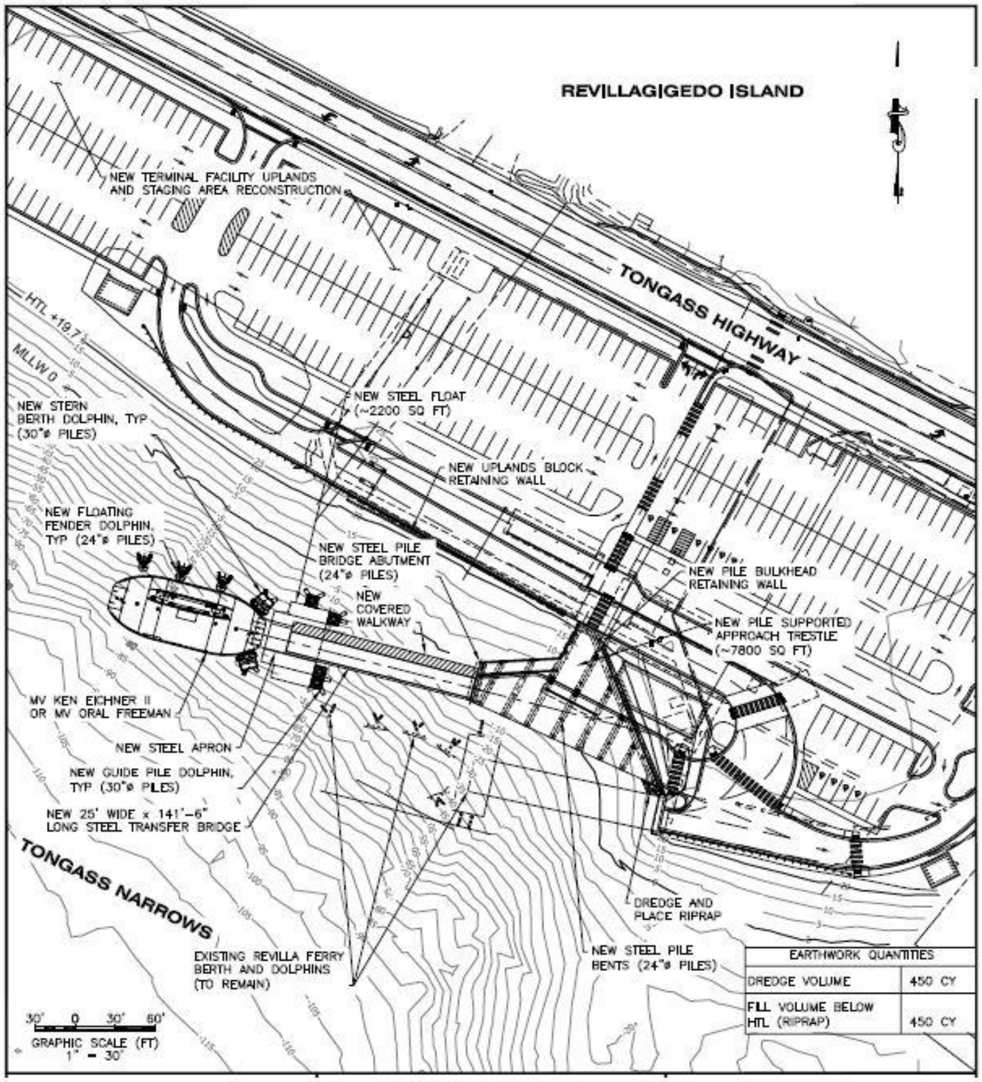

Figure 3. Site plan for the proposed new Revillagigedo Island Airport Shuttle Ferry Berth (HDR 2023).

2.1.2 Gravina New Berth

The new Gravina Island Airport Shuttle Ferry Berth facility will consist of an approximately 7,000-square-foot pile-supported approach trestle at the shore side of the ferry terminal. A 25-foot by 142-foot steel transfer bridge with vehicle traffic lane and separated pedestrian walkway will lead to a new 2,200- square-foot steel float and apron. The steel float will be supported by three new guide pile dolphins. Ferry berthing will be supported by two new stern berth dolphins and three new floating fender dolphins. To support the new facility, a new bulkhead retaining wall will be constructed between the existing ferry berth and the new approach trestle. A new fill slope measuring approximately 21,200 square feet will be constructed west of the approach trestle. Upland improvements include widening of the ferry approach road, retrofits to the existing pedestrian walkway, installation of utilities, and construction of a new employee access walkway. A plan drawing is provided in Figure 4 and the numbers of piles to be installed and removed are summarized in Table 2.

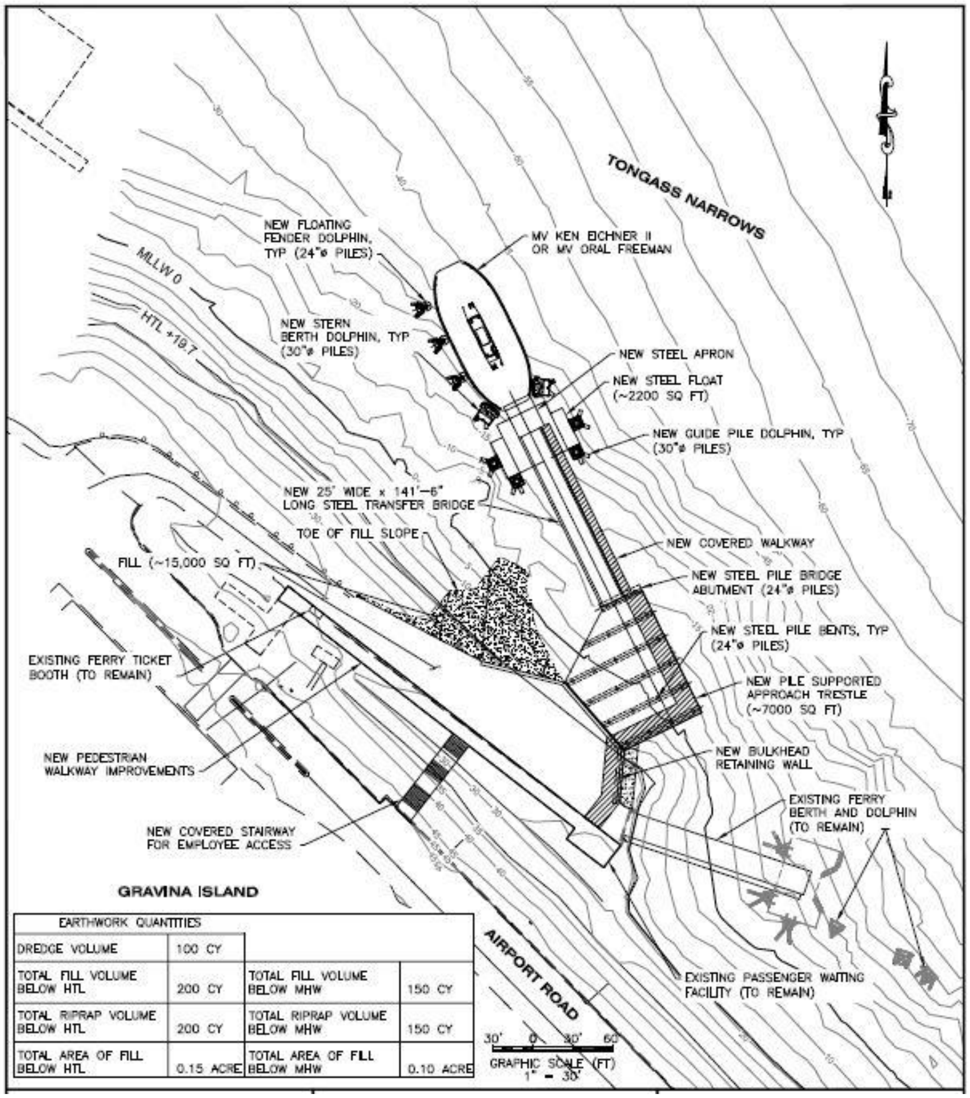

Figure 4. Site plan for the proposed new Gravina Island Airport Shuttle Ferry Berth (HDR 2023).

2.1.3 Revillagigedo Refurbish

Refurbishments to the existing Revillagigedo Island Ferry Berth will include the following: (1) replace the transfer bridge, (2) replace rubber fender elements and fender panels, (3) replace one 24-inch pile on the floating fender dolphin, and (4) replace the bridge float with a concrete or steel float of the same dimensions. Construction of the transfer bridge, bridge float, and fender elements will occur above water. The only in-water work will be pile installation and removal associated with construction of the one remaining dolphin. A plan drawing is provided in Figure 5 and summary of pile driving activities is in Table 2.

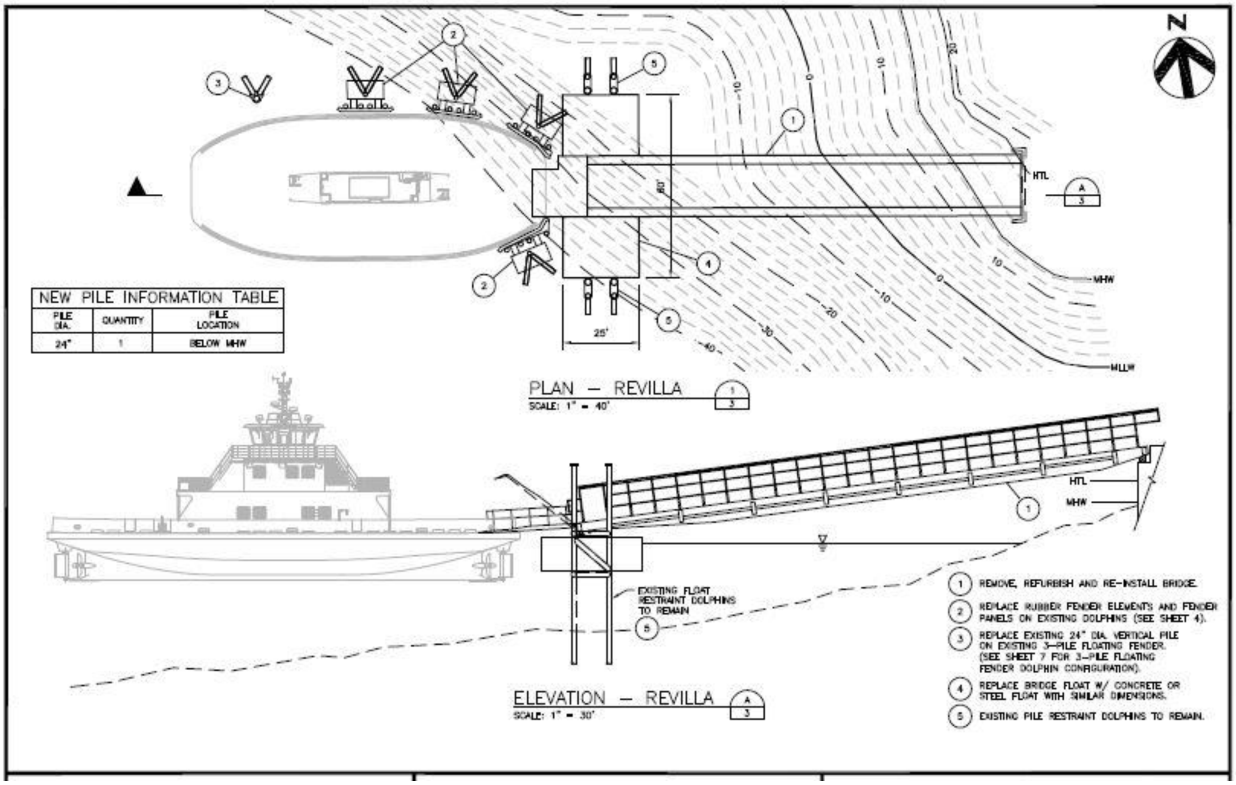

Figure 5. Plan drawing for refurbishment of existing Revillagigedo Island Ferry Berth (HDR 2023).

2.1.4 Gravina Refurbish

Refurbishments to the existing Gravina Island Ferry Berth will include the following: (1) replace the transfer bridge, (2) remove the catwalk and dolphins, (3) replace the bridge float with a concrete or steel float of the same dimensions, (4) construct a floating fender dolphin, and (5) construct four new breasting dolphins. Construction of the transfer bridge, catwalk, and bridge float will occur above water. The only in-water work will be pile installation and removal associated with construction of the dolphins. Some piles installed in previous years may need to be removed and reinstalled (Table 2). A plan drawing is provided in Figure 6.

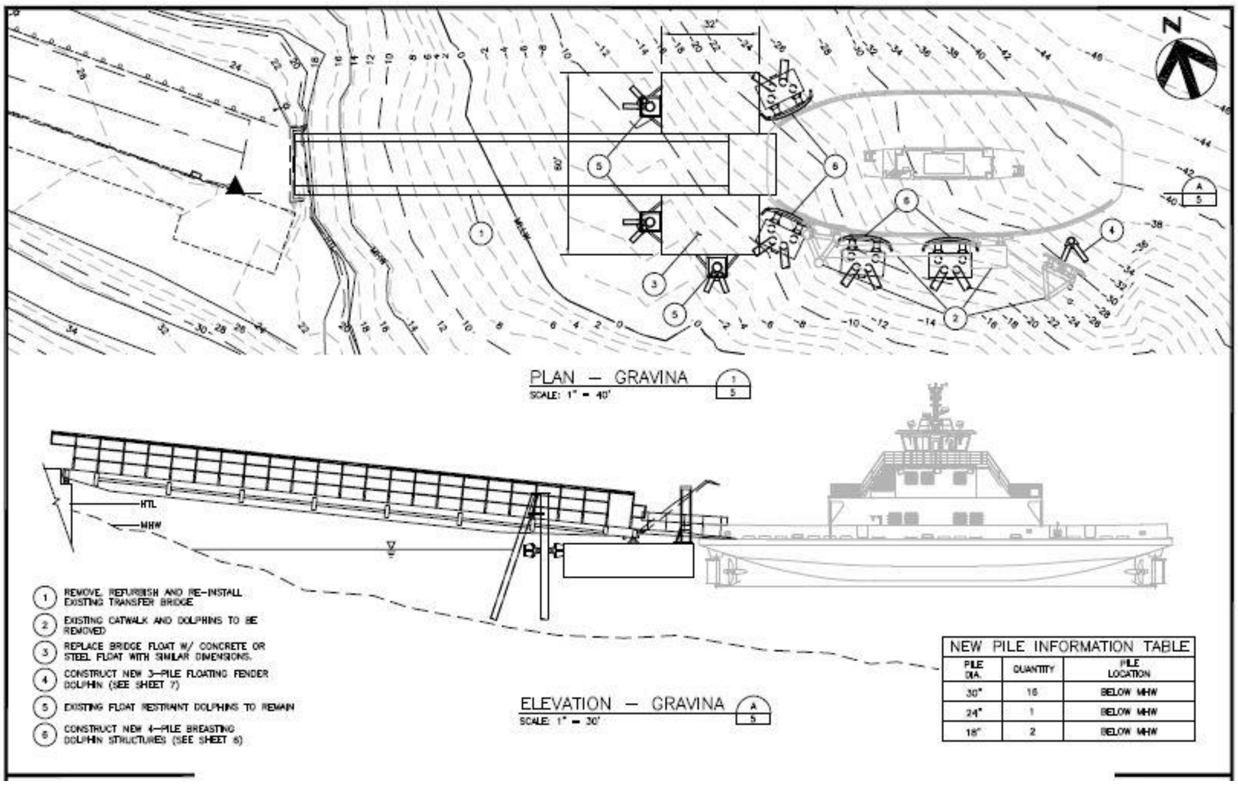

Figure 6. Plan drawing for refurbishment of the existing Gravina Island Ferry Berth (HDR 2023).

Table 2. Details of pile numbers, types, and installation methods for the four components of the project.

