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

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

City and Borough of Juneau Docks and Harbors Department
Statter Harbor Improvements Project
Juneau, Alaska

NMFS Consultation Number: AKRO-2019-03544

Action Agencies: **US Army Corps of Engineers**
NMFS Office of Protected Resources

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?
Steller Sea Lion, Western DPS (*Eumetopias jubatus)*	Endangered	Yes	No	No
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	Yes	No	N/A
Sperm Whale (Physeter macrocephalus)	Endangered	No	No	N/A

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

for Robert D Mecum
James W. Balsiger, Ph.D.
Regional Administrator

Date: December 31, 2019

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TERMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
BA	Biological Assessment
BMPs	Best management practices
CBJ	City and Borough of Juneau
CBJ D&H	City and Borough of Juneau Docks and Harbors Department
CFR	Code of Federal Regulations
CV	Curriculum vitae
CY	Cubic yard(s)
DPS	Distinct Population Segment
EDPS	Eastern Distinct Population Segment
ESA	Endangered Species Act
ESCA	Endangered Species Conservation Act
ft	feet
FMP	Fishery Management Plan
GOA	Gulf of Alaska
HTL	High tide line
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
m	Meter(s)
MHW	Mean high water
mi	Mile(s)
min	Minute(s)
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MSE	mechanically stabilized earth
NMFS	National Marine Fisheries Service
NPS	National Park Service
PBFs	Physical or biological features
PCE	Primary constituent element
PND	PND Engineers, Inc.
PR1	Office of Protected Resources, NMFS Headquarters
PRD	Protected Resources Division, Alaska NMFS
PSO	Protected Species Observers
PTS	Permanent Threshold Shifts
RPA	Reasonable and Prudent Alternative
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSL	Steller sea lion
SSV	Sound source verification
TTS	Temporary Threshold Shifts

USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service
WDPS	Western Distinct Population Segment
WNP	Western North Pacific
ZOE	Zone of Exclusion
ZOI	Zone of Influence

1. INTRODUCTION

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

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an Opinion stating how the Federal agency's action is likely to affect ESA-listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking, specifies those reasonable and prudent measures necessary to minimize such impact, and sets forth terms and conditions to implement those measures.

In this document, the action agencies are the US Army Corps of Engineers (USACE), which proposes to authorize construction activities associated with the Statter Harbor Improvements Project, and the NMFS Office of Protected Resources, Permits and Conservation Division (PR1), which proposes to permit Marine Mammal Protection Act (MMPA) Level A take (*i.e.*, take by injury or mortality) and Level B take (*i.e.*, take by harassment) of Steller sea lions (SSL) and humpback whales in conjunction with the first phase of this project, and may potentially include forthcoming MMPA permits associated with the later phases. The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's Biological Opinion (Opinion) on the effects of this proposal on endangered and threatened species.

The Opinion and ITS were prepared by NMFS in accordance with section 7(b) of the ESA (16 U.S.C. §§ 1531, et seq.), and implementing regulations at 50 CFR 402.

The 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.

As discussed below in section 1.2, NMFS previously completed a biological opinion on this project on February 22, 2019. Reinitiation of formal consultation is required to include sperm whales in the list of affected ESA-listed species, and to incorporate revised distribution numbers for WDPS Steller sea lions, which are higher than those considered in the February 2019 opinion (ECO# AKRO-2018-9770). Additionally, some minor changes in the estimated number of piles to be removed and installed were made between the issuance of the February 2019 opinion and PR1's proposed incidental harassment authorizations (IHAs) published in July 2019. Those changes are incorporated into this revised opinion.

1.1 Background

This reinitiated Opinion considers the effects of construction activities associated with the Statter Harbor Improvements Project in Juneau, Alaska. These actions may affect the Mexico Distinct Population Segment (Mexico DPS) of humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter microcephalus*), and Western Distinct Population Segment (WDPS) of Steller sea lions *(Eumetopias jubatus).* Critical habitat has been proposed for humpback whales (84 FR 54354, October 9, 2019), but has not yet been designated for this DPS or species. No designated critical habitat for any species under NMFS's jurisdiction exists in the action area.

This Opinion is based on information provided in the Revised Incidental Harassment Authorization (IHA) Application (PND Engineers 2018d); the Proposed Incidental Harassment Authorization Federal Register Notice (83 FR 52394); the Revised Biological Assessment for the Statter Harbor Improvements Project Phases III & IV (PND Engineers 2018b); the IHA application for Phase III B (PND 2019); the Proposed IHA (84 FR 55920); the updated project proposals; email and telephone conversations between NMFS Alaska Region and NMFS PR1 staff; and other sources of information.

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

1.2 Consultation History

Our communication with PR1, ADOT&PF and HDR regarding this consultation is summarized as follows:

- **November 14, 2017**: USACE designated PND Engineers, Inc. (PND) as the non-federal representative (USACE 2017).
- **February 12, 2018**: NMFS PR1 received a request from the City and Borough of Juneau Docks and Harbors Department (CBJ D&H) for an IHA to take marine mammals incidental to harbor improvement projects in Statter Harbor, Alaska.
- **February 14, 2018**: USACE submitted a request to initiate section 7 consultation to NMFS Protected Resources Division (PRD).
- **March 9, 2018**: USACE submitted a revised IHA application after discussions with NMFS PR1.
- **April 12, 2018:** PRD submitted a 30-day review letter outlining insufficiencies in the initiation package and requesting additional information.
- **August 8, 2018**: PND submitted an additional revision to the IHA to PR1.
- **September 18, 2018**: The application was deemed adequate and complete by PR1.
- **September 26, 2018**: PR1 submitted a section 7 initiation request to PRD. PRD initiated joint consultation with PR1 and USACE.
- **December 22, 2018 – January 25, 2019**: Consultation was held in abeyance for 38 days due to a lapse in appropriations and resulting partial government shutdown. Consultation resumed on January 28, 2019.

- **February 22, 2019**: Completed formal consultation on AKR-2018-9770.
- **July 2019:** PND submits IHA application for Phase III B to PR1.
- **October 16, 2019:** PR1 requests re-initiation of Section 7 consultation (NMFS 2019)
- **October 30, 2019:** AKR reinitiated consultation with PR1. The ECO number for this reinitiated consultation is AKRO-2019-03544.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

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

This action includes Phases III and IV of the Statter Harbor Improvements Project. The proposed project location is at Statter Harbor within Auke Bay in Juneau, Alaska (Figure 1). This project will include dredging and blasting, dredged material disposal, installation of commercial charter floats (including the installation of steel pipe piles), demolition and disposal of the existing boat launch ramp and boat haul out dock (including removal of steel and creosote treated timber piles), new kayak launch ramp, new retaining wall, new permanent moorage floats, and uplands improvements including a completed bus circulation area and parking pad.