Project Component / Pile Type	Number of Piles	Number of Rock Sockets	Number of Tension Anchors	Average Vibratory Duration Per Pile (minutes)	Average DTH Duration for Rock Sockets Per Pile (minutes)	Average DTH Duration for Tension Anchors Per Pile (minutes)	Impact Strikes Per Pile (duration in minutes)	Estimated Total Number of Hours per pile (Range)	Average Piles per day (Range)	Days of Installation and Removal
Revilla New Berth (Installation)										
30” Permanent	13	-	3	30	-	120 – 240	200 (15)	2 (0.75–4.75)	1 (1 – 3)	13
24” or 14” H Template	28	-	-	120	-	-	50 (15)	2.25	2 (1 – 4)	14
Revilla New Berth (Removal)										
30” Permanent	13	-	-	60	-	-	-	1	3 (1- 6)	5
24” or 14” H Template	28	-	-	60	-	-	-	1	6 (1 – 8)	5
Gravina New Berth (Installation)										
24” Permanent	27	11	28	30	180–360	120–240	200 (15)	6 (2.75-10.75)	1 (1 – 3)	27
24” or 14” H Template	24	-	-	120	-	-	50 (15)	2.25	2 (1 – 4)	12
Gravina New Berth (Removal)										
24” or 14” H Template	24	-	-	60	-	-	-	1	6 (1 – 8)	4
Revilla Refurbish Existing Ferry Berth Facility (Installation)										
24” Permanent	1	-	-	120	-	-	200 (15)	2.25	1	1
Revilla Refurbish Existing Ferry Berth Facility (Removal)										
24” Permanent	1	-	-	60	-	-	-	1	1	1
Gravina Refurbish Existing Ferry Berth Facility (Installation)										
24” Permanent	23	13	16	30	180 – 360	120 (120–240)	200 (15)	6 (2.75–10.75)	1 (1–3)	23

24” or 14” H Template	**32**	**-**	**-**	**120**	**-**	**-**	50 (15)	2.25	2 (1–4)	16
Gravina Refurbish Existing Ferry Berth Facility (Removal)										
24” Permanent	12	-	-	60	-	-	-	1	3 (1–6)	4
24” or 14” H Template	32	-	-	60	-	-	-	1	6 (1–8)	6

2.2 Proposed in-water activities: construction methods

Across the four project sites, three methods of pile installation are anticipated. These include vibratory and impact hammers, use of DTH systems to make holes for rock sockets and tension anchors at some locations. Installation of steel piles through the overburden layer would be accomplished using vibratory or impact methods. Where the overburden is deep, rock socketing or anchoring (described below) is not required, and the final approximately 10 ft (3 m) of driving would be conducted using an impact hammer. Some permanent piles would be battered (i.e., installed at an angle). In shallow overburden, an impact hammer would be used to seat the piles into competent bedrock before a DTH system would be used to create holes for the rock sockets and/or tension anchors. The pile installation methods used would depend on overburden depth and conditions at each pile location. Vibratory methods would also be used to remove temporary steel pipe piles. These proposed activities and the noise they produce have the potential to take marine mammals by Level A harassment and Level B harassment.

The estimated installation rate of piles varies depending on pile type and location (Table 2). The number of piles removed or installed may vary daily. In some instances, all of the steps necessary to install a pile (e.g., install an individual permanent pile to refusal with a vibratory hammer, use DTH methods for the rock socket, impact proof, and install the tension anchor) may not occur on the same day, so a pile may only be partially installed in a day. The construction crew may use a single installation method for multiple piles on a single day or find other efficiencies to increase production; the anticipated ranges of possible values are provided in Table 2. The estimated removal rate for temporary piles is between one and six steel pipe piles per day.

Approximately 131 days of pile installation and removal are anticipated. ADOT&PF's IHA application estimated 152 construction days rather than 131 (HDR 2023), but this number has been adjusted because one of the project components originally included in the application has been completed. Up to 26 permanent piles previously installed will be removed and reinstalled. An additional 51 permanent piles will be installed. An additional 84 template piles will be installed and removed.

Above-water work will consist of the installation of a concrete or steel platform decking panels, transfer bridges, dock-mounted fenders, pedestrian walkways, gangways, and utility lines. Upland construction activities will consist of new terminal facilities, staging areas, parking lot expansions, new roadways, retaining walls, stairways, and pedestrian walkways. No in-water noise is anticipated in association with above-water and upland construction activities, and no associated take of marine mammals is anticipated from the noise or visual disturbance. Therefore, above-water and upland construction activities are not discussed further in this document.

All dredging, excavation, and placement of fill were completed under the original biological opinion. No excavation or fill placement are anticipated for the remainder of this project.

2.2.1 Down-the-hole drilling of rock sockets and tension anchors

Rock sockets are holes made in the bedrock where overlying sediments are too shallow to adequately secure the bottom portion of a pile using other methods. Rock sockets are constructed utilizing a DTH device which uses both rotary and percussion-type drill action. These devices consist 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, creating a hole that allows for insertion of the pile. The socket holes are just large enough for the pile to fit down in to provide lateral strength for the pile. The pile is usually advanced at the same time that drilling occurs (the bit has a flexible tip that can be retracted and pulled back up through the center of a pile). Rock socket holes would be drilled up to 15 ft (4.6 m) into the bedrock. Drill cuttings are expelled from the top of the pile using compressed air and/or other fluids. It is estimated that use of DTH for rock sockets into the bedrock would take approximately 4-8 hours per pile. Some piles would be seated in rock sockets as well as anchored with tension anchors.

Tension anchors are comprised of a threaded steel rod grouted into the bedrock strata at a specified depth below the pile tip. The rod is tested and anchored to the top of the pile to resist uplift forces in the associated structure. Tension anchors are installed within piles that are DTH drilled or hammered 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 is inserted inside the larger-diameter production pile. A DTH hammer and bit is inserted into the casing, and a 6- to 8-inch-diameter hole is made into bedrock. The typical depth of the hole varies, but 20-30 ft (6.1-9.1 m) is common to meet engineering needs. Rock fragments would be removed through the top of the casing with compressed air. A steel rebar rod is then grouted into the drilled hole and affixed to the top of the pile.

2.2.2 Vibratory and impact pile installation and removal

All pile installation scenarios will use vibratory hammering as the predominant installation method (see Table 2). As needed, a combination of vibratory, impact, and DTH socketing methods will be used. Depending on the location, the pile will be advanced to refusal at bedrock using impact methods. Where sediments are deep and rock socketing or anchoring is not required, the final approximately 10 feet of driving will be conducted using an impact hammer so that the structural capacity of the pile embedment can be verified. Where sediments are shallow, an impact hammer will be used to seat the piles into competent bedrock before rock socketing begins. The pile installation methods used will depend on sediment depth and conditions at each pile location. Pile removal will be accomplished with vibratory methods.

2.2.3 Work platforms and transport of workers to and from platforms

Work will be conducted from shore or from anchored barges. The contractor has mobilized a crane and three floating barges within the project area that will be moved into location with a tugboat. Tug towing operations for construction will occur at relatively low speeds (5 knots), and the maximum transit speed for tugs and barges is anticipated to be 8–10 knots.

One or two skiffs will be used to transport workers short distances between the shore and work platforms. There could be multiple shore to barge trips during the day; however, the area of travel will be relatively small, within a very busy area, and close to shore. Vessels will be refueled at existing fuel docks along Tongass Narrows.

Upon completion of the project, one barge will be towed to Seattle via established shipping lanes and the other two barges will be towed to other locations in Ketchikan. All vessels associated with the project will follow well-established, frequently used navigation lanes within Tongass Narrows.

2.2.4 New overwater shaded area

Construction of the four remaining project components includes the placement of floats, docks, transfer bridges, and walkway surfaces that will create shade in areas below the high tide line. The estimated areas of the surfaces that will create overwater shading vary by project component (Table 3). Approximately 25,000 square feet of new overwater shading are proposed for the remainder of the project, and 63,000 square feet for the entire project (NMFS 2019).

Table 3**.** Amount of overwater shaded area associated with each project component (in square feet) (modified from Table 1.5 in HDR 2018b).

Project Component	**New or Replaced Shaded Area**				**Existing Shading Area**	**Total Shaded Area**
	Float	**Dock**	**Transfer Bridge**	**Pedestrian Access Walkway**		
Revillagigedo New Berth	2,624	9,823	0	0	0	12,447
Gravina New Berth	2,624	10,285	0	0	0	12,909
Revillagigedo Refurbish	0	0	0	0	5,480	5,480
Gravina Refurbish	0	0	0	0	5,480	5,480
Totals	**5,247**	**20,108**	**0**	**0**	**10,960**	**36,316**

2.2.5 Other in-water construction and heavy machinery activities

In addition to the activities described above, the proposed action will involve other in-water construction and heavy machinery activities. Examples of other types of activities include using standard barges, tug boats, positioning piles on the substrate via a crane (i.e., “stabbing the pile”), and removing piles from the water column and substrate via a crane (i.e., “deadpulling”). No dredging or excavation activities are proposed.

2.3 Mitigation Measures

ADOT&PF has agreed to implement the following measures to avoid and minimize impacts to listed species. For all reporting that results from implementation of these mitigation measures, ADOT&PF or its contractors will contact NMFS using the contact information specified in Table 5. In all cases, notification will reference the NMFS consultation tracking number: AKRO-2023-00339.

Unless otherwise specified, the term “pile driving activities” is defined to include vibratory pile removal, vibratory pile driving, impact pile driving, and/or rock socketing and tension anchoring using a down-the-hole hammer drill.

2.3.1 General Conditions

1. *Pre-construction notification*-- At least one week prior to commencing construction, ADOT&PF will notify the NMFS Alaska Regional Office (see Table 5) that construction is planned to begin.
2. 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 entanglement in the event that waste enters marine waters.
3. Project-associated staff will properly secure all ropes, nets, and other materials that could blow or wash overboard.
4. All trash will be immediately placed in trash bins and bins will be properly secured with locked or secured lids that cannot blow open and disperse trash into the environment.

2.3.2 Visual Monitoring by Protected Species Observers (PSOs)

2.3.2.1 Shutdown and monitoring zones

PSOs will monitor the Level A shutdown and Level B monitoring zones listed in Table 4 and depicted in Figure 7 during pile driving activities. Monitoring and shutdown zones vary based on the activity type and duration. At the start of each work day, ADOT&PF will determine the maximum scenario possible for that day (according to the defined intervals shown below in Table 4), to determine the appropriate Level A shutdown zone for that day. This Level A shutdown zone must be implemented for the entire work day. Monitoring and shutdown zones will be centered on the pile being driven and will therefore shift depending on the pile's location. All sightings of listed species will be documented.

Monitoring zones are the areas in which SPLs are expected to equal or exceed 160 and 120 dB rms (Level B harassment for impulsive and continuous sound, respectively) and where Level B harassment may occur. Monitoring zones are established so that PSOs can document instances of Level B harassment. Monitoring zones also enable observers to be aware of and communicate the presence of marine mammals in the project area but outside the shutdown zone and thus prepare for potential shutdowns of activity. Nominal radial distances for Level B monitoring zones for single activities are shown in Table 4.

Shutdown zones are the areas within which Level A harassment is likely to occur. Nominal radial distances for Level A shutdown zones for single activities are shown in Table 4.

Trained protected species observers (PSOs) will monitor all or a portion of the action area (*i.e.*, a portion of the monitoring zones) for humpback and fin whales. The extent of the monitoring zones will vary depending on the in-water work occurring at the time and the resultant isopleths.

Given the size of the monitoring zone for vibratory pile driving and rock socketing (*e.g.*, 1-11.7 km), it is impossible to guarantee that all humpback and fin whales would be observed or to make comprehensive observations of fine-scale behavioral reactions to sound. In order to document observed instances of harassment, PSOs will record all marine mammal observations, regardless of location. The observer's location, as well as the location of the pile being driven, is known from a GPS. The location of the animal is estimated as a distance from the observer, which is then compared to the location from the pile. It may then be estimated whether the animal was exposed to sound levels constituting Level A or Level B incidental harassment on the basis of predicted distances to relevant thresholds in post-processing of observational and acoustic data, and a precise accounting of observed incidences of harassment created. This information may then be used to extrapolate observed exposures to quantify total takes.

Table 4. Level A shutdown zones and Level B monitoring zones to be implemented for humpback whales and fin whales during in-water project activities

Activity	Pile Diameter(s) (inches)	Duration (min; vibratory/DTH) /# of Piles (impact)	Level A Shutdown Zone (m)	Level B Monitoring Zone (m)
Vibratory Installation or Removal, temporary and permanent	30	≤ 360	50	11,659[1]
	24 or 14	≤ 480	40	7,356
DTH (Rock Socket)	24	≤ 120	220	2,572
		121 – 180	220	
		181 – 480	350	
DTH (Tension Anchor)	8	≤ 480	30	1,274
Impact, 200 strikes	30	1	550	2,154
		2	550	
		3	720	
	24 or 14	1	140	1,000
		2	290	
		3	290	
Impact, 50 strikes	24 or 14	1 - 3	120	1,000

[1] In this location, the monitoring zone is within a narrow channel. PSOs will survey the entire zone at the outset of each day's activities, and then monitor the outer boundary across the width of the narrows to look for animals moving into the monitoring zone from either end of the channel.

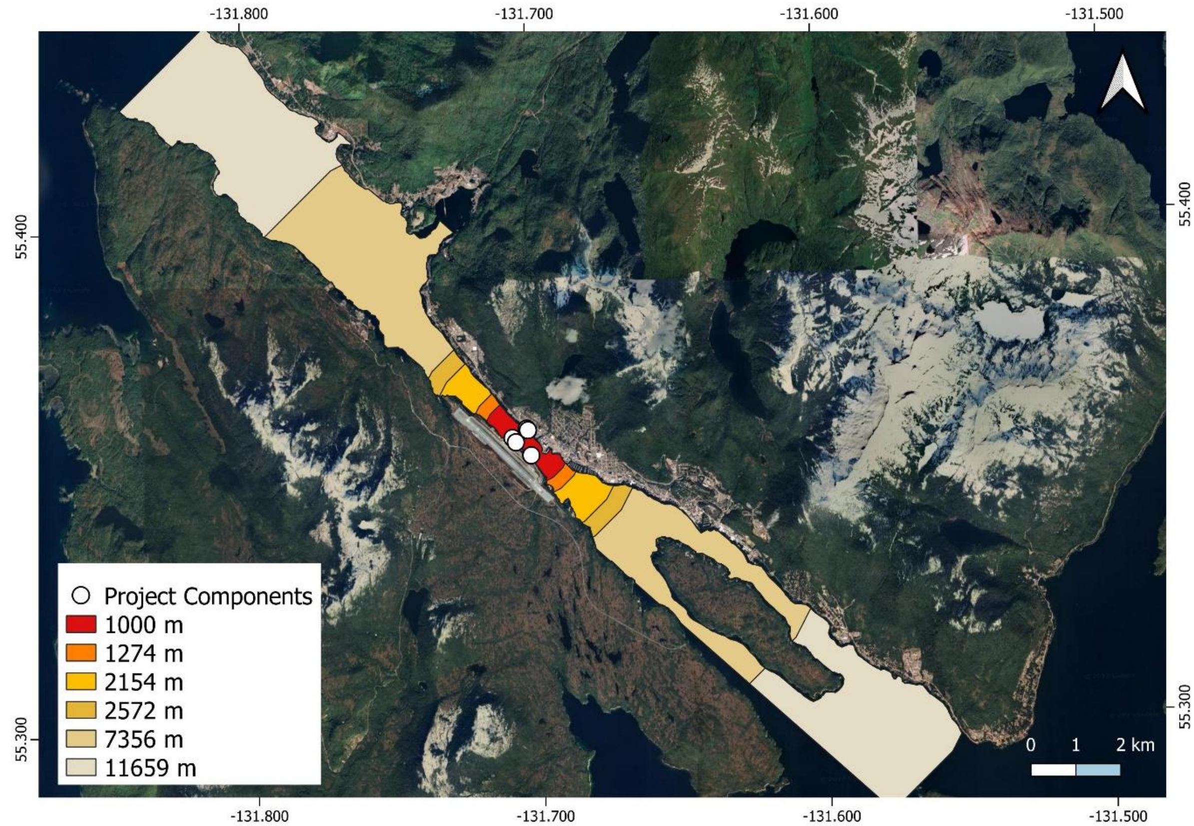

Figure 7. Approximate boundaries of Level B monitoring zones for the different pile driving activities shown in Table 4. Monitoring zones will be centered on the pile being installed and may differ slightly from what is depicted in this figure depending on the location of the pile.