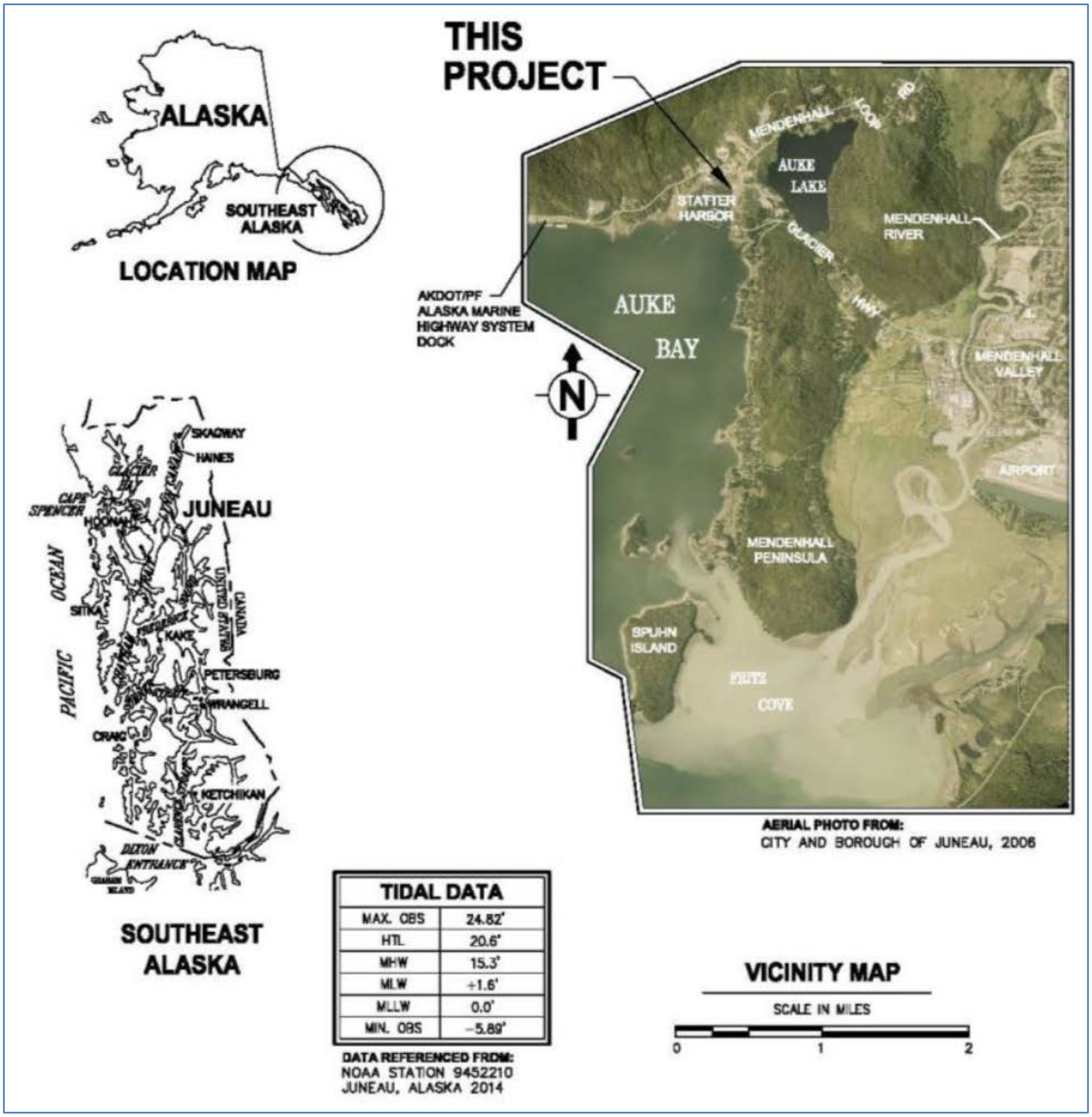

Figure 1. Vicinity Map of Statter Harbor Improvements Project (PND Engineers 2018b)

2.1.1 Proposed Activities

The proposed Statter Harbor improvements associated with this consultation will be constructed in a total of four phases: Phase III A; Phase III B; Phase III C, and Phase IV, over a total of three winter construction seasons, potentially concluding in 2022.

2.1.1.1 Phase III A

Phase III A includes demolition and disposal of the existing boat launch ramp and timber haulout pier, dredging of the planned harbor basin with offshore disposal, excavation of bedrock within the basin by blasting from a temporary fill pad, and construction of a mechanically stabilized earth (MSE) wall. Phase III A began December 2019 and is expected to be completed in the spring of 2020. PR1 is currently proposing to issue an IHA for take specific to Phase III B only, and will respond to IHA applications associated with future phases of the proposed action after they are submitted.

Demolition and Disposal

Phase III A includes demolition and upland disposal of the existing 16-foot (4.9-meter) by 200-foot (61-meter) concrete boat launch ramp and planks, an 8-foot (2.4-meter) by 240-foot (73.2-meter) boarding float, four (4) 12.75-inch (3.2-decimeter) diameter steel pipe piles, 1,152 square feet (107.0 square meters) of timber boat haulout pier, and sixteen (16) 12-inch (3.7-meter) to 16-inch (4.9-meter) creosote-treated timber piles. Demolition of the existing timber boat haulout pier and boat launch ramp will be performed with track excavators, loaders, crane barges, crane dead-pulling (preferred method), vibratory hammer (if needed), various hand tools, and labor forces.

Dredging and Dredge Disposal

The project includes 24,300 cubic yards (18,578.7 cubic meters) of dredging in the existing harbor. When the material is removed from the ground it will take up more space in the barge due to increased water content and fluff. To account for this, a conservative factor of 1.25 has been applied to the dredged volume, resulting in up to 30,375 cubic yards (23,223.4 cubic meters) of material to be disposed of.

A Sampling and Analysis Plan (PND Engineers 2016)) was developed for the dredge area and was implemented in October of 2016. The sample results indicated the material did not contain any contaminants above the regulatory screening levels and thus is suitable for in-water disposal. The USACE issued a determination of in-water suitability of disposal materials under POA-2008-782-M4.

Dredging will be performed by either an excavator or a crane with clamshell from a flat deck or derrick barge. The barge will be fixed in place to allow the excavator access to an area and periodically repositioned to gain access to new areas. It is anticipated that the barge would need to be repositioned once per day, or less. Once material is removed from the seafloor, it will be placed into a second belly dump dredge barge where the material will dewater and then be towed by a tug to the disposal site to be deposited.

The original target location provided by the Alaska Department of Fish and Game (ADF&G) for the disposal site for dredged material (just outside of the harbor) was latitude 58° 22' 22.08" N and longitude 134° 39'49.32" W. The USACE MPFate model was utilized to determine the barge release necessary to place the material within the target disposal location and to determine what the resulting mound may look like. The MPFate model simulates multiple dredged material placements to estimate the resulting bathymetry change within and around the placement site (USACE 2014). Due to limitations and uncertainties in the MPFate model, an overall footprint of approximately 40 acres was conservatively determined and an additional 200-foot (61.0-meter) buffer added, resulting in a 65-acre (26.3-hectare) disposal site. Based on conversations with ADF&G, the goal is to minimize the disposal footprint. Thus, in order for the material to situate in the specified disposal location, the barge release target location was changed and now is 58°

22' 19" N, 134° 39' 58" W. Actual disposal times and current conditions during disposal will vary depending on the contractor and site conditions. The coordinates for the corners of the proposed site are as follows (see Figure 2):

Northwest corner: 58° 22' 30.37" N, 134° 40' 7.03" W
Northeast corner: 58° 22' 30.39" N, 134° 39' 35.64" W
Southeast corner: 58° 22' 12.64" N, 134° 39 '34.98" W
Southwest corner: 58° 22' 12.42" N, 134° 40' 5.82" W

Blasting and Excavation

A geotechnical investigation, including borehole samples and test probing, was performed by PND in 2016 and revealed shallow bedrock within the harbor basin. The design depth, necessary for safe navigation, is 16 feet (4.9 meters) below mean lower low water (MLLW) with an additional 1-foot (0.3-meter) overdredge allowance. Test probing showed that the top-of-rock elevations within the dredge basin range from approximately 4 feet below MLLW to depths greater than the design elevation (17 feet (5.2 meters) below MLLW with overdredge allowance).

During construction, the dredging will be conducted first to remove the overburden from the bedrock. A survey will then be conducted to determine the exact extent of bedrock to be removed. The estimated amount of rock excavation is 1,761 cubic yards (2,000 cubic yards permitted volume to account for uncertainty) based on preconstruction surveys. Temporary fill to confine the blast will be placed using conventional construction equipment. Of the total 15,000 CY of fill placed, all will be below MHW. After blasting, this temporary fill will be removed and stockpiled in uplands for later use.

Alaska Seismic and Environmental prepared a General Blast Plan and Analysis and a SPL and SEL Isopleth Distances report (Appendix D of the CBJ D&H Request for an IHA (PND Engineers 2018d)) detailing the bedrock removal plan and how the exclusion zones for each hearing group were determined. The selected methodology for the blast is to perform two blasts. Each blast will be approximately one second in duration. Both blasts will consist of several detonations separated by millisecond delays. The number of charges will vary depending on conditions after overburden is removed, but is anticipated to be between 50 and 75 holes per blast. Individual charge size will depend on conditions after holes are drilled; maximum charge size (explosive weight) detonated per 8-milliseconds delay period will be limited to 93.5 pounds (42.4 kilograms).

Individual charge amounts and other hole-loading details will be determined by the contractor's blaster-in-charge and blasting consultant after holes are drilled. This allows for safe and appropriate loading decisions to be made based on rock features, such as voids, seams, fractures, and other discontinuities encountered during drilling.

After blasting, the temporary fill will be removed with excavators, loaded into dump trucks, and stockpiled in the uplands to be reused during the MSE wall construction. The blasted material will be excavated, separated from the temporary fill, and hauled offsite to an uplands disposal site.

2.1.1.2 Phase III B

New infrastructure to be installed during phase III B includes 9,136 square feet (848.8 square meters) of timber floats supported by twenty (20) 16-inch (4.1-decimeter) diameter steel pipe piles and an 800 square-foot gangway (74.3 square-meter).

In addition to the new infrastructure, three existing piles will be repaired. A transient float was installed in Statter Harbor in 2018 as part of a different project and it is not operating as intended due to wave action and excessive movement of the float. Three temporary piles were installed without rock anchors as a temporary fix. During Phase III B these piles will be removed with a crane or vibratory hammer and reinstalled with rock anchors to provide sufficient moorage capacity for the float ((PND 2019)).

Pile driving will be conducted from a floating barge, utilizing a down the hole hammer to drill rock sockets and a vibratory hammer to install piles. Use of impact hammers is not anticipated, and will only be used for piles that encounter soils too dense to penetrate with the vibratory equipment. The floats will be unloaded from a barge and placed in the water. Piles will be driven as each float section is installed to hold the floats in place. CBJ D&H will specify the use of vibratory pile driving equipment as the primary installation method for the project. Phase III B is scheduled for October 2020 – May 2021, subject to funding.

<u>MSE Wall</u>

The MSE wall will be constructed with track excavators, loaders, vibratory drum rollers, dump trucks, various hand tools, and labor forces. Excavated material will be placed into dump trucks and hauled off-site. The concrete retaining wall blocks will be set in place one course at a time. Imported fill will be delivered by dump truck, spread behind the blocks in lifts, and compacted with vibratory rollers to meet design grades and compaction requirements. A layer of geotextile fabric will be placed behind the wall on the compacted fill with each course of blocks. A total of 6,800 cubic yards (5,199 cubic meters) of shot rock material will be placed below the HTL behind the MSE wall.

A 5-foot (1.5-meter) thick armored dredge basin slope will require an additional 650 cubic yards (497 cubic meters) of armor rock material, and a lower 2-foot (0.6-meter) thick slope will require an additional 1,350 cubic yards (1,032.1 cubic meters) of material. Total fill material placed below the HTL is not expected to exceed 8,800 cubic yards (6,728.1 cubic meters). All work in intertidal zones will be performed during low tides so that all material will be placed above current water levels.

2.1.1.3 Phase III C

Phase III C is primarily an uplands improvement, which also includes a small amount of in-water construction for a new kayak launch ramp. Phase III C generally consists of completing the MSE wall, an uplands bus circulation area and parking pad, and a 12-foot (3.7-meter) by 208-foot (63.4-meter) kayak launch ramp.

The kayak ramp will be constructed with track excavators, loaders, vibratory drum rollers, dump trucks, various hand tools and labor forces. The existing ground will be excavated and material will be placed into dump trucks and then hauled off-site. Imported fill will be delivered by dump truck, spread in lifts and compacted with vibratory rollers to meet design grades and compaction requirements. The new concrete ramp planks will be placed on the compacted sub-base. To the maximum extent possible, all work will be performed during low tides and all material placed above the water level. Phase III C is scheduled for October 2021 through spring 2022, subject to funding.

2.1.1.4 Phase IV

Phase IV consists of six 24-inch steel pipe piles and 4,140 square feet (385 square meters) of concrete moorage floats. The action area extends 5,050 meters from the project area as a result of the sound levels generated during drilling and vibratory pile driving activities. Pile driving will be conducted from a stationary barge platform, utilizing a down the hole hammer to drill rock sockets and a vibratory hammer to install piles. Impact hammers shall only be allowed for piles that encounter soils too dense to penetrate with the vibratory equipment. The floats will be unloaded from a barge and placed in the water. Piles will be driven as each float section is installed to hold the floats in place. CBJ D&H will specify the use of vibratory pile driving equipment as the primary installation method for the project during contract solicitation. Phase IV is anticipated to begin fall 2022, subject to funding.

2.1.2 Mitigation Measures

The proposed project intends to avoid impacts to marine mammals and the marine environment to the extent practicable, but some impacts cannot be avoided entirely, as this project is dependent upon maritime access and construction activity. While the IHA contains mitigation measures that address all marine mammals, this Opinion deals exclusively with the mitigation measures for listed species that fall under the purview of the ESA- specifically Mexico DPS humpback whales and WDPS Steller sea lions. The following measures and best management practices BMPs will be incorporated by the applicant in order to avoid, reduce intensity, or otherwise minimize potential impacts:

- The harbor improvement structures are designed to limit contaminant releases and will be maintained in a manner that manages pollutants and debris streams to avoid incidental introduction of deleterious materials into Auke Bay.
- Harbor improvement structures were designed to provide barrier-free migration and vertical movement for marine and estuarine fish in Auke Bay.
- Fuels, lubricants, chemicals and other hazardous substances will be stored above the ordinary high water mark to prevent spills.
- Properly sized equipment will be used to drive piles.
- Oil booms will be readily available for containment should any releases occur.
- To prevent spills or leakage of hazardous material during construction, standard spill-prevention measures will be implemented during construction. The Contractor will provide and maintain a spill clean-up kit on-site at all times. If the total aggregate capacity of aboveground oil storage containers is greater than 1,320 gallons the Contractor will be required to prepare and implement a Spill Prevention Control and Countermeasure Plan as required by law.

- The contractor will monitor equipment and gear storage areas for drips or leaks regularly, including inspection of fuel hoses, oil drums, oil or fuel transfer valves and fittings, and fuel storage that occurs at the project site. Equipment will be maintained and stored properly to prevent spills.
- During construction, activities which may attract marine mammals, such as fish cleaning and carcass disposal, will be managed in concert with the CBJ Docks and Harbor staff to eliminate mammal attractants to the project area where possible.
- If contaminated or hazardous materials are encountered during construction, all work in the vicinity of the contaminated site will be stopped until a corrective action plan is devised and implemented to minimize impacts on surface waters and organisms in the project area.
- Marine mammal observers will monitor permitted activities in accordance with protocols reviewed and approved by NMFS in phase specific monitoring plans developed during the IHA process. Mitigation measures for Phase III A have been developed and are shown below. Phase III B and Phase IV will have specific mitigation measures developed during the IHA process. Phase III C will not undergo the IHA process, as this phase is not anticipated to result in take, provided the mitigation measures in Section 2.1.2.2 are used.

Protected species observers (PSOs) will monitor permitted activities in accordance with protocols reviewed and approved by NMFS in phase specific monitoring plans developed during all current and future IHA processes. Future phases of the project will require specific mitigation measures developed according to their corresponding IHAs. For Phase III A, CBJ D&H will employ the following standard mitigation measures:

- Conduct a briefing between construction supervisors, crews, and the marine mammal monitoring team prior to the start of construction, and when new personnel join the work, explain responsibilities, communication procedures, marine mammal monitoring protocols, and operational procedures.
- For in-water and over-water heavy machinery work, if a marine mammal comes within 10 m, operations must cease and vessels must reduce speed to the minimum level required to maintain steerage and safe working conditions. This 10 m shutdown zone encompasses the Level A harassment zone for pile removal and dredging.
- Work may only occur during daylight hours and during weather conditions when visual monitoring of marine mammals can be conducted.
- If take reaches the authorized limit for an authorized species, activity for which take is authorized will be stopped as these species approach the monitoring zones to avoid any additional take.

The following measures will apply to CBJ D&H's mitigation requirements:

<u>Establishment of Monitoring Zones for Level B Harassment</u>

CBJ D&H will establish Level B harassment monitoring zones, or zones of influence (ZOI), which are areas where sound pressure levels (SPLs) are equal to or exceed the 120 dB rms threshold during vibratory removal and dredging. Similar harassment monitoring zones will be established for the TTS isopleths associated with each functional hearing group for blasting activities. Monitoring zones provide utility for observing by establishing monitoring protocols for the areas adjacent to the shutdown zones (Level A harassment zones). Monitoring zones enable PSOs to be aware of and communicate the presence of marine mammals in the project area outside the shutdown zone and thus help prepare for a potential cease of activity should the animal approach the shutdown zone. The Level B monitoring zones and Level A shutdown zones are depicted in Table 1 and Figure 2.