2.3.2.2 General requirements for visual monitoring

5. For all vibratory pile driving and removal, ADOT&PF must employ at least three PSOs. For all impact pile driving and DTH, ADOT&PF must employ at least two PSOs. A minimum of one PSO (the lead PSO) must be assigned to the active pile driving or DTH location to monitor the Level A shutdown zones and as much of the Level B monitoring zones as possible. The observation points of the additional PSOs may vary depending on the construction activity and location of the piles.
6. *Establishing Point of Contact with Construction Crew:* 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.
7. PSOs will have no duties other than to watch for and report on events related to marine

mammals during monitoring periods. PSOs will have no construction-related tasks or responsibilities while monitoring for marine mammals

8. PSOs will have the authority and obligation to order appropriate mitigation response, including shutdowns, to avoid unauthorized takes of all listed species.
9. *Shifts*-- PSOs will work in rotating shifts of 4–6 hours, as needed, each day to prevent fatigue. Pile installation and removal are intermittent by nature and it is anticipated that periods of rest will be interspersed throughout the day. PSOs will not perform duties as a PSO for more than 12 hours in a 24-hour period to reduce fatigue.

2.3.2.3 Monitoring the Shutdown Zone

10. For each in-water pile driving activity, at least one PSO will monitor all marine waters within the indicated shutdown zone radius for that activity (Table 4 and Figure 7). The placement of the PSOs during all pile driving and removal and DTH activities will ensure that the entire shutdown zone is visible.
11. For other in-water heavy machinery activities, on days when pile driving activities are not scheduled to occur, monitoring of the shutdown zone may be performed by construction personnel.
12. At least one PSO will continuously monitor the shutdown zone and adjacent waters during in-water construction activities for the presence of listed species.
13. *Pre-activity clearing of the shutdown zone:* Prior to commencing pile driving activities, or whenever a break in pile driving activities of 30 minutes or longer occurs, PSOs will scan waters within the shutdown zone and confirm no listed species are within the relevant shutdown zone for at least 30 minutes immediately prior to initiation of the in-water activity. If one or more listed species are observed within the relevant shutdown zone, the in-water activity will not begin until the listed species exits the shutdown zone of its own accord, or the shutdown zone has remained clear of listed species for 30 minutes immediately prior to pile driving activities. Pre-activity clearance monitoring must be conducted during periods of visibility sufficient for the lead PSO to affirm that the shutdown zones indicated in Table 4 are clear of listed species. Pile driving may commence following 30 minutes of observation after the determination is made that the shutdown zones are clear of ESA-listed marine mammals.
14. If visibility degrades to where the PSO cannot ensure that the relevant shutdown zone remains devoid of listed species during pile driving activities, the crew will cease in-water work until the entire shutdown zone is visible and the PSO has indicated that the zone has remained devoid of listed species for 30 minutes.
15. If pile driving is delayed or halted due to the presence of a listed species in the relevant shutdown zone, the activity may not commence or resume until either the whale(s) has voluntarily exited and been visually confirmed beyond the shutdown zone, or 30 minutes have elapsed without re-detection of the whale(s).
16. The PSO will order the pile driving activities to immediately cease if one or more individuals of a listed species approaches, has entered, or appears likely to enter, the associated shutdown zone.

17. ADOT&PF and their contractors must also avoid direct physical interaction with marine mammals during construction activity. If a marine mammal comes within 10 m of such activity, operations must cease and vessels must reduce speed to the minimum level required to maintain steerage and safe working conditions.
18. If a listed species is observed within a shutdown zone during production of in-water sound or is otherwise harassed, harmed, injured, or disturbed, PSOs will immediately report that occurrence to NMFS using the contact information specified in Table 5.

2.3.2.4 Monitoring the Level B Zones

19. *Pre-activity survey of the monitoring zone during vibratory pile driving and removal:* At the start of the 30-minute pre-activity monitoring period, one PSO will remain at the construction site to monitor the Level A shutdown zone, while two or more PSOs will start at the project site and travel along Tongass Narrows, counting all humpback and fin whales present, until they have reached the edge of the Level B monitoring zone. At this point, the PSOs will identify suitable observation points from which to observe the Level B monitoring zone for the duration of pile driving activities. (During impact pile driving and DTH, the entire Level B monitoring zone may be observable and monitored by two observers.)
20. During pile driving and removal operations, PSOs will be responsible for observing only the width of Tongass Narrows at the Level B zone entry point/boundary rather than the entirety of the Level B zone because any humpback or fin whale entering the Level B zone would need to pass by one of these PSOs. All PSOs will be in constant radio contact with one another and the lead PSO will be in contact with the construction team to inform them of the presence of marine mammals and request a work stoppage, if necessary.
21. When a humpback or fin whale is present in the Level B monitoring zone, activities may continue if authorized take levels have not been met, and Level B take will be recorded and reported.
22. If the boundaries of the Level B monitoring zone have not been monitored continuously during a work stoppage, the entire Level B zone will be surveyed again for the presence of humpback whales.
23. If a listed species for which authorization has not been granted is observed approaching or within the Level B monitoring zone (Table 4 and Figure 7), pile driving activities must shut down immediately using delay and shut-down procedures. Activities must not resume until the animal has been confirmed to have left the area or 30 minutes have passed without subsequent detections of marine mammals in the Level B monitoring zone.

2.3.2.5 Post-activity Monitoring

24. PSOs will conduct post-activity monitoring of the shutdown and monitoring zones for 30 minutes after the daily cessation of in-water construction and pile driving activities.
25. The length of the post-activity monitoring period may be reduced if pile driving activities continue for more than 30 minutes after sunset and darkness precludes visibility of the shutdown and monitoring zones.

2.3.2.6 Soft Start Procedures for Impact Pile Installation

26. Once the shutdown zone has been cleared, soft-start procedures will be implemented prior to starting impact pile driving activities. Contractors will provide an initial set of three 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 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.
27. Following this soft-start procedure, operational impact pile driving may commence and continue provided listed species remain absent from the shutdown zone and Level B harassment take authorizations have not been met.

2.3.2.7 Scheduling

28. In-water activities will take place only:
    a. between civil dawn and civil dusk when PSOs can effectively monitor for the presence of marine mammals;
    b. when the entire shutdown zone and adjacent waters are visible (e.g., monitoring effectiveness is not reduced due to rain, wind, fog, snow, etc.).
    c. Exception: Some pile driving activities may continue for up to 30 minutes after sunset during evening civil twilight, as necessary to secure a pile for safety prior to demobilization for the evening. PSO(s) will continue to observe shutdown and monitoring zones during this time.

2.3.2.8 Qualifications of PSOs

Monitoring must be conducted by qualified, NMFS-approved PSOs, who will be present during all pile installation and removal activities, including vibratory, impact, and DTH methods, in according with the following:

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

30. The action agency or its designated non-federal representative will provide resumes of PSO candidates to the NMFS Office of Protected Resources (see *Contact Information* in Table 5) for approval at least one week prior to in-water work. NMFS will provide a brief explanation of lack of approval in instances where an individual is not approved.

31. At least one PSO will have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization. Other PSOs may substitute other relevant experience, education (degree in biological science or related field), or training.
32. PSOs must complete PSO training prior to deployment. The training will include instruction on:
    a. field identification of marine mammals and marine mammal behavior;

   b. ecological information on Alaska's marine mammals and specifics on the ecology and management concerns of those marine mammals;
   c. ESA and MMPA regulations;
   d. mitigation measures outlined in this letter;
   e. proper equipment use;
   f. methodologies in marine mammal observation and data recording and proper reporting protocols; and,
   g. PSO roles and responsibilities.

33. When a team of three or more PSOs is required, a lead observer or monitoring coordinator must be designated. The lead observer must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization
34. All PSOs will have the following abilities:
   a. adequate vision to perform their duties;
   b. ability to to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary;
   c. ability to conduct field observations and collect data accurately and in accordance with assigned protocols;
   d. ability to identify to species all marine mammals that are endemic to the action area;
   e. ability to identify and record marine mammal behavior;
   f. sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations; and
   g. writing skills sufficient to prepare a report of observations including but not limited to the number of species of marine mammals observed; dates and times when in-water construction activities were conducted; dates, times, and reason for implementation of mitigation (or why mitigation was not implemented when required); and marine mammal behavior.
35. *Required PSO Equipment:*

PSOs will have the following equipment to perform 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. global positioning system;

g. a legible copy of this biological opinion and all appendices

h. legible and fillable observation record form allowing for required PSO data entry.

2.3.3 Vessel Strike Avoidance

36. To minimize the risk of vessel strikes, vessel operators will:

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

   b. stay at least 91 m (100 yd) away from listed marine mammals;

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

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

   e. not position vessel(s) in the path of whales, and will not cut in front of whales in a way or at a distance that causes the whales to change their 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;

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

   h. 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));

   i. 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.

   j. follow established transit routes and will travel <10 knots while in the action area. The speed limit within Tongass Narrows is 7 knots for vessels over 23 feet in length.

   k. 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 yd) 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.

2.3.4 Hazardous Material Spill Avoidance

37. If contaminated or hazardous materials are spilled or released during construction, all work in the vicinity of the contaminated site will be stopped until the Alaska Department of Environmental Conservation (ADEC) is contacted, and a corrective action plan is approved by ADEC and implemented.

38. The contractor will provide and maintain a spill cleanup kit on-site at all times, to be implemented as part of the Spill Prevention, Control, and Countermeasure (SPCC) Plan, as well as the Hazardous Material Control Plan (HMCP) and Water Quality Control Plan

(WQCP), in the event of a spill or if any oil products are observed in the water.

39. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, and similar equipment will be checked regularly for drips or leaks, and will be maintained and stored properly to prevent spills.
40. Oil booms will be readily available for oil or other fuel spill containment should any release occur.
41. All chemicals and petroleum products will be properly stored to prevent spills. No petroleum products, cement, chemicals, or other deleterious materials will be allowed to enter surface waters.

2.3.5 Estimation of Take for Mexico DPS humpback whale

Estimated takes will be calculated based on the total number of humpback whales observed (or estimated) in the Level B monitoring zone multiplied by 2% (the percentage of humpback whales in the action area estimated to be from the listed Mexico DPS (Wade 2021). Therefore, for every 50 humpback whales observed in the monitoring zone, approximately one (2%) would be considered take of a Mexico DPS humpback whale allowed by the Incidental Take Statement issued with this opinion. ADOT&PF will consider the 25^{th}, 75^{th}, and 125^{th} humpback whales taken by Level B harassment to be from the listed Mexico DPS.

2.3.6 General Data Collection and Reporting

2.3.6.1 Data Collection

42. PSOs will record observations on data forms or into electronic data sheets.
43. The action agency will ensure that PSO data will be submitted to NMFS electronically in a format that can be queried such as a spreadsheet or database (i.e., digital images of data sheets are not sufficient).
44. PSOs will record the following, at minimum:
    a. Dates and times (begin and end) of all marine mammal monitoring;
    b. Construction activities occurring during each daily observation period, including the number and type of piles driven or removed and by what method (i.e., impact, vibratory or DTH), the total equipment duration for vibratory installation/removal or DTH for each pile or hole and total number of strikes for each pile (impact driving);
    c. PSO locations during marine mammal monitoring;
    d. Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon, and estimated observable distance;
    e. Upon observation of a marine mammal, the following information will be recorded:
        - Name of PSO who sighted the animal(s) and PSO location and activity at time of sighting;

- Time of sighting;
- Identification of the animal(s) (e.g., genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species;
- Distance and bearing of each marine mammal observed relative to the pile being driven for each sighting (if pile driving was occurring at time of sighting);
- Estimated number of animals (min/max/best estimate);
- Estimated number of animals by cohort (adults, juveniles, neonates, group composition, sex class, etc.);
- Animal's closest point of approach and estimated time spent within the harassment zone; and
- Description of any marine mammal behavioral observations (e.g., observed behaviors such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g., no response or changes in behavioral state such as ceasing feeding, changing direction, flushing, or breaching);

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

2.3.6.2 Unauthorized Take

45. 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 *Final Report* section below):

b. number of whales 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 whale(s) was first observed or entered the shutdown zone, and, if known, the time the whale was last seen or exited the zone, and the fate of the whale;

f. mitigation measures implemented prior to and after the whale was taken; and

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

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

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

46. 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.

2.3.6.4 Illegal Activities

47. 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).

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

2.3.6.5 Monthly Report

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

50. 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 15, 2023.

2.3.6.6 Final Report

51. A draft final report will be submitted to NMFS within 90 calendar days of the completion of the project summarizing the data recorded and submitted to the email addresses shown in Table 5. 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. If no comments are received from NMFS within 30 days, the draft report will constitute the final report. If comments are received, a final report addressing NMFS comments must be submitted within 30 days after receipt of comments.

52. The final report will include:

    a. summaries of monitoring efforts, including dates and times of construction, dates and times of monitoring, and dates, times, and duration of shutdowns due to marine mammal presence;

    b. date and time of marine mammal observations, geographic coordinates of marine mammals at their closest approach to the project site, marine mammal species, numbers, age/size/sex categories (if determinable), and group sizes;

    c. number of marine mammals observed (by species) during periods with and without project activities (and other variables that could affect detectability);

d. observed marine mammal behaviors and movement types versus project activity at time of observation;

e. numbers of marine mammal observations/individuals seen versus project activity at time of observation;

f. distribution of marine mammals around the action area versus project activity at time of observation;

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

2.3.7 Summary of Agency Contact Information

Table 5. Summary of agency contact information.

Topic	**Contact Information**
NMFS ESA Section 7 Consultation	NMFS Alaska Regional Office, Protected Resources Division *Alaska Region Section 7 Coordinator:* AKR.prd.section7@noaa.gov *Consultation Biologist:* Julie Scheurer, Julie.Scheurer@noaa.gov, 907-586-7111
NMFS MMPA IHA Authorization and PSO resumes	NMFS Office of Protected Resources Permits Division Kate Fleming, itp.fleming@noaa.gov 301-427-8495
Monthly PSO Monitoring Reports & Data Submittal	AKR.section7@noaa.gov Julie.scheurer@noaa.gov
Final PSO Monitoring Reports & Data Submittal	AKR.section7@noaa.gov PR.ITP.MonitoringReports@noaa.gov ITP.fleming@noaa.gov Julie.scheurer@noaa.gov
Stranded, Injured, or Dead Marine Mammals (*not related to project activities*)	NMFS Alaska Region 24-hr Stranding Hotline 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

Topic	Contact Information
Unauthorized Take by Project Activities	NMFS Alaska Regional Office 907-586-7236 *Alaska Region Section 7 Coordinator:* AKR.section7@noaa.gov *Section 7 Consultation Biologist:* Julie Scheurer, Julie.Scheurer@noaa.gov, 907-586-7111 NMFS Office of Protected Resources Permits Division Kate Fleming, itp.fleming@noaa.gov 301-427-8495

2.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur.

The action area includes the area in which pile driving and other in-water work activities will take place (Figure 2), the ensonified area around pile driving activities (see Table 4), and other in-water work activities associated with the project, as well as the transit path of personnel, materials, vessels, and equipment to the site. The project lies within Tongass Narrows near Ketchikan, Alaska.