Table 1. Shutdown and Monitoring Zones

Activity	Monitoring Zones (Distance by species)		Shutdown Zones
	Humpback whales	**Steller sea lions**	**All species**
Vibratory Removal – Steel	1,820 m	1,820 m	10 m
Vibratory Removal – Timber	1,360 m	1,360 m	10 m
Dredging	110 m	110 m	10 m
Blasting (PTS)	380 m	95 m	N/A
Blasting (TTS)	2,120 m	280 m	N/A

In general, PSOs will monitor for the presence of humpback whales and Steller sea lions within these zones and will order a shutdown of the specified activities if a humpback whale or sea lion is spotted in or approaching these zones. As shown, the largest Level B zone for Phase III A is 2,120 m, making it unlikely that PSOs would be able to view the entire harassment area. Thus, during blasting, listed species may be exposed to noise levels of concern. To account for this, PSOs will record observed Level B exposures and extrapolate the number of whales and sea lions exposed (i.e. number of takes) based upon the number observed within the monitoring zone and the percentage of the Level B harassment zone that was visible.

Pre-Activity Monitoring

Prior to the start of daily in-water activity, or whenever a break in activity of 30 minutes or longer occurs, the PSO will observe the shutdown and monitoring zones for a period of 30 minutes. The shutdown zone will be considered cleared when a marine mammal has not been observed within the zone for that 30-minute period. If a marine mammal is observed within the shutdown zone, activity cannot proceed until the animal has left the zone or has not been observed for 15 minutes. When a marine mammal permitted for Level B take is present in the Level B harassment zone, or if the entire zone cannot be observed and permitted marine mammal presence is extrapolated, activities may begin and Level B take will be recorded. If work ceases for more than 30 minutes, the pre-activity monitoring of both the Level B and shutdown zone will commence.

For blasting, the TTS zone will be monitored for a minimum of 30 minutes prior to detonating the blasts. If a marine mammal is sighted within the TTS zone, blasting will be delayed until the zone is clear of marine mammals for 30 minutes. This will continue as long as practicable within the constraints of the blasting design, but not beyond sunset on the same day, as the charges cannot lay dormant for more than 24 hours, which may force the detonation of the blast in the presence of marine mammals. Charges will be laid as early as possible in the morning.

Monitoring and Reporting

Requests for incidental harassment authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both for compliance and for ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (e.g., presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (e.g., source characterization, propagation, ambient noise); (2) affected species (e.g., life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure;
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (e.g., marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); or
- Mitigation and monitoring effectiveness.

Monitoring for blasting activities would be conducted for 30 minutes pre-blast and 1 hour post-blast. All other monitoring would be conducted 30 minutes before, during the entire construction activity, and 30 minutes after construction activities. In addition, PSOs must record all incidents of marine mammal occurrence, regardless of distance from activity, and must document any behavioral reactions in concert with distance from construction activities.

PSOs would be land-based or float-based observers. PSOs will be stationed at locations that provide adequate visual coverage for shutdown and monitoring zones. Potential observation locations are depicted in Figures 2 and 3 of the applicant’s Marine Mammal Mitigation and Monitoring Plan (Appendix B of the Statter Harbor Improvements Project Phase III A IHA (PND Engineers 2018d)). A minimum of three PSOs will be observing the action area at all times: one PSO would be placed at a vantage point providing total coverage of the monitoring zones and for observation zones larger than 500 m, and at least two other additional PSOs will be placed at the outermost float or other similar vantage point in order to observe the extent of the observation zone. Optimal observation locations will be selected based on visibility and the type of work occurring. All PSOs will be trained in marine mammal identification and behaviors and are required to have no other project-related tasks while conducting monitoring. In addition, monitoring will be conducted by qualified PSOs, who will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. The applicant must adhere to the following conditions when selecting PSOs:

- Independent PSOs must be used (i.e., not construction personnel).
- At least one PSO must have prior experience working as a marine mammal observer during construction activities.
- Other PSOs may substitute education (degree in biological science or related field) or training for experience.
- Where a team of three or more PSOs are required, a lead observer or monitoring coordinator must be designated. The lead observer must have prior experience working as a PSO during construction.
- The applicant must submit PSO CVs for approval by NMFS.

The applicant must ensure that PSOs have the following additional qualifications:

- Ability to conduct field observations and collect data according to assigned protocols.
- Experience or training in the field identification of marine mammals, including the identification of behaviors.
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations.
- Expected content of this report should include,- but is not limited to,- the number and 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.
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

The PSO will have the following equipment to aid in determining the location of observed listed species, to take action if listed species enter the shutdown zone, and to record these events:

  - Binoculars
  - Range finder
  - GPS
  - Compass
  - Two-way radio communication with construction foreman/superintendent
  - A log book of all activities, which will be made available to USACE and NMFS

upon request at any time

A draft marine mammal monitoring report shall be submitted to NMFS within 90 days after the completion of each Phase of construction activities. It will include an overall description of work completed, a narrative regarding marine mammal sightings, and associated PSO data sheets. Specifically, the report must include:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (e.g., percent cover, visibility);
- Water conditions (e.g., sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from construction activity;
- Distance from construction activities to marine mammals and distance from the marine mammals to the observation point;
- Locations of all marine mammal observations; and
- Other human activity in the area.

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.

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA, such as a serious injury or mortality, CBJ D&H would immediately cease the specified activities and report the incident to PR1, PRD, and the Alaska Regional Stranding Hotline at 1-877-925-7773. The report would include the following information:

- Description of the incident;
- Environmental conditions (e.g., Beaufort sea state, visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with CBJ D&H to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA and ESA compliance. The CBJ D&H would not be able to resume their activities until notified by NMFS via letter, email, or telephone.

In the event that CBJ D&H discovers an injured or dead marine mammal at any time in the action area, the CBJ D&H would immediately report the incident to PR1, PRD, and the Alaska Regional Stranding Hotline at 1-877-925-7773. The report would include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with the CBJ D&H to determine whether modifications in the activities are appropriate.

Most of the construction activities during Phase III C will occur in the uplands. However, there is the potential for a small amount of fill to be placed in-water during construction of the kayak ramp. In the event that any in-water work will be required, CBJ D&H will employ the following standard mitigation measures in order to minimize the risk of harm to listed species for this phase of the proposed project:

1. The applicant will monitor a 110 m exclusion zone around the proposed placement of fill. Fill disposal activities will be shut down if listed species appear likely to enter the exclusion zone.

2. The project will incorporate measures to control erosion and minimize turbidity effectively.

There are no interdependent or interrelated activities associated with this action. All activities that would not occur but for the action are addressed in this Opinion.

2.2 Action Area

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

The action area for this Opinion will include all proposed activities outlined in Section 2.1.1. We define the action area for this consultation to include the area within which project-related noise levels are ≥120 dB re 1 μPa (rms) (i.e., the point where no measureable effect from the project would occur). Noise levels associated with drilling in Phase IV will extend further than other components of the proposed action, thus the action area extends 5,050 meters from the project site (red boundary in Figure 2) where drilling related noise reaches 120 dB, which encompasses all other phases as well as the dredged material disposal site. The action area also includes the transit area for vessels involved in construction, and traffic lanes during operation of the harbor improvements.

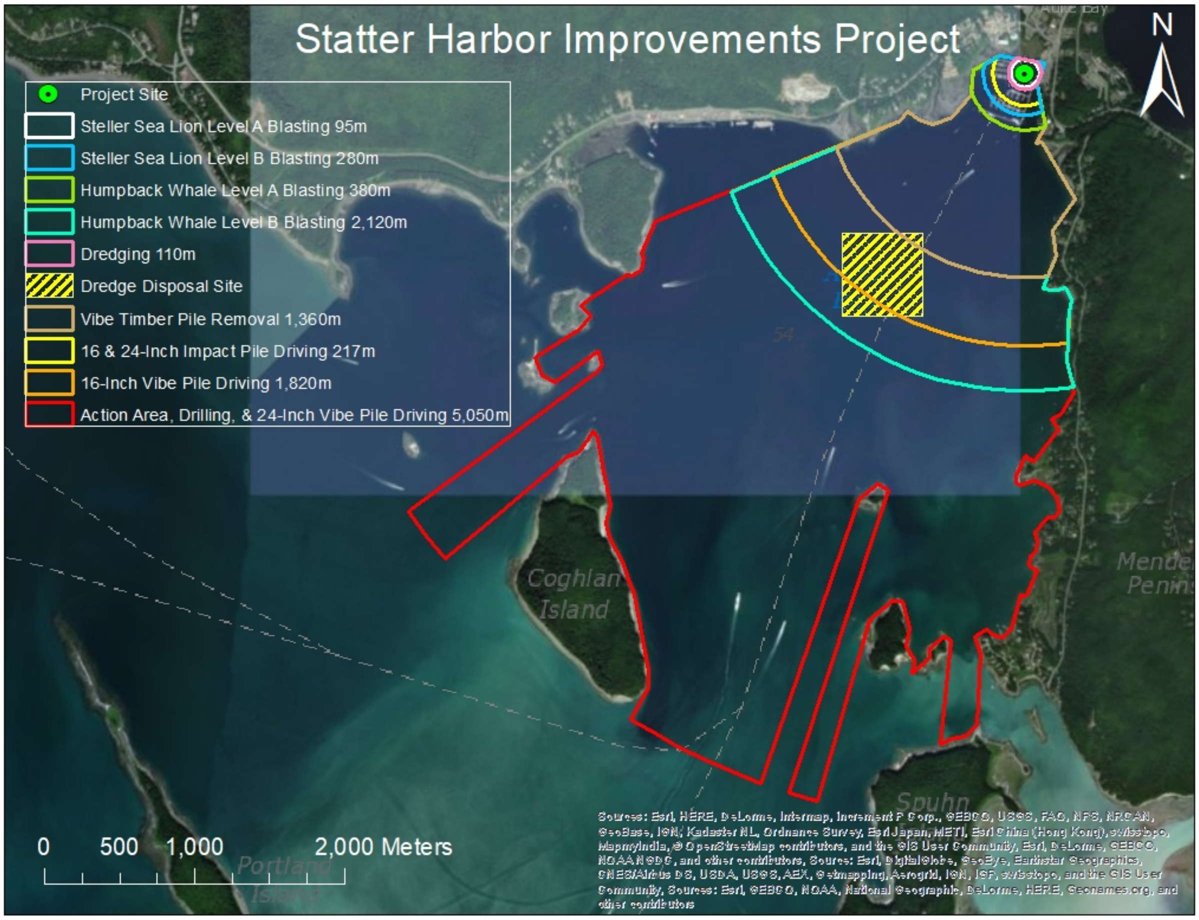

Figure 2. Statter Harbor Improvements Project Action Area

3 APPROACH TO THE ASSESSMENT

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

"To jeopardize the continued existence of a listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological Opinion (51 FR 19926, 19934 ((June 2, 1986)).

Under NMFS's regulations, the destruction or adverse modification of critical habitat "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (50 CFR 402.02).

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

We use the following approach to determine whether the proposed action described in Section 2.1 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify those aspects (or stressors) of the proposed action that are likely to have direct or indirect effects on listed species or critical habitat. 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 and critical habitat likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the rangewide status of critical habitat by examining the condition of its PBFs - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this Opinion.
- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7

consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this Opinion.

- Analyze the effects of the proposed 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 gender of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 6 of this Opinion with the exposure analysis described in Section 6.2 of this Opinion.
- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this Opinion.
- Describe any cumulative effects. Cumulative effects, as defined in NMFS's implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this Opinion.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this Opinion.
- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.
- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

4 RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

Two species of marine mammals listed under the ESA under NMFS's jurisdiction may occur in the action area— western Distinct Population Segment (WDPS) Steller sea lions and Mexico DPS humpback whales. No critical habitat occurs within the action area. This Opinion considers the effects of the proposed action on these species (Table 2).

Table 2. Listing status and critical habitat designation for marine mammals considered in this Opinion.

Species	Status	Listing	Critical Habitat
Steller Sea Lion, WDPS (*Eumetopias jubatus*)	Endangered	May 5, 1997, 62 FR 24345	August 27, 1993, 58 FR 45269
Humpback Whale, Mexico DPS (*M egaptera nov aeangliae*)	Threatened	September 8, 2016, 81 FR 62260	Not designated
Sperm Whale *Physeter macrocephalus*	Endangered	NMFS 1970 35 FR 18319	Not designated

4.1 Species and Critical Habitat Not Considered Further In This Opinion

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

We applied these criteria to the species and critical habitat listed above and determined that neither sperm whales nor Steller sea lion critical habitat are likely to be adversely affected by the proposed action.

4.1.1 Steller Sea Lion Critical Habitat

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

1. Alaska rookeries, haulouts, and associated areas identified at 50 CFR 226.202(a), including:
   - 1.1. Terrestrial zones that extend 914 m (3,000 ft) landward
   - 1.2. Air zones that extend 914 m (3,000 ft) above the terrestrial zone
   - 1.3. Aquatic zones that extend 914 m (3,000 ft) seaward from each major rookery and major haulout east of 144° W. longitude
   - 1.4. Aquatic zones that extend 37 km (23 mi) seaward from each major rookery and major haulout west of 144° W. longitude

2. Three special aquatic foraging areas identified at 50 CFR 226.202(c):
    2.1. Shelikof Strait
    2.2. Bogoslof
    2.3. Seguam Pass

The ensonified area associated with the project does not overlap with designated critical habitat. The nearest critical habitat is Benjamin Island (Figure 3) located 27 km northwest of Juneau, and outside of the ensonified area. While transit routes to and from the construction site are currently unknown, mitigation measures require all vessels associated with construction operations to avoid the 3,000 ft (914 m) aquatic zone surrounding any designated critical habitat in Southeast Alaska. We do not expect the project to affect Steller sea lion critical habitat.