The action area for the four components of the proposed Tongass Narrows project includes the maximum area within which project-related noise levels are expected to reach or exceed 120 dB re 1 µPa rms (henceforth 120 dB). The loudest sound source with the greatest propagation distance is anticipated to be associated with vibratory installation of 30-inch steel piles. Based on modeled sound propagation, received levels of underwater noise from vibratory pile driving with a source level of 166 dB re 10 µPa (Hotchkin 2023) are estimated to decline to 120 dB re 10 µPa (rms) at approximately 11.7 km from the source. However, the action area would be truncated where land masses obstruct underwater sound transmission (in this case, land masses on either side of Tongass Narrows and islands within Tongass Narrows); thus, the action area encompasses all of Tongass Narrows from the northeastern tip of Annette Island in Revillagigedo Channel to the south and northward to where Tongass Narrows opens into Clarence Strait. A description of the methods used to calculate the distance to the 120 dB isopleth to define the action area is given in Section 6.4.1 of this opinion.

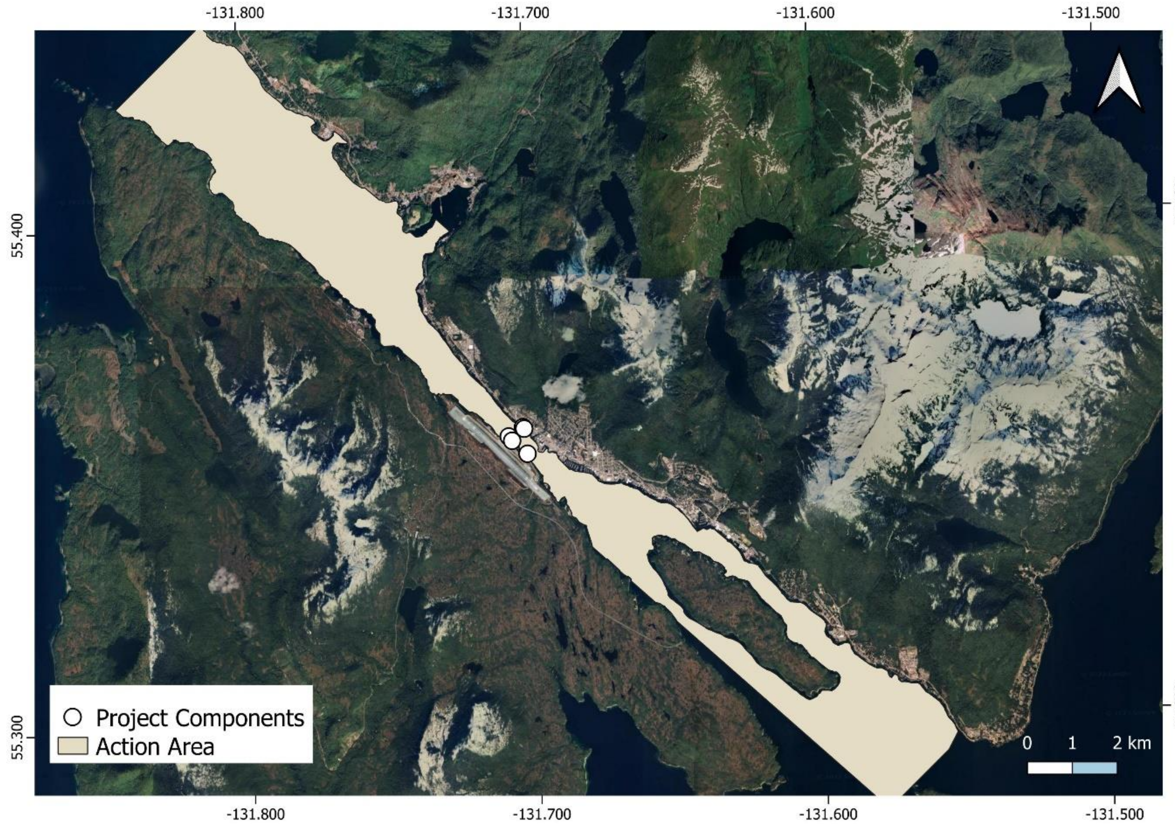

Figure 8. Action area for Tongass Narrows Project. The underwater action area extends approximately 11.7 km in each direction from the construction site.

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. Because there is no critical habitat in or near the action area, we do not consider adverse modification further in this biological opinion.

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 will result in a jeopardy biological opinion (51 FR 19926, 19934 (June 2, 1986)).

We use the following approach to determine whether the proposed action described in Section 2 is likely to jeopardize listed species:

- Identify those aspects (or stressors) of the proposed action that are likely to have direct or indirect effects on listed species. As part of this step, we identify the action area – the spatial and temporal extent of these direct and indirect effects.
- Identify the rangewide status of the species likely to be adversely affected by the proposed action. This section describes the current status of each listed species relative to the conditions needed for recovery. *Status of the Species* is discussed in Section 4 of this biological opinion.
- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The *Environmental Baseline* is discussed in Section 5 of this biological opinion.
- Analyze the effects of the proposed actions. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our exposure analyses). In this step of our analyses, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. The *Effects of the Action* are described in Section 6 and the *Exposure Analysis* is described in Section 6.4 of this biological opinion.
- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.5 of this biological 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 biological 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 *Rangewide Status of the Species and Critical Habitat* (Section 4). *Integration and Synthesis* with risk analyses are described in Section 8 of this biological opinion.

- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the *Integration and Synthesis* Section 8.
- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

4 Range-wide Status of the Species and Critical Habitat

ESA-listed marine mammal species under NMFS's jurisdiction that may occur in the action area include the threatened Mexico DPS humpback whale and fin whale. No critical habitat for any ESA-listed species occurs within the action area (Table 6).

Table 6. Listing status and critical habitat designation for marine mammals considered in this biological opinion.

Species	Status	Listing	Critical Habitat
Humpback whale, Mexico DPS *(Megaptera novaeangliae)*	Threatened	September 8, 2016 81 FR 62260	April 21, 2021 86 FR 21082
Fin whale (*Balaenoptera physalus*)	Endangered	December 2, 1970 35 FR 18319	n/a

4.1 Climate Change

Factors which affect the ocean, like temperature and pH can have direct and indirect impacts on marine mammals and the resources they depend upon. First, we provide background on the physical effects climate change has caused on a broad scale; then we focus on changes that have occurred in Alaska. Next, we provide an overview of how these physical changes translate to biological effects.

4.1.1 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 2020 was the second warmest year in the 141-year record, and global land and ocean surface temperatures increased +0.98°C (+1.76°F) over the 20th-century average[2]. The seven warmest years in the 1880–2020 record have all occurred since 2014, and the 10 warmest years have occurred since 2005[2].

The impacts of climate change are especially pronounced at high latitudes. 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). Although 2020 experienced its coldest year since 2012 in 2020[3], 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 7 years[4].

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).

A marine heat wave is 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).

[2] NOAA National Centers for Environmental Information webpage. Assessing the global climate in 2020. Available from https://www.ncei.noaa.gov/news/global-climate-202012, accessed January 3, 2022.
[3] NOAA National Centers for Environmental Information webpage. Assessing the U.S. Climate in 2020. Available at https://www.ncei.noaa.gov/news/national-climate-202012, accessed January 3, 2022.
[4] 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 January 3, 2022.
[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.

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 415 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).

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). 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 (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.

[6] NOAA Global Monitoring Laboratory website. Trends in Atmospheric Carbon Dioxide. Available at https://www.esrl.noaa.gov/gmd/ccgg/trends/, accessed January 3, 2022.

Some of the biological consequences of the changing ocean conditions are shown in Table 7.

Table 7. A summary of possible direct and indirect health effects for humpback whales 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 Loss of suitable habitat Change in prey base
Ocean acidification	Changes in prey base
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.
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.

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). Other typically subarctic species, such as humpback, minke, and fin whales, appear to be expanding their ranges to include higher latitudes in response to climate change (Brower et al. 2018).

4.2 Status of Listed Species

This biological opinion examines the status of the listed species that are likely to be adversely affected by the proposed action. For this action, the threatened Mexico DPS humpback whale and the endangered fin whale are the only listed species that we expect to be present in the action area. The statuses are determined by the level of extinction risk that these species face, informed by parameters considered in documents such as recovery plans, status reviews, and listing decisions which are incorporated largely by reference. This section also describes the species' population status and trend, distribution in southeast Alaska, distribution in the action area, and relevant threats.

The sections below provide a foundation for the exposure and response analyses in Sections 6.4 and 6.5 of this biological opinion. These analyses compared against the species' statuses and trends help us determine whether the action's direct or indirect effects are likely to increase the species' probabilities of extinction or failure to recover.

4.2.1 Humpback whale

The humpback whale (*Megaptera novaeangliae*) was listed as endangered under the ESCA on June 2, 1970 (35 FR 8491, baleen whales listing; 35 FR 18319, December 2, 1970, humpback whale listing). Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered. NMFS conducted a global status review that led to changing the status of humpback whales under the ESA and dividing the species into 14 distinct population segments (DPS) (81 FR 62260, September 8, 2016). Of these 14 DPSs, NMFS listed four as endangered, one as threatened, and delisted the remaining nine. Three DPSs occur in waters of Alaska. The Western North Pacific DPS is listed as endangered; the Mexico DPS is listed as threatened; and the Hawaii DPS is not listed (81 FR 62260, September 8, 2016).

The Hawaii DPS population is estimated to be 11,540 animals (CV=0.04) with an annual growth rate between 5.5 and 6.0 percent. The Mexico DPS is comprised of approximately 2,913 animals (CV=0.7; Wade 2021) with an unknown, but likely declining, population trend (81 FR 62260; September 8, 2016). Approximately, 1,084 animals (CV=0.09) comprise the Western North Pacific DPS (Wade 2021). Humpback whales in the Western North Pacific remain rare in some parts of their former range, such as the coastal waters of Korea, and have shown little sign of recovery in those locations.

Whales from these three DPSs overlap on feeding grounds off Alaska, and are visually indistinguishable unless individuals have been photo-identified on breeding grounds and again on feeding grounds. All waters off the coast of Alaska may contain ESA-listed humpbacks.

Humpback whales produce a variety of vocalizations ranging from 20 Hz to 10 kHz (Silber 1986; Richardson et al. 1995; Au 2000; Erbe 2002; Au et al. 2006; Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2018).

4.2.1.1 Southeast Alaska

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 Hawaii DPS (98 percent) and Mexico DPS (2 percent; Wade 2021)(Table 8). 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 et al. 1985; Straley 1990).

Table 8. Percent probability of encountering humpback whales from each DPS in the North Pacific Ocean (columns) in various summer feeding areas (Wade 2021).

Summer Feeding Areas	**North Pacific Distinct Population Segments (DPS) (percent)**			
	Western North Pacific (endangered)	**Hawaii (not listed)**	**Mexico (threatened)**	**Central America (endangered)**
Kamchatka	91	9	0	0
Aleutian I / Bering / Chukchi Seas	2	91	7	0
Gulf of Alaska	1	89	11	0
Southeast Alaska / Northern BC	**0**	**98**	**2**	**0**
Southern BC / WA	0	69	25	6
OR/CA	0	0	58	42
Note that in the past iteration of this guidance, upper confidence intervals were used for endangered DPSs. However, the revised estimates do not have associated coefficients of variation to cite. Therefore, the point estimate is being used for each probability of occurrence.				

Additional information on humpback whales is available at:

Humpback Whale Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-Large Whales

Humpback Whale Critical Habitat

4.2.1.2 Humpback Whale Critical Habitat

Critical habitat for the Mexico and Western North Pacific DPS humpback whales was designated May 21, 2021 (86 FR 21082, April 21, 2021; Figure 9). Critical habitat for the Western North Pacific DPS includes areas in the eastern Aleutian Islands, the Shumagin Islands, and around Kodiak Island. Critical habitat for the Mexico DPS includes those same areas plus the Prince William Sound area.

For the Mexico DPS, the physical and biological features associated with critical habitat include: prey species, primarily euphausiid zooplankton and small pelagic schooling fishes, such as Pacific sardines, northern anchovy, Pacific herring, capelin, juvenile walleye pollock and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

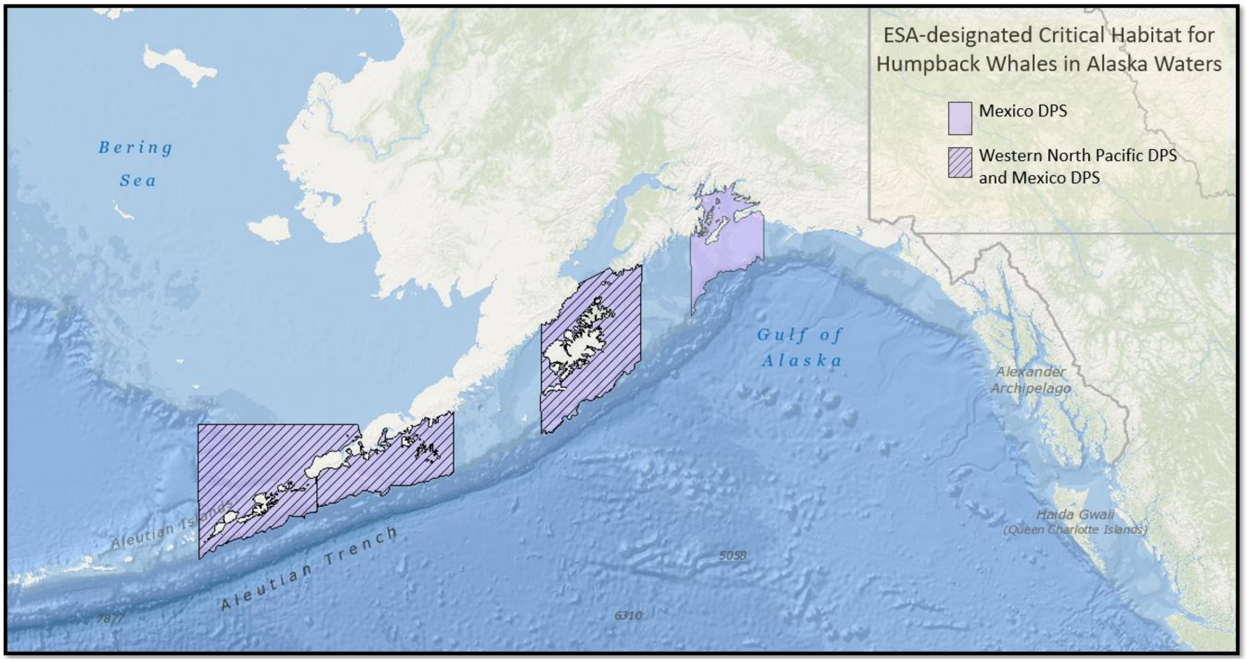

Figure 9. Critical habitat for Mexico DPS and Western North Pacific DPS humpback whales in waters off Alaska.

4.2.1.3 Humpback whales and critical habitat in the action area

Given their widespread range, relative abundance, opportunistic foraging strategies, and frequent near-shore occurrence, Mexico DPS humpback whales may occur year-round in low numbers in the vicinity of the Tongass Narrows Project. ADOT&PF has conducted 215 days of monitoring across two years during the first phase of this project and observed 80 humpback whales during that time (0.37 whale/day). The average group size observed was 1.25 whales and the maximum group size was four whales.[7] The City of Ketchikan Berth II Rock Pinnacle project reported one humpback whale sighting of one individual during the project (December 2019 - January 2020) (Sitkiewicz 2020). During the Ward Cove Cruise Ship Dock Construction, PSOs observed 28 sightings of humpbacks on eighteen days of in water work that occurred between February and September 2020, with at least one humpback being recorded every month. A total of 42 individuals were recorded and group sizes ranged from solo whales to pods of up to six animals (PSSA 2020). Humpbacks were recorded in each month of construction, with the most individuals (n=10) being recorded in May 2020. Based on these recent observations, we estimate that an average of one humpback whale per day may occur in the project vicinity.

There is no critical habitat in or near the action area (the nearest humpback whale critical habitat is about 1000 km away from the action area); therefore, critical habitat will not be considered further in this opinion.

[7] Monthly monitoring reports from ADOT&PF available from NMFS AKR.

4.2.2 Fin whale

The fin whale (*Balaenoptera physalus*) was decimated by commercial whaling in the 1800s and early 1900s. It was listed as an endangered species under the ESCA in 1970 (35 FR 8491, June 2, 1970 (baleen whales listing); 35 FR 18319, December 2, 1970 (fin whale listing)), and continued to be listed as endangered following passage of the ESA. Critical habitat has not been designated for fin whales.