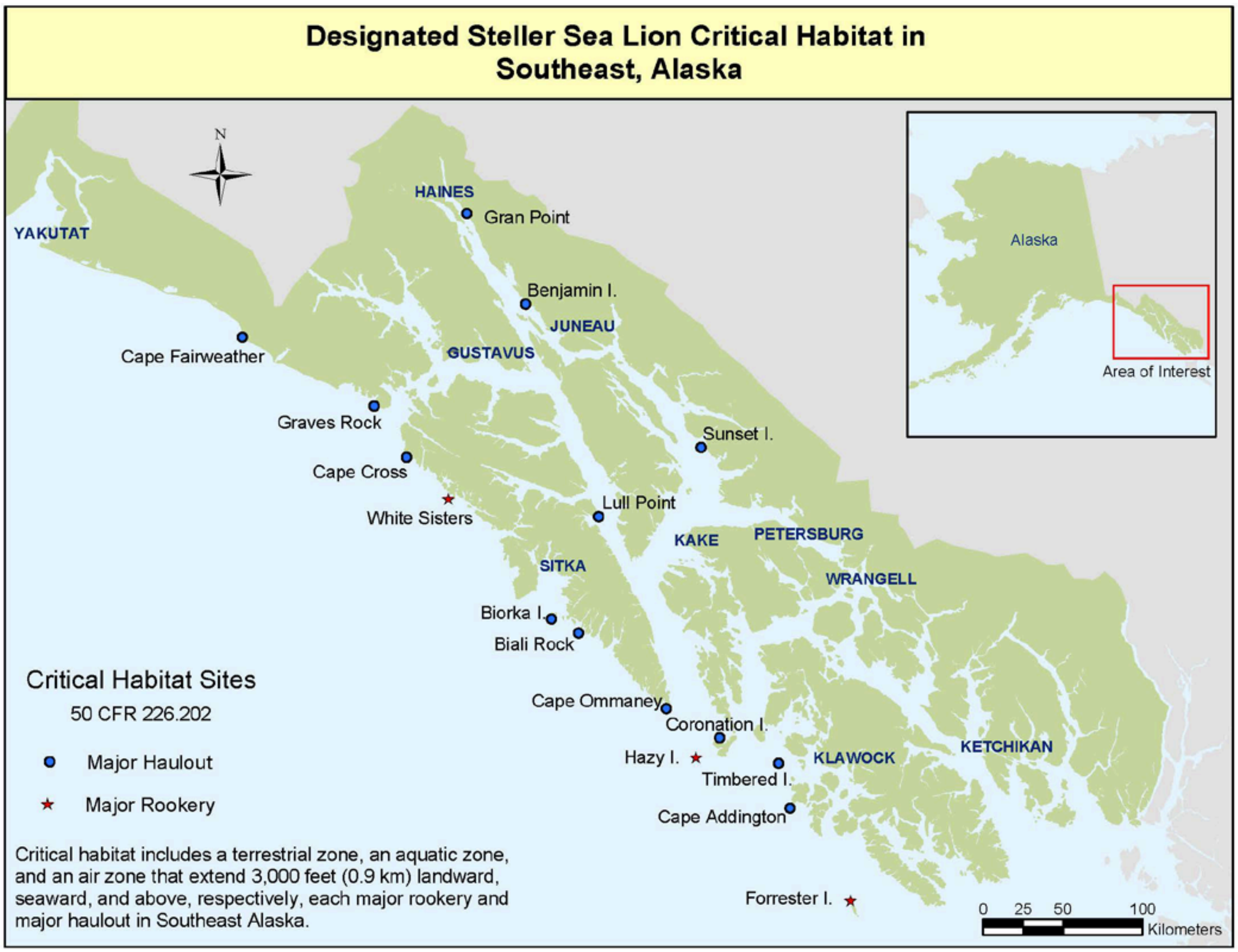

Figure 3. Designated critical habitat for Steller sea lions in Southeast Alaska.

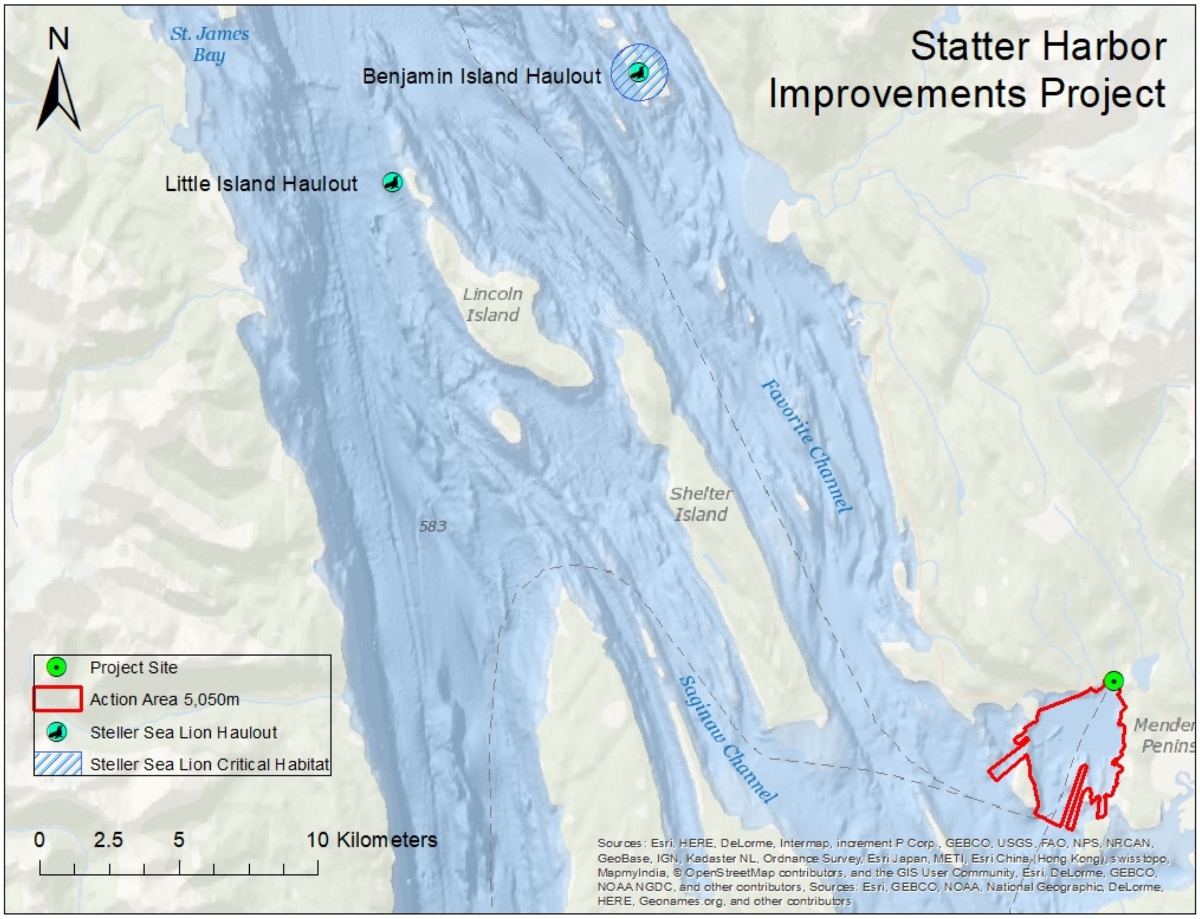

Figure 4. Steller Sea Lion Critical Habitat near Auke Bay in relation to Statter Harbor Project Site

The transit route will not pass near enough to landmasses to affect hauled-out pinnipeds; however, foraging sea lions may be encountered during vessel transit. It is unlikely that vessel transit will impact critical habitat surrounding haulouts and rookeries to any measurable degree considering vessels will avoid designated aquatic zones.

4.1.2 Sperm Whales

Tagged sperm whales have recently been tracked within the Gulf of Alaska, with two whales tracked north of Admiralty Island in Lynn Canal in 2014 and 2015 (SEASWAP 2017). In addition, one beached sperm whale was discovered north of Berners Bay on March 19, 2019, with the cause of death determined to be vessel strike.

Tagging studies primarily show that sperm whales use the deep water slope habitat extensively for foraging (Mathias et al. 2012). Interaction studies between sperm whales and the longline fishery have been focused along the continental slope of the eastern Gulf of Alaska in water depths between about 1,970 and 3,280 ft (600 and 1,000 m) (Straley et al. 2005, Straley et al. 2014). The shelf-edge/slope waters of the Gulf of Alaska are far outside of the action area.

Though we do not expect sperm whales will occur in the action area where pile driving activities will occur, it is possible these species may be encountered during transit from staging areas to the construction site in Auke Bay. However, it is unlikely that vessels will strike sperm whales for the following reasons:

- Few, if any, sperm whales are likely to be encountered because they are generally found in deeper waters than those in which the transit route will occur.
- NMFS's guidelines for approaching marine mammals discourage vessels approaching within 100 yards of marine mammals and ADOT&PE have agreed to follow these guidelines as part of their mitigation measures.

We conclude that the stressors associated with construction activities for this project are extremely unlikely to affect sperm whales because they are not anticipated to overlap in time and space, and ship strike associated with equipment mobilization and demobilization is also extremely unlikely to occur.

4.2 Climate Change

In accordance with NMFS guidance on analyzing the effects of climate change (Sobeck 2016), NMFS assumes that climate conditions will be similar to the status quo throughout the length of the direct and indirect effects of this project. We present an overview of the potential climate change effects on WDPS Steller sea lions and Mexico DPS humpback whales and their habitat below.

There is widespread consensus within the scientific community that atmospheric temperatures on earth are increasing and that this will continue for at least the next several decades (Watson and Albritton 2001, Oreskes 2004). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of extreme events such as heat waves, floods, storms, and wet-dry cycles. Warming of the climate system is explicit, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (Pachauri and Reisinger 2007).

The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (±0.2) since the mid-1800s, with most of the change occurring since 1976. 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). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on observed climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity. Based on their review, the IPCC concluded that natural phenomena are insufficient to explain the increasing trend in land and sea surface temperature, and that most of the warming observed over the last 50 years is likely to be attributable to human activities (Stocker *et al.* 2013).

Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century (Watson and Albritton 2001). 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 (Houghton 2001, McCarthy 2001, Parry 2007). Climate change would result in increases in atmospheric temperatures, changes in sea surface temperatures, increased ocean acidity, changes in patterns of precipitation, and changes in sea level (Stocker *et al.* 2013).