Coastal and pelagic catch data from the first half of the twentieth century indicate that fin whales were not uncommon near Unalaska Bay and around Unalaska Island (Nishiwaki 1966; Reeves et al. 1985); however, fin whales have been documented infrequently around Unalaska Island since whaling ended (Stewart et al. 1987; Zerbini et al. 2006). High concentrations of fin whales are found around Kodiak Island, indicating the region's importance for foraging (Angliss and Outlaw 2007; Stafford et al. 2007; Ferguson et al. 2015; Rone et al. 2017; Brower et al. 2022). Five passive acoustic monitoring sites in the Gulf of Alaska recorded fin whales year-round with more calls at sites on or near the continental shelf compared to seamount sites in deeper water (Rice et al. 2021).

Fin whale sounds have increasingly been recorded during surveys in the eastern Chukchi Sea (67°–72°N, 157°–169°W) from July to October primarily over the continental shelf (Brower et al. 2018). During similar aerial surveys in 1982–1991, there was a complete lack of sightings of these whales (Brower et al. 2018). Fin whale sightings have been increasing during surveys conducted in the U.S. portion of the northern Chukchi Sea from July to October, and fin whale calls were recorded each year from 2007 to 2010 in August and September in the northeastern Chukchi Sea and August to October just north of the Bering Strait, suggesting they may be re-occupying habitat used prior to large-scale commercial whaling (Muto et al. 2020).

In 2012, a fin whale was recorded by a passive recorder located 50 km north of Utqiagvik, Alaska, which was approximately 280 and 365 km northeast of the previous closest acoustic detection, and confirmed visual sighting, of a fin whale, respectively (Crance et al. 2015). A passive recorder located in the southern Chukchi Sea from 2012 to 2015 documented fin whale songs from August to November (Furumaki et al. 2021).

Fin whales produce a variety of low-frequency sounds in the 10 Hz to 0.2 kHz range (Thompson et al. 1992; Rice et al. 2021). While there is no direct data on hearing in low-frequency cetaceans, the applied frequency range is expected to be between 7 Hz and 35 kHz (NMFS 2018). Estimates based on scans of a fin whale calf skull indicate the range of best hearing for fin whale calves to range from approximately 20 Hz to 10 kHz, with maximum sensitivities between 1 to 2 kHz (Cranford and Krysl 2015).

Additional information on fin whales is available at:

Fin Whale Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-Large Whales

2019 Status Review

4.2.2.1 Fin whales in the action area

Fin whales are typically found in deep water (Matsuoka et al. 2013; Rone et al. 2017) away from the immediate coast (Clarke et al. 2020); however, a fin whale was recently observed in the waters of Clarence Strait near the action area.[8] Fin whales are unlikely to occur in Tongass Narrows, but may infrequently be present in low numbers in the northern portion of the action area that extends into Clarence Strait.

5 Environmental Baseline

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

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

The project vicinity is an area of high human use and habitat alteration. Ongoing human activity in the action area that impacts marine mammals includes marine vessel activity, pollution, climate change, noise (e.g., aircraft, vessel, pile-driving, etc.), and coastal zone development.

5.1 Recent Biological Opinions for Projects in the Action Area

NMFS has issued a number of biological opinions and letters of concurrence for construction projects in Tongass Narrows in recent years including:

Ketchikan Berth IV Dock Upgrades (PCTS #AKR-2018-9764), Ketchikan Dock Company, July 2018.

Tongass Narrows (Gravina Access) Project (ECO # AKRO-2019-03432), Alaska Department of Transportation and Public Facilities, December 2019.

Berth II Rock Pinnacle Removal Project, (ECO # AKRO-2019-00553), City of Ketchikan, July 2019.

Ward Cove Cruise Ship Dock Letter of Concurrence, (ECO # AKRO-2019-03664), Power Systems and Supplies of Alaska (PSSA), January 2020.

[8] J. Scheurer, NMFS AKR, personal observation, April 2023.

City of Ketchikan Berth III Mooring Dolphins, (ECO #AKRO-2020-02183), February 2021.

NOAA Office of Marine and Aviation Operations Ketchikan Port Facility Recapitalization Project (ECO #AKRO-2021-02754), February 2022.

These biological opinions are available on the Environmental Consultation Organizer (ECO) Public Portal at https://appscloud.fisheries.noaa.gov/suite/?signin=native.

5.2 Marine Vessel Activity

The action area normally experiences high levels of marine vessel traffic with highest volumes occurring May through September. Marine vessels that use the action area include cruise ships, passenger ferries, commercial freight vessels/barges, commercial tank barges, U.S. Coast Guard vessels, commercial fishing boats, charter vessels, recreational vessels, kayaks, and floatplanes (USCG 2012).

Cruise ships are the largest vessels that routinely use the action area. At any given time during the summer (May–September), as many as six large cruise ships may be moored or at anchor in the Port of Ketchikan and Ward Cove. Cruise ship stops in Ketchikan have increased steadily since the 1990s except for a brief hiatus in 2020-2022 owing to the COVID-19 pandemic. Forty-six ships visited Ketchikan in 2019 with a total of 570 stops and more than 1.18 million passengers[9]. In 2023 cruise ship tourism is expected to exceed pre-COVID levels in Alaska and Ketchikan anticipates more than 500 cruise ship stops and approximately 1.6 million cruise ship passenger visitors this season (Weibold 2023). The length of the cruise ship season, size of ships, numbers of ships, numbers of stops, and numbers of passengers are all expected to increase in the future.

Two passenger ferries transport passengers across Tongass Narrows from the City of Ketchikan to the airport on Gravina Island year-round, 7 days a week, 16 hours a day, making up to 60 crossings of the channel each day. These vessels, the M/V *Ken Eichner 2* and the M/V *Oral Freeman*, are each 116 ft (35.4 m) long and are powered by twin diesel 850 hp motors. The airport ferries can carry up to 20 vehicles and 50–100 passengers at a time. Each crossing takes approximately 3.5 minutes at speeds averaging 5 kt and not exceeding 9 kt.[10]

The Alaska Marine Highway operates ferries year-round in Ketchikan, although the number of vessels, sailings, and ridership have decreased in recent years. Ketchikan used to receive ferry service seven days per week in the summer, and typically five to six days per week in the winter. Summer sailings have been reduced to six days per week in 2023 and the winter sailing schedule is not yet available.[11]

The waters of the Inside Passage support marine cargo transportation. According to automatic identification system passage-line data plots obtained from the Marine Exchange of Alaska, in 2011, 1,489 vessels moved north or south between Alaska and British Columbia. The data show

[9] Ketchikan Visitors Bureau Visitor Statistics. Available https://www.visit-ketchikan.com/en/Membership/Visitor-Statistics, accessed May 2023.
[10] Ketchikan Gateway Borough website (available at https://www.borough.ketchikan.ak.us/147/Airport-Ferry, accessed May 2023), and personal communication with Mike Carney, General Manager of Ketchikan International Airport (Dec. 2018).
[11] Alaska Marine Highway website. Available at https://www.dot.state.ak.us/amhs/, accessed May 2023.

that 288 vessels moved east or west between the Dixon Entrance and the Pacific Ocean during that year. Cargo ships calling at Prince Rupert dominated the east-west large vessel traffic. Cruise ships, tugs, and ferries dominated the north-south traffic (Nuka Research and Planning Group 2012). While an updated report is not currently available, NMFS assumes that marine cargo transportation has increased since 2011.

The Ketchikan Port & Harbors Department operates and maintains six boat harbors (Bar Harbor North, Bar Harbor South, Thomas Basin, Casey Moran, Knudson Cove, and Hole-In-The-Wall), the Port of Ketchikan (with four berths), and three launch ramps[12].

All of these sources of vessel traffic increase underwater noise and contribute to the risk of vessel-whale collisions.

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

- Most vessels that strike whales are less than 49 ft (15 m) long
- Most fatal vessel collisions occur at speeds over 13 knots
- Most collisions occur between May and September
- Calves and juveniles appear to be at higher risk of collisions than adult whales

Between 2016-2020, 18 ships strikes of humpback whales were documented in Alaska that resulted in mortality or serious injury (Freed et al. 2022). Of those, NMFS estimates that 0.4 Mexico/North Pacific stock humpback whales suffered from vessel strike in Southeast Alaska annually (Young et al. 2022). Four fin whale mortalities due to ship strikes in Alaska waters were reported between 2016-2020, and one of those was in Southeast Alaska (Freed et al. 2022).

NMFS implemented regulations to minimize harmful interactions between ships and humpback whales in Alaska (see 50 CFR §§ 216.18, 223.214, and 224.103(b)). See Section 2.2.8 *Strike Avoidance* for additional information. In addition to the approach regulations discussed above, some whale watching companies in the Ketchikan area participate in NMFS's Whale SENSE program, agreeing to practice additional precautions around whales. NMFS implemented Whale SENSE Alaska in 2015, a voluntary program developed in collaboration with the whale-watching industry that recognizes companies who commit to responsible practices. More information is available at https://whalesense.org.

Since 2011, cruise lines, pilots, NMFS, and National Park Service (NPS) biologists have worked together to produce weekly whale sightings maps to improve situational awareness for cruise ships and state ferries in Southeast Alaska. In 2016, NMFS and NPS launched Whale Alert, another voluntary program that receives and shares real-time whale sightings with controlled access to reduce the risk of ship strike and contribute to whale avoidance. More information is available at https://www.fisheries.noaa.gov/resource/tool-app/whale-alert.

The USCG published voluntary guidelines for all vessel types and operators in Tongass Narrows (USCG 2012). These guidelines are intended to enhance the safety of all persons operating

[12] City of Ketchikan, Port and Harbors. Available at https://www.ktn-ak.us/port-harbors, accessed May 2023.

vessels of any type on Tongass Narrows. Indirectly, these guidelines also protect the safety of facilities and structures within Tongass Narrows and may reduce the risk of vessel strikes of marine mammals.

Regulations at 33 CFR §162.240 establish a maximum speed limit of 7 knots for vessels over 23 feet in length overall within Tongass Narrows.

5.3 Fishery Interactions Including Entanglements

Entanglement of marine mammals in fishing gear and other human-made material is a major threat to their survival worldwide. Other materials also pose entanglement risks including marine debris, mooring lines, anchor lines, and underwater cables. While in many instances, marine mammals may be able to disentangle themselves (see Jensen et al. 2009), other entanglements result in sublethal and lethal trauma to marine mammals including increased energy expenditure, reduced fitness, reduced foraging, injury, and death and (van der Hoop et al. 2016).

The NMFS Alaska Marine Mammal Stranding Network database has records of 224 large whale entanglements between 2000 and 2020.[13] 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.

The minimum mean annual mortality and serious injury rate due to interactions with Southeast Alaska fisheries in 2016-2020 is 5.5 humpback whales. No incidental mortality or serious injury of fin whales due to interactions with fisheries in Alaska waters was reported to the NMFS Alaska Region marine mammal stranding network between 2014 and 2020 (Muto et al. 2022).

Commercial fisheries may indirectly affect whales by reducing the amount of available prey or affecting prey species composition.

5.4 Pollution

A number of contaminant discharges into marine waters have been reported within the action area including domestic, municipal, and industrial wastewater discharges such as graywater from cruise ships. Many of the historically contaminated sites are associated with underground storage tanks and their cleanups are listed as complete on the Alaska Department of Environmental Conservation's (ADEC) Contaminated Sites Database[14]. Contaminated sites exist within the project vicinity in proximity to the shoreline of Revillagigedo and Gravina Island. The ADEC Spills Database has records of 1,378 marine spills since 1995 that have occurred in Tongass Narrows, 67 of which occurred between 2020 and May 2020[15]. Spills generally consisted of

[13] NMFS Alaska Marine Mammal Stranding Network database, accessed November 5, 2020.
[14] ADEC Contaminated Sites website, available at https://dec.alaska.gov/spar/csp/, accessed May 16, 2023.
[15] ADEC Spills Database Search, available at https://dec.alaska.gov/applications/spar/publicmvc/perp/spillsearch, accessed May 16, 2023.

hydraulic oil, diesel, aviation fuel, gasoline, and engine lube/gear oil. Spills since 2020 were generally less than 1 gallon, but up to 125 gallons.

5.5 Climate Change

As discussed in Section 4.1, there is widespread consensus within the scientific community that atmospheric temperatures on earth are increasing. Recent studies and observations have shown changes in distribution (Brower et al. 2018), body condition (Neilson and Gabriele 2020), and migratory patterns[16] of humpback whales, likely in response to climate change. The indirect effects of climate change on Mexico DPS humpback whales over time would likely include changes in the distribution of ocean temperatures suitable for many stages of their life history, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

5.6 Coastal Zone Development

Coastal zone development results in the loss and alteration of nearshore marine mammal habitat and changes in habitat quality. Increased development may prevent marine mammals from reaching or using important feeding, breeding, and resting areas. The shoreline at the project site is highly developed, with man-made structures and impervious surfaces at the shoreline. Within and near the project area, there is little coastline area that has not been impacted by human development. There is moderate shoreline development on nearby Pennock and Gravina islands. The majority of the City of Ketchikan is located on Revillagigedo Island. Marine facilities include fish processing plants, small boat harbors, cruise ship and ferry terminals, float plane docks, a dry dock, shipyard, and other infrastructure. Ketchikan International Airport is located on Gravina Island.

5.7 In-Water Noise

Ambient underwater noise levels in Tongass Narrows range from 110-130 dB and fluctuate temporally, with levels at the highest during summer months (HDR 2018a; Reyff and Ambaskar 2023). Main sources of underwater background sounds originate from man-made sources such as coastal construction, seafood processing facilities, aircraft, upland vehicle traffic and vessels including recreational vessels, passenger ferries, commercial freight vessels/barges, cruise ships, charter vessels and commercial fishing vessels. Natural sounds consist of marine mammal and fish sounds and surface-generated wind and waves. During January and March 2023, Reyff and Ambaskar (2023) measured an overall median ambient sound level of 114 dB at the project site, with vessel traffic being the primary source of sound.

Because responses to anthropogenic noise vary among species and individuals within species, it is difficult to determine long-term effects to humpback and fin whales in the action area. Habitat abandonment due to anthropogenic noise exposure has been found in terrestrial species (Francis and Barber 2013). Clark et al. (2009) identified increasing levels of anthropogenic noise as a habitat concern for whales because of its potential effect on their ability to communicate (i.e., masking). Some research (Parks 2003; McDonald et al. 2006; Parks 2009) suggests marine mammals compensate for masking by changing the frequency, source level, redundancy, and

[16] Dr. Suzie Teerlink, National Marine Fisheries Service, Alaska Region, personal communication, February 9, 2021.

timing of their calls. However, the long-term implications of these adjustments, if any, are currently unknown.

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. This section identifies the stressors that may be produced by the proposed action. Based on our review of the IHA application (HDR 2023), personal communications, and available literature as referenced in this biological opinion, our analysis recognizes that the proposed action may cause these primary stressors:

- Underwater noise produced by impulsive and non-impulsive noise sources related to pile driving activities including vibratory pile installation and removal, impact pile driving, and down-the-hole drilling;
- Injury or disturbance due to vessel traffic or vessel noise;
- Disturbance to seafloor, marine mammal habitat, and marine mammal prey; and
- Pollution from unauthorized spills.

6.2 Stressors Not Likely to Adversely Affect ESA-listed Species

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

6.2.1 Vessel strike or disturbance

The possibility of vessel strike or measurable disturbance from vessels associated with the proposed action is extremely unlikely. The contractor has mobilized a crane and three floating barges within the project area that will be moved into location with a tugboat. Tug towing operations for construction occur at relatively low speeds (5 knots), and the maximum transit speed for tugs and barges is anticipated to be 8–10 knots. Once vessels arrive at the construction site, they are anchored. Skiffs transport workers very short distances and at low speeds from shore to the work platform(s). Upon completion of the project, one barge will be towed to Seattle via established shipping lanes and the other two barges will be towed to other locations in Ketchikan. All vessels associated with the project will follow well-established, frequently used navigation lanes within Tongass Narrows.

Between 2016 and 2020 the minimum mean annual mortality and serious injury rate due to ship strikes reported for humpback whales in Southeast Alaska was 1.75 whales (Muto et al. 2022). Of the 98 confirmed vessel strike reports to the NMFS Alaska Region Marine Mammal Stranding Program between 2000 and 2022, 82 involved humpback whales, and 85% were reported to have occurred in Southeast Alaska (Trifari et al. *In prep.*).

Following construction of the project, levels of vessel traffic between Revillagigedo and Gravina islands will remain about the same. There is potential for increased passenger load in the future, but the primary purpose for the new ferry berths is provide a backup berthing facility on either side of the channel in case a berth becomes damaged or inaccessible, not to increase the number of vessel crossings or passengers. The two existing passenger ferries will continue to provide multiple daily trips across the channel, where collision with or disturbance to humpback whales is possible, but unlikely.

Vessel activity is common throughout the action area. Most ship strikes of large whales occur when vessels are traveling at speeds of 10 knots or more (Laist et al. 2001; Jensen and Silber 2004). Because the ferries travel at speeds averaging 5-6 knots, it is unlikely that a ferry will collide with a humpback whale. Vessel activity in Tongass Narrows is a regular and almost constant occurrence. Humpback whales have become accustomed to vessel traffic and continue to use marine waters in the action area, including in Tongass Narrows. Fin whales have not been observed within Tongass Narrows. A potential small increase in airport ferry vessel activity in the future, particularly in an area with existing high levels of vessel activity, will not significantly increase the potential for vessel strikes of humpback whales or fin whales.

Vessel disturbance or strikes on humpback or fin whales are not expected because 1) commercial and recreational vessels are common in the action area; 2) humpbacks are infrequently present in the action area and those present are likely accustomed to regular vessel traffic; 3) vessels associated with the project are primarily slow-moving tugboats and barges and small skiffs for transporting workers; 4) airport ferry vessel traffic is not expected to increase substantially once the project is completed; 5) airport ferries using the new and existing berths will transit at speeds averaging 5-6 knots and not exceeding 9 knots, slow down when whales are present, and announce over the radio to alert other mariners when whales are present [17]; 6) fin whales are extremely unlikely to be present in the busy portion of the action area within Tongass Narrows; and 7) vessels will follow NMFS's regulations that prohibit approaching within 100 yards of humpback whales. All of these factors limit the risk of disturbance and strike. We conclude the anticipated effects of strike are unlikely to occur and any effects from disturbance are expected to be negligible.

6.2.2 Vessel noise

Tongass Narrows near Ketchikan is a busy industrial port with median background noise levels ranging from 110-130 dB (HDR 2018a; Reyff and Ambaskar 2023), and much of that noise is from vessels. Vessel noise transmitted through water is a continuous (non-impulsive) noise source. Broadband source levels for tugs and barges have been measured at 145 to 170 dB re 1 µPa-m @ 1 m, and 151 to 152 dB re 1µPa-m @ 1m for small vessels with outboard motors (Richardson et al. 1995). Sound from vessels within this size range would reach the 120 dB threshold at distances between 46 and 2,154 m (151 and 7,067 feet) from the source[20].

Vessel noise associated with this action will be minimal because most work will be conducted from anchored barges and work platforms. Workers will be transported to and from these platforms by skiffs traveling only short distances from shore and at slow speeds.

NMFS anticipates minimal low-level exposure of short-term duration to listed humpback and fin whales from vessel noise related to this action. If whales are exposed and do respond, they may exhibit slight deflection from the noise source and engage in low-level avoidance behavior, short-term vigilance behavior, or short-term masking behavior, but these behaviors are not likely to result in adverse consequences for the whales. The nature and duration of response is not anticipated to be a significant disruption of important behavioral patterns such as feeding or resting. The action area is not considered high quality habitat for humpback or fin whales, so slight avoidance of the area is not likely to adversely affect them. The few vessels involved in the construction portion of the action will travel only short distances at slow speeds. Additionally, the infrequent occurrence of humpback whales and rare occurrence of fin whales in the action area, adherence to the mitigation measures, and vessels following the Alaska Humpback Whale Approach Regulations and Marine Mammal Code of Conduct should minimize close approaches and exposure to noise from vessels related to this action. The impact of vessel noise on Mexico DPS humpback whales and fin whales is therefore determined to be minimal.

6.2.3 Disturbance to seafloor

During pile installation and removal activities, in particular rock socketing, a temporary and localized increase in turbidity and sedimentation near the seafloor is possible in the immediate area surrounding each pile. Mud and other substrates that accumulate inside the pile will be augered out and allowed to settle close to the base of the pile. In general, turbidity associated with pile installation is expected to be localized to about a 25-ft radius around the pile (Everitt et al. 1980).

[17] Personal communication with Mike Carney, Ketchikan International Airport General Manager, December 21, 2018.

Considering local currents, tidal action, and implementation of best management practices, any potential water quality exceedances would likely be temporary and highly localized. The local tides and currents would disperse suspended sediments from pile installation and removal and excavation and fill activities at a moderate to rapid rate depending on tidal stage.

Humpback and fin whales are not expected to come close enough to the Tongass Narrows Project sites to encounter increased turbidity from construction activities, and if they do, any impact from increased turbidity levels would be negligible and would not cause a disruption of behavioral patterns that would rise to the level of harassment. Therefore, we conclude that the effects from this stressor are so small that they are not measurable, i.e., they are negligible.

6.2.4 Introduction of pollutants into waters

An SPCC Plan, HMCP, WQCP, Construction General Permit, and other Best Management Practices (as described in Section 2.3 of this opinion) will be implemented during construction to prevent contaminants from entering the water column. Plans are in place and materials available for spill prevention and cleanup activities at the marine terminal to limit potential contamination. 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 humpback whales would be immeasurably small. Therefore, we conclude that the effects from this stressor are negligible.

6.2.5 Overwater shading and effects to prey

Completion of the remaining four in-water components of the Tongass Narrows Project would result in a net increase of approximately 25,000 square feet of overwater shading. This may result in a small, localized reduction in habitat and productivity for benthic invertebrate resources in the project footprint due an increase in shading beneath the new and expanded docks. However, prey habitat in the vicinity of the Tongass Narrows Project has been subjected to prior development and disturbance and the effects of a slight increase in overwater shading are expected to have minimal impacts on prey resources. Indirect effects to prey would be too small to detect or measure due to the small area affected, and effects to humpback or fin whales would be negligible.

6.2.6 Loss of marine mammal habitat

The Tongass Narrows Project will occur within the same footprint of existing marine infrastructure. This area is already extensively developed and is not considered important habitat for feeding, resting, reproduction, or other important life functions of humpback whales. No new fill is planned for this phase of the project; therefore further modification of this habitat is not likely and is not expected to have an effect on humpback or fin whale distribution or habitat use. Effects to humpback and fin whales from the loss of habitat would be too small to detect or measure due to the small area affected.

6.2.7 Indirect effects of increasing accessibility of Gravina Island

Two of the goals of the Tongass Narrows Project are to improve access to developable land on Gravina Island and facilitate economic development in the Ketchikan Gateway Borough, specifically on Gravina Island. Development on Gravina Island may increase the demand for passenger ferries between Revillagigedo and Gravina islands, but the borough does not currently have plans to increase the number of daily ferry crossings[17].

The City of Ketchikan anticipates an increase in the number of cruise ship passengers that visit Ketchikan annually. This may also increase the demand for ferries between the islands, so that cruise ship passengers may access the airport, but again, the borough does not currently have plans to increase the number of daily ferry crossings.

To meet the demands of increased development on Gravina Island and increasing numbers of visitors to Ketchikan, NMFS expects that other types of marine vessel traffic (e.g., float planes, charter fishing vessels, whale watching vessels, ferries, etc.) will increase. An overall increase in vessel traffic could affect listed humpback and fin whales through increased noise, harassment, risk of vessel strike, displacement, exposure to pollution, etc.; however, the incremental effects of an increase in other types of vessel traffic in an already busy area would likely have no effect on the fitness of humpback and fin whales because they are uncommon to rare in the action area and the area is not an important habitat for either species.

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

In conclusion, based on review of available information, we determined effects from vessel strike and disturbance are extremely unlikely to occur. We consider the effects to Mexico DPS humpback whales and fin whales to be negligible.

We determined vessel noise associated with the action is not likely to have measurable impact; therefore, we consider the effects to Mexico DPS humpback whales and fin whales to be negligible.

We determined disturbance to seafloor, introduction of pollutants, overwater shading and effects to prey, and loss of habitat are not likely to have measurable impact; therefore, we consider the effects to Mexico DPS humpback whales and fin whales to be negligible.

We determined that the incremental effects of increased accessibility of Gravina Island to Mexico DPS humpback whales and fin whales to be negligible.

Although these stressors are not likely to adversely affect listed species, the effects of these stressors are considered and addressed in the *Integration and Synthesis* portion of the opinion.

6.3 Stressors Likely to Adversely Affect ESA-listed Species

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

6.3.1 Description of sound sources

The marine soundscape is comprised of both ambient (naturally-produced) and anthropogenic sounds. Ambient sound is defined as the all-encompassing sound in a given place and is usually a composite of sound from many sources both near and far (ANSI 1995). 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).

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise "ambient" or "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. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson 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 form a distinctive signal that may affect marine mammals.

In-water construction activities associated with the project would include impact pile driving, vibratory pile driving and removal, and use of DTH equipment. 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 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; 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 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). We note that DTH drilling has characteristics of both impulsive and non-impulsive sound.

Three types of hammers would be used on this project: impact, vibratory, and DTH. 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 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 et al. 2005).

A DTH hammer is essentially a drill bit that drills through the bedrock using a rotating function like a normal drill, in concert with a hammering mechanism operated by a pneumatic (or sometimes hydraulic) component integrated into to the DTH hammer to increase speed of progress through the substrate *(*i.e., it is similar to a "hammer drill" hand tool). The sounds produced by the DTH method contain both a continuous non-impulsive component from the drilling action and an impulsive component from the hammering effect (Denes 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.

6.3.2 Acoustic thresholds

ADOT&PF intends to conduct construction activities that would introduce underwater noise into the marine environment that may result in disturbance to listed species.

Since 1997 NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871, 1872). NMFS recently developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent threshold shifts (PTS: Level A harassment) and temporary threshold shifts (TTS; Level B harassment) (81 FR 51693). 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[18], expressed in root mean square[19] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA:

impulsive sound: 160 dB re 1 μPa_{rms}

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

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (NMFS 2018). These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (L_E) and peak sound level (pk) for impulsive sounds and L_E for non-impulsive sounds (Table 7):

Table 9. Summary of PTS onset acoustic thresholds for Level A harassment (NMFS 2018).

Hearing Group	**PTS Onset Thresholds* (Received Level)**	
	Impulsive	**Non-impulsive**
Low-Frequency (LF) Cetaceans	*Lp*,0-pk,flat: 219 dB *L*E,*p*, LF,24h: 183 dB	*L*E,*p*, LF,24h: 199 dB
Mid-Frequency (MF) Cetaceans	*Lp*,0-pk,flat: 230 dB *L*E,*p*, MF,24h: 185 dB	*L*E,*p*, MF,24h: 198 dB
High-Frequency (HF) Cetaceans	*Lp*,0-pk,flat: 202 dB *L*E,*p*,HF,24h: 155 dB	*L*E,*p*, HF,24h: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Lp*,0-pk.flat: 218 dB *L*E,*p*,PW,24h: 185 dB	*L*E,*p*,PW,24h: 201 dB

[18] 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.

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

Hearing Group	PTS Onset Thresholds* (Received Level)	
	Impulsive	Non-impulsive
Otariid Pinnipeds (OW) (Underwater)	$L_{p,0\text{-pk,flat}}$: 232 dB $L_{E,p,OW,24h}$: 203 dB	$L_{E,p,OW,24h}$: 219 dB

* Dual metric 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 are recommended for consideration.

Note: Peak sound pressure level ($L_{p,0\text{-pk}}$) has a reference value of 1 μPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1μPa^{2}s. In this Table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kHz). 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 weighted 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 thresholds will be exceeded.

The MMPA, as well as applicable regulations at 50 CFR § 216.3, define "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, but which does not have the potential to injure a marine mammal or marine mammal stock in the wild [Level B harassment].

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 the purposes of this consultation, any incidental harassment of listed species under the MMPA—whether Level A or Level B—constitutes an incidental take under the ESA and must be authorized by the Incidental Take Statement (see Section 10).

As described below, we anticipate that exposures to listed marine mammals from noise associated with the proposed action may result in disturbance (Level B harassment) and potential injury. With the addition of mitigation measures (including shutdown zones), no mortalities or permanent impairment to hearing are anticipated.

6.4 Exposure Analysis

As discussed in the *Approach to the Assessment* section of this biological 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 2.2 above, ADOT&PF proposed mitigation measures that should avoid or minimize exposure of Mexico DPS humpback whales and fin whales to stressors from the proposed action.

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

6.4.1 Ensonified area

This section describes the operational and environmental parameters of each construction activity that allow NMFS to estimate the area ensonified above the acoustic thresholds, including source levels and transmission loss coefficients, based on only a single construction activity occurring at a time.

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

ADOT&PF proposed proxy sound source levels (SPLs) in their IHA application that, with one exception, were not deemed suitable for this project. To determine appropriate proxy SPLs for impact and vibratory pile driving of all pile types, NMFS completed a comprehensive review of source levels relevant to Southeast Alaska to generate regionally specific source levels (Hotchkin 2023). All available data from Puget Sound and Southeast Alaska were compiled, and adjusted to account for distance and noise-attenuation devices. Average source levels were then calculated for each project and for each pile type. Impact pile driving project averages were weighted by the number of strikes per pile and values averaged. The source levels for these various pile types, sizes, and methods are listed in Table 10. NMFS agrees to use the 24-inch sound source values for any impact or vibratory pile driving of 14-inch H-piles proposed by ADOT&PF, because the source value of smaller piles of the same general type (steel in this case) are not expected to exceed a larger pile.

Table 10. Estimates of mean underwater sound levels generated during vibratory and impact pile installation, DTH, and vibratory pile removal.

Pile Type	RMS SPL (dB re 1 μPa)	SEL_{ss} (dB re 1 μPa ^{2} sec)	Peak SPL (dB re 1 μPa)	References	TL coefficient[2]
Vibratory Hammer					
30-inch steel piles	166	NA	NA	Hotchkin 2023	15
24-inch steel piles	163	NA	NA	Hotchkin 2023	15
[3]Steel 14" H-piles	163	NA	NA	24-inch as proxy	15
DTH of Rock Sockets and Tension Anchors – Continuous					
24-inch (Rock Socket)	167	NA	NA	Heyvaert & Reyff 2021; Reyff and Ambaskar 2023	19.5
8-inch DTH (Tension Anchor)	156	NA	NA	Reyff & Heyvaert 2019; Reyff 2020; Reyff and Ambaskar 2023	17.1
Impact Hammer					
30-inch steel piles	195	183	210	Hotchkin 2023	15
24-inch steel piles	190	177	203	Caltrans 2015, Caltrans 2020	15
[3]Steel 14" H-piles	190	177	203	24-inch as proxy	15
DTH of rock sockets and tension anchors - Impulsive					
24-inch (Rock Socket)	NA	159	184	Heyvaert & Reyff 2021; Reyff and Ambaskar 2023	19.9
8-inch (Tension anchor)	NA	144	170	Reyff 2020; Reyff and Ambaskar 2023	17.1

[1] Many values proposed in this table differ from those proposed in the DOT&PF's application for reasons discussed in the notice text
[2] NMFS recommends a default transmission loss of 15*log10(R) when site-specific data are not available (NMFS 2020; NMFS 2022). Site-specific transmission loss coefficients are described in Reyff and Ambaskar (2023).
[3]14-inch H piles will uses 24-inch piles as a conservative proxy.
Note: 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, measures underwater SPL.; dB re 1 μPa2-sec = dB referenced to a pressure of 1 microPascal squared per second, measures underwater SEL.