The indirect effects of climate change on WDPS Steller sea lions and Mexico DPS humpback whales would likely include changes in the distribution of temperatures suitable for many stages of their life history, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

4.3 Status of Listed Species

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

This section consists of narratives for both of the endangered and threatened species that occur in the action area and that may be adversely affected by the proposed action. In each narrative, we present a summary of information on the population structure and distribution of the species to provide a foundation for the exposure analyses that appear later in this Opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determinations we make later in this Opinion. That is, we rely on a species' status and trend to determine whether or not an action's direct or indirect effects are likely to increase the species' probability of becoming extinct.

After the *Status* subsection of each narrative, we present information on feeding, prey selection, diving, and social behavior of the different species because those behaviors help determine how certain activities may impact each species. We also summarize information on the vocalization and hearing of the species to inform our assessment of how the species are likely to respond to sounds produced from the proposed activities.

More detailed background information on the status of these species can be found in a number of published documents including stock assessment reports on Alaska marine mammals (Muto et al. 2017b), and recovery plans for humpback whales (NMFS 1991a) and Steller sea lions (NMFS 2008b).

4.3.1 Mexico DPS Humpback Whales

4.3.1.1 Population Structure and Status

The humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA) on December 2, 1970 (35 FR 18319). Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered. NMFS recently conducted a global status review and changed the status of humpback whales under the ESA. The globally listed species was divided into 14 DPSs, four of which are endangered, one is threatened, and the remaining nine are not listed under the ESA (81 FR 62260; September 8, 2016).

Wade et al. (2016) analyzed humpback whale movements throughout the North Pacific Ocean between winter breeding areas and summer feeding areas, using a comprehensive photo-identification study of humpback whales in 2004-2006 during the SPLASH project (Structure of Populations, Levels of Abundance and Status of Humpbacks). A multi-strata mark recapture model was fit to the photo-identification data using a six-month time-step, with the four winter areas and the six summer areas defined to be the sample strata. The four winter areas corresponded to the four North Pacific DPSs: Western North Pacific (WNP), Hawaii, Mexico, and Central America. The analysis was used to estimate abundance within all sampled winter and summer areas in the North Pacific, as well as to estimate migration rates between these areas. The migration rates were used to estimate the probability that whales from each winter/breeding area were found in each of the six feeding areas. The probability of encountering whales from each of the four North Pacific DPSs in various feeding areas is summarized in Table 3 below (NMFS 2016a).

Table 3. Probability of encountering humpback whales from each DPS in the North Pacific Ocean (columns) in various feeding areas (on left). Adapted from Wade et al. (2016).

Summer Feeding Areas	North Pacific Distinct Population Segments			
	Western North Pacific DPS (endangered)[1]	**Hawaii DPS (not listed)**	**Mexico DPS (threatened)**	**Central America DPS (endangered)[1]**
Kamchatka	100%	0%	0%	0%
Aleutian I/Bering/Chukchi	4.4%	86.5%	11.3%	0%
Gulf of Alaska	0.5%	89%	10.5%	0%
Southeast Alaska / Northern BC	0%	93.9%	6.1%	0%
Southern BC / WA	0%	52.9%	41.9%	14.7%
OR/CA	0%	0%	89.6%	19.7%

[1]For the endangered DPSs, these percentages reflect the 95% confidence interval of the probability of occurrence in order to give the benefit of the doubt to the species and to reduce the chance of underestimating potential takes.

Whales from the WNP, Mexico, and Hawaii DPSs overlap on feeding grounds off Alaska, and are not visually distinguishable. All waters off the coast of Alaska may contain ESA-listed humpbacks. Critical habitat has not been designated for the WNP or Mexico DPSs (NMFS 2016a).

The Mexico DPS is comprised of approximately 3,264 (CV=0.06) animals (Wade *et al.* 2016) with an unknown population trend. The abundance of humpback whales has increased in Southeast Alaska, though a trend for the Southeast Alaska portion of the Mexico DPS cannot be estimated from the data because of differences in methods and areas covered (Muto et al 2018).

4.3.1.2 Distribution

Humpback whales migrate seasonally between warmer, tropical or sub-tropical waters in winter months (where they reproduce and give birth to calves) and cooler, temperate or sub-Arctic waters in summer months (where they feed) (see Figure 4). In their summer foraging areas and winter calving areas, humpback whales tend to occupy shallower, coastal waters; during their seasonal migration however, humpback whales disperse widely in deep, pelagic waters and tend to avoid shallower coastal waters (Winn and Reichley 1985).

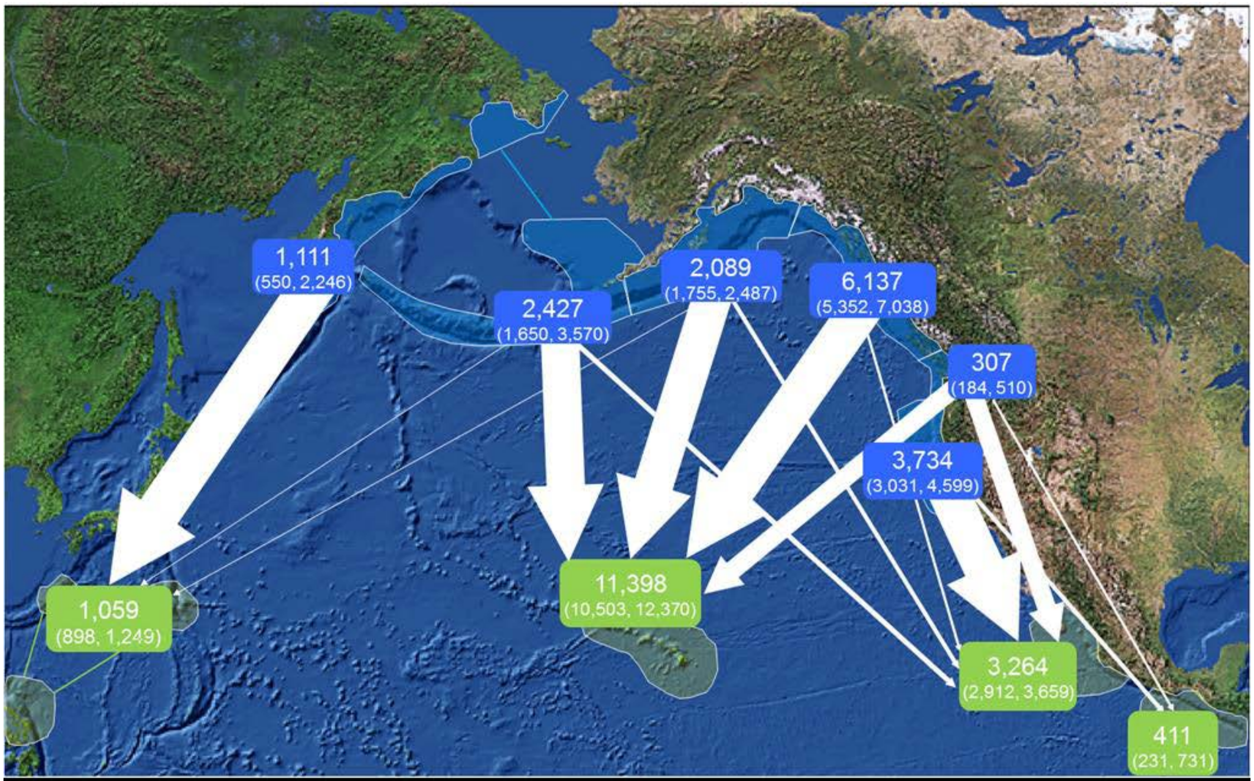

Figure 3. Abundance by summer feeding areas (blue), and winter breeding areas (green), with 95% confidence limits in parentheses. Migratory destinations from feeding area to breeding area are indicated by arrows with width of arrow proportional to the percentage of whales moving into winter breeding area (Wade et al. 2016).

Humpback whale populations in Southeast Alaska have been steadily increasing in recent decades. The Southeast Alaska-specific rate of increase is approximately 5.6% annually (Calambokidis et al. 2008) and the latest estimate of abundance for Southeast Alaska and northern British Columbia is between 3,005 and 6,137 humpback whales, depending on the modeling approach employed. As previously mentioned, humpback whales in Southeast Alaska are 94% comprised of the Hawaii DPS (not listed) and 6% of the Mexico DPS (threatened; Wade *et al.* 2016). Given Wade *et al.* (2016), we use 6% in this analysis to approximate the percentage of observed humpbacks that are from the Mexico DPS. WNP DPS humpback whales are not anticipated to occur in Southeast Alaska (Table 3).