NMFS developed a spreadsheet tool[20] to help implement the 2018 Technical Guidance (NMFS 2018) that incorporates the duration of an activity into the estimation of a distance to the Level A isopleth. This estimation can then be used in conjunction with marine mammal density or

[20] User spreadsheet tool (version 2.2) and instruction manual available at https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance, accessed January 26, 2021.

occurrence to help predict takes. NMFS notes that because of some of the assumptions included in the methods used for these tools, the isopleths estimated may be overestimates, and the resulting estimate of Level A take almost certainly overestimates the number of whales that actually experience PTS if they should cross the Level A isopleth for fairly brief amounts of time. However, these tools offer the best available way to conservatively predict appropriate isopleths until more sophisticated modeling methods are widely available. NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources such as impact driving, vibratory driving, and DTH pile installation, the NMFS User Spreadsheet predicts the distance at which a marine mammal would incur PTS if it remained at that distance for the duration of the activity. Inputs used in the User Spreadsheet are shown in Table 11, and the resulting Level A and Level B isopleths are shown in Table 12.

Level A harassment thresholds for impulsive sound sources (impact pile driving and DTH) are defined for both cumulative SEL (SEL_{cum}) and Peak SPL with the threshold that results in the largest modeled isopleth for each marine mammal hearing group used to establish the Level A harassment isopleth. In this project, Level A harassment isopleths based on SEL_{cum} were always larger than those based on Peak SPL. It should be noted that there is a duration component when calculating the Level A harassment isopleth based on SEL_{cum}, and this duration depends on the number of piles that would be driven in a day and strikes per pile. For some activities, ADOT&PF has proposed to drive variable numbers of piles per day throughout the project. ADOT&PF would determine at the beginning of each pile driving day the maximum number of piles or duration of pile driving for that day. To incorporate this flexibility, we calculated level A zones for different durations of pile driving or numbers of daily piles to be driven (Table 12).

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

ADOT&PF's proposed construction activity for the Tongass Narrow Project includes the use of non-impulsive and impulsive sources, and therefore the 120 and 160 dB re 1 μPa RMS thresholds for Level B behavioral harassment are applicable.

Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$$TL = B * \text{Log10}(R1/R2), \text{ where}$$

TL = transmission loss in dB

B = transmission loss coefficient; for practical spreading equals 15

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

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

Absent site-specific acoustical monitoring with differing measured transmission loss, a practical spreading value of 15 is used as the transmission loss coefficient in the above formula. Site-specific transmission loss data for the Tongass Narrows are not available for vibratory pile installation and removal and impact pile driving; therefore, the default coefficient of 15 is used to determine the distances to the Level A harassment and Level B harassment thresholds for these activities and associated pile types. In the case of DTH activities, ADOT&PF conducted sound source verification studies (SSV) at the project site that provides data to support site-specific TLs for DTH of 24-inch rock sockets and 8-inch tension anchors (Reyff and Ambaskar 2023). NMFS agrees to use the most conservative transmission loss values measured for each pile type at this project site (Table 10).

Using the practical spreading model, ADOT&PF determined underwater noise would fall below the Level B threshold of 120 dB RMS for marine mammals at a maximum radial distance of 11,659 m for vibratory installation or removal of 30-inch piles. This distance determines the maximum Level B harassment zone for the project. Other activities, including DTH and impact pile driving, have smaller Level B harassment zones. All Level B harassment isopleths are reported in Table 12 below. It should be noted that based on the geography of Tongass Narrows and the surrounding islands, sound will not reach the full distance of the Level B harassment isopleth in most directions. Generally, due to interactions with land, only a thin slice of the possible area is ensonified to the full distance of the Level B harassment isopleth.

Table 11. User Spreadsheet (version 2.2)[20] input parameters for pile driving activities for calculating Level A and Level B isopleths. All calculations use a standard transmission loss value of 15 except DTH which used site-specific measurements of Reyff and Ambaskar (2023). (RMS values are reported in units of dB re 1 µPa @ 10 m and SEL values are reported in dB re 1 µPa ^{2} sec @ 10 m).

Activity	**Vibratory Pile Driving**		**DTH**		**Impact**	
Pile Size (all are steel)	30-in	24-in or H-pile	Rock Socket (24-in)	Tension Anchor (8-in)	30-in	24-in or H-pile
Installation or Removal	Installation and Removal	Installation and Removal	Installation	Installation	Installation	Installation
Spreadsheet Tab Used	A.1) Vibratory Pile Driving	A.1) Vibratory Pile Driving	E.2) DTH Pile Driving	E.2) DTH Pile Driving	E.1) Impact Pile Driving	E.1) Impact Pile Driving
Source Level (SPL)	166 RMS	163 RMS	167 RMS, 159 SEL	156 RMS, 144 SEL	183 SEL	177 SEL
Transmission Loss Coefficient	15	15	19.5, 19.9	17.1, 17.1	15	15
Weighting Factor Adjustment (kHz)	2.5	2.5	2	2	2	2
Activity Duration (hours) within 24 hours	*0.5 - 6	*0.5 - 8	1 - 8	1 - 8		
Strike rate strike per second	-	-	10	19		
Number of strikes per pile	-	-	-	-	50 (temporary); 200 (permanent)	50 (temporary); 200 (permanent)
Number of piles per day	1-6	1-8	1	1	1-3	1-3
Distance of sound pressure level measurement	10	10	10	10	10	10

Table 12. Calculated distances to Level A and Level B isopleths for low-frequency cetaceans by type and duration of pile driving activity.

Activity	Pile Diameter (inches)	Max. Daily Duration or # of Piles *	Level A Harassment Isopleth (m)	Level B Harassment Isopleth (m)
Vibratory Installation or Removal	30	≤360	48.6	11,659
	24 or 14	≤480	37.1	7,356
DTH (Rock Socket)	24	≤120	210.3	2,572
		121 - 180		
		181 - 480	344.3	
DTH (Tension Anchor	8	≤480	118.7	1,274
Impact, 200 strikes	30	1	542.1	2,154
		2		
		3	710.4	
	24 or 14	1	136.0	1,000
		2	282.8	
		3		
Impact, 50 strikes	24 or 14	1 - 3	112.2	1,000

6.4.2 Estimating humpback whale occurrence and exposure

In this section we provide the information about the presence, density, or group dynamics of humpback whales that informed the take calculations.

Humpback whales occur frequently in Tongass Narrows during summer and fall months to feed, but are less common during winter and spring. As described in Section 4.2.1.3 *Humpback whales and critical habitat in the action area*, for the proposed project, NMFS estimates one whale may be present in the action area each day.

Based on the expected local occurrence of one whale per day, with 131 expected days of project-related construction noise, we expect a maximum of 131 exposures of humpback whales to noise that would cause Level B harassment.

As described in Section 4.2.1.1, an estimated 2 percent of humpback whales in Southeast Alaska are from the Mexico DPS (Wade 2021). Therefore, of the 131 instances of Level B harassment due to ADOT&PF in-water construction activities, we expect that 2 percent of these exposures (2.62 rounded to 3) would be ESA-listed Mexico DPS humpback whales, and the remaining exposures would be from the non-listed Hawaii DPS.

6.4.3 Estimating fin whale occurrence and exposure

In this section we provide the information about the presence, density, or group dynamics of fin whales that informed the take calculations.

Fin whales have not been recorded in Tongass Narrows, but were recently observed in spring 2023 in Clarence Strait near the northern entrance of Tongass Narrows. As described in Section 4.2.2.1 *Fin whales in the action area*, for the proposed project, fin whales are expected to rarely occur in the Clarence Strait portion of the action area. NMFS estimates two whales may be present during the duration of the project that might be exposed to Level B harassment.

6.4.4 Exposure analysis conclusions

ADOT&PF requested no authorization for serious injury or mortality or take by Level A harassment because these large whales can be effectively detected and monitored and work can be halted before whales enter the Level A shutdown zone when they are present. The largest Level A zone to be monitored is 710 m, and multiple PSOs will monitor Tongass Narrows to ensure that no humpback or fin whales approach or enter the Level A shutdown zone undetected. Humpback and fin whales are usually readily visible; therefore, shutdown measures can be implemented prior to any humpback or fin whales entering Level A shutdown zones.

Table 13. Amount of proposed incidental harassment (takes) of Mexico DPS humpback whales and fin whales from ADOT&PF pile driving activities. Take estimates are rounded to the nearest whole number.

Species	Proposed Authorized Level A Takes	Proposed Authorized Level B Takes
Mexico DPS humpback whale	0	3
Fin whale	0	2

Temporarily elevated underwater noise during pile driving activities has the potential to result in Level B (behavioral) harassment of marine mammals. Level A harassment (resulting in injury) is not expected to occur as a result of the proposed action because shutdown zones will be implemented and the mitigation measures proposed in Section 2.3 will reduce the potential for exposure to levels of underwater noise above the injury threshold established by NMFS.

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

Exposure Assumptions

- A whale occurring within the Level A ensonified zone during pile driving activities would only be counted as Level A take, not both Level A and Level B take, even though the Level A zone is within the Level B zone.

- Exposures are based on total number of days that pile driving activities could occur when whales might occur in the ensonified zone.
- All humpback and fin whales occurring in the portion of the action area that is ensonified to levels that are expected to cause harassment during pile driving activities are assumed to be incidentally taken (i.e., exposures to sound levels at or above the relevant thresholds equate to take).
- An individual whale can only be taken once during a 24-hour period.
- For whales that may occur in groups, each individual in the group exposed to levels of sound capable of causing harassment would be considered taken.
- Level B exposure estimates are unmitigated and do not take into account monitoring and mitigation efforts to reduce take as described in Section 2.2.
- The percentage of humpback whale exposures that is estimated to be from the threatened Mexico DPS (2 percent) is based on the percentages reported in Wade (2021).

6.5 Response Analysis

As discussed in the *Approach to the Assessment* section of this biological opinion, response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (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.

Loud underwater noise can result in physical effects on the marine environment that can affect 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 Responses
  - Temporary or permanent hearing impairment (threshold shifts)
  - Non-auditory physiological effects
- Behavioral responses
  - Auditory interference (masking)
  - Tolerance or habituation
  - Change in dive, respiration, or feeding behavior
  - Change in vocalizations
  - Avoidance or displacement
  - Vigilance
  - Startle or fleeing/flight

6.5.1 Responses to major noise sources (pile driving/removal activities)

As described in the *Exposure Analysis*, Mexico DPS humpback whales are expected to occur in the action area and are anticipated to overlap with noise associated with pile installation and removal activities. Fin whales are unlikely to occur, but may occur in the action area and may overlap with project associated noise. 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 2.3, we do not anticipate that any Mexico DPS humpback whales or fin 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 three exposures of Mexico DPS humpback whales and two exposures of fin whales to noise levels sufficient to cause Level B harassment, as described in Section 6.4.2. All level B instances of take are anticipated 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&PF'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 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 et al. 2003; Southall et al. 2007). Here we discuss physical auditory effects (threshold shifts) followed by behavioral effects.

6.5.1.1 Threshold Shifts

NMFS defines a noise-induced threshold shift (TS) as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). In other words, a threshold shift is a hearing impairment and may be temporary (such as ringing 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 et al. 2014), and 7) the overlap between the animal and the sound source (e.g., spatial, temporal, and spectral).

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 describe TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in (Southall et al. 2007).

For 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 mild and temporary and not likely to affect the long term fitness of the affected individuals.

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 37 m to 710 m. The shutdown zones to be implemented are larger than the calculated isopleths to ensure that no humpback whales are exposed to noise levels that could cause PTS or other Level A disturbance. No exposures are anticipated at levels resulting in PTS due to conservative estimates of Level A isopleths and mitigation measures to shut down pile driving activities if a humpback whale or fin whale approaches a Level A zone.

6.5.1.2 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 et al. 2006; Southall 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 et al. 2003; Lankford et al. 2005; Crespi et al. 2013). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano et al. 2002) and, more rarely, studied in wild populations (Romano et al. 2002). For example, 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 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 131 individuals) and fin whales (no more than 2 individuals) may experience TTS and may experience non-auditory physiological effects from project activities. Of the affected whales, we expect that no more than three humpback whales 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 whales would leave the ensonified areas to avoid excessive noise and avoid stress. If whales 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.

6.5.1.3 Behavioral Disturbance Reactions

Behavioral responses are influenced by an animal’s assessment of whether a potential stressor poses a threat or risk. Behavioral responses may include: changing durations of surfacing and dives, number of blows per surfacing, or 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).

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995; NRC 2003; Wartzok et al. 2003).

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

6.5.1.4 Auditory Masking

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

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

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

6.5.2 Response analysis summary

Humpback and fin 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 humpback and fin whales 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. Tongass Narrows has not been identified as important foraging habitat for humpback or fin whales, and the proposed activities are not expected to displace foraging whales. Because humpback and fin whales 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 and their probable exposures to noise sources are not likely to reduce their fitness. .

7 Cumulative Effects

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

Some continuing non-Federal activities are 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).

The Tongass Narrows Project is intended to increase the accessibility of Gravina Island and development on the island, which may increase vessel traffic between Gravina and Revillagigedo islands. Tourism and community development are expected to continue, likely increasing the demands for transportation, goods, and services. Tongass Narrows will continue to function as the main transportation corridor for the City of Ketchikan and surrounding communities. We do not expect the cumulative effects of these activities to hinder population growth of Mexico DPS humpback whales or fin whales.

8 Integration and Synthesis

This section is the final step of NMFS's assessment of the risk posed to listed species 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 result in appreciable reductions in the likelihood of the survival or recovery of the species in the wild by reducing its numbers, reproduction, or distribution. These assessments are made in full consideration of the *Status of the Species* (Section 4).

As discussed in the *Approach to the Assessment* (Section 3) section of this biological 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.

Based on the results of the exposure and response analyses, we expect a maximum of 131 instances of Level B harassment of humpback whales by noise from pile driving activities (impact, vibratory, and DTH), and 2 percent (3 individuals) of those instances of harassment of humpback whales are anticipated to affect whales from the threatened Mexico DPS. We expect no more than 2 instances of Level B harassment of fin whales by noise from pile driving activities. 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 Tongass Narrows, and the unlikelihood of these type of interactions. Disturbance to seafloor, habitat, and prey resources are not expected to adversely affect humpback or fin whales because these disturbances are temporary, and the action area is not important habitat to humpback or fin 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 and fin 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. Most Mexico DPS humpback whales that feed in Southeast Alaska in the summer and fall months 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.

Similarly, fin whales are very rare in the action area and it is unlikely that action overlaps in space or time with their breeding. Therefore, the probable responses to pile driving and removal noise are not likely to reduce the current or expected future reproductive success of fin 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 and fin whales at a level comparable to present. The current and recent population trends for fin and 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 or fin whales. As a result, this project is not likely to appreciably reduce Mexico DPS humpback whales' or fin whales' likelihood of surviving or recovering in the wild.

9 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mexico DPS of humpback whale or fin whale.

10 Incidental Take Statement

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. NMFS extended all the prohibitions of section 9 to threatened Mexico DPS humpback whales and endangered fin whales through a rule issued pursuant to ESA section 4(d) (81 FR 62260, 62314; September 8, 2016). "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. 16 USC § 1532(19). "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR §402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (1) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (2) 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, NMFS anticipates that any take will be by Level B harassment only. No serious injury, mortality, or Level A takes are contemplated or authorized. This ITS is valid only for the activities described in this biological opinion that have a federal nexus, and which have been authorized under section 101(a)(5) of the MMPA.

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. Absent such authorization, this ITS is inoperative.

The terms and conditions described below are nondiscretionary. The ADOT&PF and OPR have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, the ADOT&PF and OPR must monitor and report the progress of the action and its impact on the species as specified in the ITS (50 CFR §402.14(i)(3)). If the ADOT&PF or OPR fail to require the authorization holder to adhere to the terms and conditions of the ITS through enforceable terms that are added to the authorization, or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

10.1 Amount or Extent of Take

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or utilize a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for whales 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 and fin 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 14 lists the amount and timing of authorized take (incidental take by harassment) for this action. The method for estimating the number of whales exposed to sound levels expected to result in Level B harassment is described in Section 6.4.

NMFS anticipates that 131 instances of Level B harassment of humpback whales may occur. Of these 131 whales, 2 percent (2.62 rounded to 3 whales) is predicted to be from the Mexico DPS. Therefore, NMFS is authorizing 3 acoustic harassment takes of listed Mexico DPS humpback whales under the ESA. Furthermore, NMFS anticipates that two instances of Level B harassment of fin whales may occur, and therefore authorizes 2 acoustic harassment takes of fin whales.

Pile driving activities will be halted as soon as possible when it appears a humpback or fin whale is approaching the Level A shutdown zone and before it reaches the Level A isopleth. No Level A take of marine mammals is authorized in this biological opinion.

Table 14. Summary of anticipated instances of exposure to sound from pile driving activities resulting in the incidental take of Mexico DPS humpback whales and fin whales by Level B harassment. These take numbers reflect only the individuals that are expected to be from the ESA-listed Mexico DPS of humpback whales that may be present in the action area.

Species	**Total Amount of Take Associated with Proposed Action**	
	Level A	**Level B**
Mexico DPS humpback whale	0	3
Fin whale	0	2

10.2 Effect of the Take

The only takes authorized during the proposed action are Level B takes by acoustic harassment from pile driving activities. No serious injury or mortality or Level A harassment is anticipated or authorized as part of this proposed action. This consultation has assumed that exposure to pile driving activities might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses of these whales and any associated disruptions are not expected to affect their fitness, reproduction, survival, or recovery.

In Section 9 of this biological opinion, NMFS determined that the level of incidental take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of Mexico DPS humpback whales or fin whales.

10.3 Reasonable and Prudent Measures

Reasonable and prudent measures (RPMs) 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 2.2). We presume that the mitigation measures will be implemented as described in this opinion. The failure to do so will constitute a change to the action that may require reinitiation of consultation pursuant to 50 CFR § 402.16.

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

1. ADOT&PF and OPR will implement a monitoring and reporting program consistent with section 2.3 of this Biological Opinion that allows NMFS AKR to evaluate the exposure estimates contained in this biological opinion and that underlie this ITS.
2. ADOT&PF and OPR will ensure the implementation of any additional mitigation measures applicable to humpback and fin whales that are required by the IHA issued by NMFS Permits Division.

10.4 Terms and Conditions

"Terms and conditions" implement the reasonable and prudent measures (50 CFR § 402.14(i)(2)). These must be carried out for the exemption in section 7(o)(2) of the ESA to apply.

In order to be exempt from the prohibitions of section 9 of the ESA, the ADOT&PF and OPR or any contractor must comply with the following terms and conditions. These terms and conditions are in addition to the mitigation measures included in the proposed action, as set forth in Section 2.1.2 of this opinion. The ADOT&PF and OPR, or any contractor, 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 RPMs #1 and 2 the ADOT&PF, OPR, or its authorization holder must undertake the following:

1. Submit timely monitoring reports to assess effectiveness of mitigation measures.
2. Contact NMFS AKR with any questions about or challenges to implementing the mitigation measures.
3. Immediately report to NMFS AKR (see Table 5 for *Contact Information*) the taking of any ESA-listed marine mammal in a manner other than that described in this ITS.

11 Conservation Recommendations

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

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.

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

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 biological 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 biological 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.

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 biological opinion addresses these DQA components, documents compliance with the DQA, and certifies that this biological opinion has undergone pre-dissemination review.

13.1 Utility

This document records the results of an interagency consultation. The information presented in this document is useful to NMFS, the FHA, the City of Ketchikan, ADOT&PF, 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 Environmental Consultation Organizer (ECO) Public Portal at https://appscloud.fisheries.noaa.gov/suite/?signin=native under consultation number AKRO-2023-00339.

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 biological opinion contain 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 Literature Cited

Angliss, R. P., and R. B. Outlaw. 2007. Alaska marine mammal stock assessments, 2006. U.S. Dept. of Comemrce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, January 2007. NOAA Technical Memorandum NMFS-AFSC-168, 244 p.

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

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

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

Au, W. W. L., A. A. Pack, M. O. Lammers, L. M. Herman, M. H. Deakos, and K. Andrews. 2006. Acoustic properties of humpback whale songs. Journal of the Acoustical Society of America 120(2):1103-1110.

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.

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

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

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

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

Burek, K. A., F. Gulland, and T. M. O'Hara. 2008. Effects of climate change on Arctic marine mammal health. Ecological Applications 18(2):S126-S134.

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.

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

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

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.

Clarke, J., A. Brower, M. Ferguson, A. Willoughby, and A. Rotrock. 2020. Distribution and relative abundance of marine mammals in the eastern Chukchi Sea, eastern and western Beaufort Sea, and Amundsen Gulf, 2019 annual report. U.S. Dept. of Interior, Bureau of Ocean Energy Management (BOEM), Alaska OCS Region, Anchorage, AK, June 2020. OCS Study BOEM 2020-027 prepared under Interagency Agreement M17PG00031 by the NOAA, Alaska Fisheries Science Center, Marine Mammal Laboratory.

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.

Crance, J. L., C. L. Berchok, J. Bonnel, and A. M. Thode. 2015. Northeasternmost record of a North Pacific fin whale (*Balaenoptera physalus*) in the Alaskan Chukchi Sea. Polar Biology 38(10):1767-1773.

Cranford, T. W., and P. Krysl. 2015. Fin whale sound reception mechanisms: skull vibration enables low-frequency hearing. PLoS One 10(1):e0116222.

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

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

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, Document 00188, Version 1.0, 10 September 2019.

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

Ellison, W. T., B. L. Southall, C. W. Clark, and A. S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology 26(1):21-28.

Erbe, C. 2002. Hearing abilities of baleen whales. Defense Research and Development Canada, Ottawa, Ontario, October 2002. DRDC Atlantic CR 2002-065.

Everitt, R., C. Fiscus, and R. DeLong. 1980. Northern Puget Sound marine mammals. Interagency Energy. Environment R & D Program Report, US EPA, EPA-600/7-80-139. US EPA, Washington, DC.

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

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

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

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

Feely, R. A., C. L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. J. Fabry, and F. J. Millero. 2004. Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305(5682):362-366.

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.

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.

Francis, C. D., and J. R. Barber. 2013. A framework for understanding noise impacts on wildlife: An urgent conservation priority. Frontiers in Ecology and the Environment 11(6):305-313.

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

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

Furumaki, S., K. Tsujii, and Y. Mitani. 2021. Fin whale (*Balaenoptera physalus*) song pattern in the southern Chukchi Sea. Polar Biology 44(5):1021-1027.

Hastings, M. C., and A. N. Popper. 2005. Effects of sound on fish. Report prepared by Jones and Stokes under contract with California Department of Transportation, No. 43A0139, Sacramento, CA, January 28, 2005.

HDR. 2018a. Application for Marine Mammal Protection Act Incidental Harassment Authorizations for the Tongass Narrows Project (Ketchikan-Gravina Island Access, Revilla New Ferry Berth, & New Gravina Island Shuttle Ferry Berth Projects). Prepared by HDR, Inc., for the Alaska Dept. of Transportation and Public Facilities, Anchorage, AK, September 2018.

HDR. 2018b. Biological Assessment for the Tongass Narrows Project. Prepared by HDR, Inc., for Alaska Department of Transportation and Public Facilities, Anchorage, AK, September 2018.

HDR. 2023. Application for Marine Mammal Protection Act Incidental Harassment Authorizations for the Tongass Narrows Project. Prepared by HDR, Inc., for the Alaska Dept. of Transportation and Public Facilities, Anchorage, AK, January 2023.

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

Hinzman, L. D., N. D. Bettez, W. R. Bolton, F. S. Chapin, M. B. Dyurgerov, C. L. Fastie, B. Griffith, R. D. Hollister, A. Hope, H. P. Huntington, A. M. Jensen, G. J. Jia, T.

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

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

Hotchkin, C. 2023. Proxy sound source recommendations for Southeast Alaska. U.S. Dept. of Commerce, NOAA, NMFS, Office of Protected Resources, Silver Spring, MD, July 29, 2023. Internal guidance document for conducting ESA Section 7 consultations.

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

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, 151 p.

IPCC. 2019. Summary for Policymakers. Pages 1-36 *in* H.-O. Pörtner, and coeditors, editors. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY.

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

Jensen, A., M. Williams, L. Jemison, and K. Raum-Suryan. 2009. Somebody untangle me! Taking a closer look at marine mammal entanglement in marine debris. Pages pp. 63-69 *in* M. Williams, and E. Ammann, editors. Marine Debris in Alaska: coordinating our efforts, 09-01. Alaska Sea Grant College Program, University of Alaska Fairbanks.

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

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

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

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

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

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

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

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.

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.

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

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

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

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

Matsuoka, K., S. A. Mizroch, and H. Komiya. 2013. Cruise report of the 2012 IWC-Pacific Ocean Whale and Ecosystem Research (IWC-POWER). International Whaling Commission, Cambridge, 43 p.

McDonald, M. A., J. A. Hildebrand, and S. M. Wiggins. 2006. Increases in deep ocean anibient noise in the Northeast Pacific west of San Nicolas Island, California. Journal of the Acoustical Society of America 120(2):711-718.

Moberg, G. P. 2000. Biological response to stress: Implications for animal welfare. Pages 1-21 *in* G. P. Moberg, and J. A. Mench, editors. The biology of animal stress: basic principles and implications for animal welfare. CABI Publishing, Oxon, United Kingdom.

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.

Muto, M. M., V. T. Helker, B. J. Delean, R. P. Angliss, P. L. Boveng, J. M. Breiwick, B. M. Brost, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivaschenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, K. L. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2020. Alaska marine mammal stock assessments, 2019. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, July 2020. NOAA Technical Memorandum NMFS-AFSC-404, 395 p.

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

Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, August 2022. NOAA Technical Memorandum NMFS-AFSC-441, 398 p.

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

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

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

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. Pages 171-191 *in* K. S. Norris, editor. Whales, dolphins, and porpoises. University of California Press, Berkeley, CA.

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

NMFS. 2019. Endangered Species Act Section 7 biological opinion for listed species under the jurisdiction of the National Marine Fisheries Service for the Alaska Department of Transportation and Public Facilities for construction of the Tongass Narrows Project (Gravina Access), Ketchikan, Alaska. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Regional, Protected Resources Division, Juneau, AK, February 6, 2019. Consultation number AKRO-2019-03432.

NMFS. 2020. Manual for Optional User Spreadsheet Tool (Version 2.1; December) 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. U.S. Dept. of Commerce, NOAA, NMFS, Office of Protected Resources, Silver Spring, MD.

NMFS. 2022. Acoustic guidance for assessment of down-the-hole (DTH) systems. U.S. Dept. of Commerce, NOAA, NMFS, Office of Protected Resources, Silver Spring, MD, November 2022. Unpublished guidance document prepared by C. Hotchkin available at https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance#other-nmfs-acoustic-thresholds-and-tools.

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

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

Nuka Research and Planning Group, L. 2012. Southeast Alaska Vessel Traffic Study, Revision 1, July 23, 2012.

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), February 2009, 298 p.

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

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

Parks, S. E. 2003. Response of North Atlantic right whales (*Eubalaena glacialis*) to playback of calls recorded from surface active groups in both the North and South Atlantic. Marine Mammal Science 19(3):563-580.

Parks, S. E. 2009. Assessment of acoustic adaptations for noise compensation in marine mammals. Report prepared by the Pennsylvania State University Applied Research Laboratory for the Office of Naval Research under award number N00014-08-1-0967, State College, PA.

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

PSSA. 2020. Protected species final report for the Ward Cove Cruise Ship Dock Project, Ketchikan, Alaska. Monitoring report for Ward Cove Cruise Ship Dock Project (AKRO-2019-03664) prepared by Power Systems & Supplies of Alaska, Ward Cove, AK, Submitted December 12, 2020, and modified December 23, 2020.

Reeves, R. R., S. Leatherwood, S. A. Karl, and E. R. Yohe. 1985. Whaling results at Akutan (1912-39) and Port Hobron (1926-37). Report of the International Whaling Commission 35:441-457.

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

Reyff, J., and A. Ambaskar. 2023. DTH drilling sound source verification: Gravina freight and Gravina Airport ferry layup facilities, Ketchikan, AK. Prepared by Illingworth and Rodkin, Inc. for the Alaska Department of Transportation and Public Facilities, Cotati, CA, March 2023, 152 p.

Rice, A. C., A. Širović, J. S. Trickey, A. J. Debich, R. S. Gottlieb, S. M. Wiggins, J. A. Hildebrand, and S. Baumann-Pickering. 2021. Cetacean occurrence in the Gulf of Alaska from long-term passive acoustic monitoring. Marine Biology 168.

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

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. Naval Command, Control and Surveillance Center, RDT&E Division, San Diego, California, July 1997.

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

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

Rone, B. K., A. N. Zerbini, A. B. Douglas, D. W. Weller, and P. J. Clapham. 2017. Abundance and distribution of cetaceans in the Gulf of Alaska. Marine Biology 164(23).

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.

Sitkiewicz, S. 2020. 2019-2020 City of Ketchikan Berth II rock pinnacle removal project: marine mammal monitoring and mitigation report, Final report prepared by Fairweather Science for the National Marine Fisheries Service for AKRO-2019-00553, Anchorage, AK, April 2020.

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.

Stafford, K. M., D. K. Mellinger, S. E. Moore, and C. G. Fox. 2007. Seasonal variability and detection range modeling of baleen whale calls in the Gulf of Alaska, 1999-2002. Journal of the Acoustical Society of America 122(6):3378-3390.

Stewart, B. S., S. A. Karl, P. K. Yochem, S. Leatherwood, and J. L. Laake. 1987. Aerial surveys for cetaceans in the former Akutan, Alaska, whaling grounds. Arctic 40(1):33-42.

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.

Sweeney, K., R. Towell, and T. Gelatt. 2018. Results of Steller Sea Lion Surveys in Alaska, June-July 2018: Memorandum to The Record. U.S. Dept. of Commerce, NOAA, NMFS, Alaska Fisheries Science Center, Marine Mammal Laboratory, Seattle, WA. December 4, 2018.

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

Thompson, P. O., L. T. Findley, and O. Vidal. 1992. 20-Hz pulses and other vocalizations of fin whales, *Balaenoptera physalus*, in the Gulf of California, Mexico. The Journal of the Acoustical Society of America 92(6):3051-3057.

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.

USCG. 2012. Tongass Narrows voluntary waterway guide. U.S. Coast Guard Marine Safety Detachment, Ketchikan, AK, April 24, 2012.

van der Hoop, J. M., P. Corkeron, J. Kenney, S. Landry, D. Morin, J. Smith, and M. J. Moore. 2016. Drag from fishing gear entangling North Atlantic right whales. Marine Mammal Science 32(2):619-642.

Vu, E. T., D. Risch, C. W. Clark, S. Gaylord, L. T. Hatch, M. A. Thompson, D. N. Wiley, and S. M. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aquatic Biology 14(2):175-183.

Wade, P. R. 2021. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas.

National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA. Paper submitted to the International Whaling Commission SC/68C/IA/03.

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

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.

Watson, R. T., and D. L. Albritton. 2001. Climate change 2001: Synthesis report: Third assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Weibold, K. 2023. Has Alaska tourism fully bounced back? Alaska Economic Trends 43(4):4-10.

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

Zerbini, A. N., J. M. Waite, J. L. Laake, and P. R. Wade. 2006. Abundance, trends and distribution of baleen whales off Western Alaska and the central Aleutian Islands. Deep Sea Research Part I-Oceanographic Research Papers 53(11):1772-1790.