Humpback whales are present in Southeast Alaska in all months of the year. Most Southeast Alaska humpback whales winter in low latitudes, but some individuals have been documented over-wintering near Sitka and Juneau (Moran et al. 2018) (J.R. Morana 2017). Late fall and winter whale habitat in Southeast Alaska appears to correlate with areas that have over-wintering herring (such as lower Lynn Canal, Tenakee Inlet, Whale Bay, Ketchikan, and Sitka Sound), none of which are in the action area (Baker et al. 1985, Straley 1990). However, the aggregation of some herring in the action area (inner Auke Bay) has the potential to provide a habitat where whales may feed on small volumes of fish and rest to conserve energy between foraging opportunities.

4.3.1.3 Threats to the Species

Natural Threats

There is limited information on natural phenomena that kill or injure humpback whales. Humpback whales are killed by orcas (Whitehead and Glass 1985, Dolphin 1987b, Florezgonzalez et al. 1994, Naessig and Lanyon 2004), and are probably killed by false killer whales and sharks. Calves sometimes remain protected near mothers or within a group and lone calves have been known to be protected by presumably unrelated adults when confronted with attack (Ford and Reeves 2008).

Harmful algal blooms are a potential stressor for humpback whales. Out of 13 marine mammal species examined in Alaska, domoic acid was detected in all species examined with humpback whale showing 38% prevalence. Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales (50%) and bowhead whales (32%) (Lefebvre et al. 2016). The occurrence of the nematode *Crassicauda boopis* appears to increase the potential for kidney failure in humpback whales and may be preventing some populations from recovering (Lambertsen 1992).

Anthropogenic Threats

Three human activities are known to threaten humpback whales: whaling, entanglement (principally in in commercial fishing gear), and ship strikes.

Whaling

Historically, commercial whaling represented the greatest threat to every population of humpback whales and was ultimately responsible for listing humpback whales as an endangered species. From 1900 to 1965, nearly 30,000 whales were taken in modern whaling operations in the Pacific Ocean. Prior to that, an unknown number of humpback whales were taken (Perry et al. 1999). In 1965, the International Whaling Commission banned commercial hunting of humpback whales in the Pacific Ocean.

There were no reported takes of humpback whales by subsistence hunters in Alaska or Russia for the 2011-2015 period (Muto et al. 2018a). One humpback whale was taken illegally by Alaska Native subsistence hunters near Toksook Bay in western Alaska in 2016, and while it could have been a member of the Mexico DPS or Western North Pacific DPS, it was more likely from the non-listed Hawaii DPS (NMFS unpublished data; Wade et al. 2016).

Entanglement

Humpback whales are also killed or injured during interactions with commercial fishing gear and other entanglements, although the evidence available suggests that these interactions may not

have significant, adverse consequence for humpback whale populations in Southeast Alaska. From 1979-2008 on the Canadian Atlantic coast, 1,209 whales were recorded entangled, 80% of which were humpback whales (Benjamins et al. 2012). Along the Pacific coast of Canada, 40 humpback whales have been reported as entangled between 1980 and 2011, four of which are known to have died (Ford et al. 2009, COSEWIC (Committee on the Status of Endangered Wildlife in Canada) 2011). A photography study of humpback whales in Southeast Alaska in 2003 and 2004 found at least 53% of individuals showed some kind of scarring from entanglement (Neilson et al. 2005).
The minimum estimate of the mean annual mortality and serious injury rate incidental to U.S. commercial fisheries for the Central North Pacific stock- which includes whales from the Hawaii DPS, Mexico DPS, and Western North Pacific DPS- in 2012-2016 is 9.9 humpback whales, based on observer data from Alaska (0.2 in federal fisheries + 5.5 in the state-managed Southeast Alaska salmon drift gillnet fishery), observer data from Hawaii (0.9), and Marine Mammal Authorization Program (MMAP) fishermen self-reports and reports, in which the commercial fishery is confirmed, to the NMFS Alaska Region stranding network. (Muto et al. 2018).

Strandings of humpback whales entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. The mean annual human-caused mortality and serious injury rate for 2011-2015 based on fishery and gear entanglements reported in the NMFS Alaska Regional Office stranding database is 0.4. The minimum average annual mortality and serious injury rate due to interactions with all fisheries in 2011-2015 is 18 Central North Pacific humpback whales (8.5 in commercial fisheries + 0.7 in recreational fisheries + 0.3 in subsistence fisheries + 8.8 in unknown fisheries) (Muto et al. 2018).

Entanglements in marine debris reported to the NMFS Alaska Region stranding network account for a minimum mean annual mortality and serious injury rate of 2.8 Central North Pacific humpback whales in 2011-2015 (Muto et al. 2018).

Ship Strike
Ship strikes and other interactions with vessels unrelated to fisheries occur frequently with humpback whales (Muto et al. 2018). Neilson et al. (2012) summarized 108 large whale ship-strike events in Alaska from 1978 to 2011, 25 of which are known to have resulted in the whale's death. Eighty-six percent of these reports involved humpback whales. Most ship strikes of humpback whales are reported from Southeast Alaska (Muto et al. 2018).

In 2017, there were seven reported vessel strikes to humpback whales in Alaska (https://alaskafisheries.noaa.gov/sites/default/files/17strandings.pdf). Between 2010 and 2014 the minimum mean annual mortality and serious injury rate due to ship strikes reported in Alaska for humpback whales was 2.7 whales (Muto et al. 2017a). These incidents account for a very small fraction of the total humpback whale population (Laist et al. 2001).

Vessel collisions with humpback whales remain a significant management concern, given the increasing abundance of humpback whales foraging in Alaska, as well as the growing presence of marine traffic in Alaska's coastal waters. Based on these factors, injury and mortality of humpback whales as a result of vessel strike will continue into the future (NMFS 2006).

4.3.1.4 Reproduction and Growth

Humpbacks give birth and presumably mate on low-latitude wintering grounds in January to March in the Northern Hemisphere. Females attain sexual maturity at 5 years in some populations and exhibit a mean calving interval of approximately two years (Clapham 1992, Barlow and Clapham 1997). Gestation is about 12 months, and calves probably are weaned by the end of their first year (Perry et al. 1999).

4.3.1.5 Feeding and Prey Selection

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

Humpback whales are relatively generalized in their feeding compared to some other baleen whales. In the Northern Hemisphere, known prey includes: euphausiids (krill); copepods; juvenile salmonids; Arctic cod; walleye pollock; pteropods; and cephalopods (Johnson and Wolman 1984, Perry et al. 1999). Foraging is confined primarily to higher latitudes (Stimpert et al. 2007). Feeding by humpback whales is observed most of the year in Auke Bay.

4.3.1.6 Diving and Social Behavior

In Hawaiian waters, humpback whales remain almost exclusively within the 1800 m isobath and usually within water depths less than 182 meters. Maximum diving depths are approximately 170 m (558 ft) (but usually <60 m [197 ft]), with a very deep dive (240 m [787 ft]) recorded off Bermuda (Hamilton et al. 1997). They may remain submerged for up to 21 min (Dolphin 1987a). Dives on feeding grounds ranged from 2.1-5.1 min in the north Atlantic (Goodyear unpublished manuscript). In Southeast Alaska average dive times were 2.8 min for feeding whales, 3.0 min for non-feeding whales, and 4.3 min for resting whales, with the deepest dives to 148m (Dolphin 1987a), while whales observed feeding on Stellwagen Bank in the North Atlantic dove <40m (Hain et al. 1992). Because most humpback whale prey is likely found above 300m, most humpback dives are probably relatively shallow. Hamilton et al. (1997) tracked one possibly feeding whale near Bermuda to 240 m depth.

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

4.3.1.7 Vocalization and Hearing

While there is no direct data on hearing in low-frequency cetaceans, the functional hearing range is anticipated to be between 7 Hz to 35 kHz (Watkins 1986, Au et al. 2006, Southall et al. 2007a, Ciminello et al. 2012, NMFS 2016b). Baleen whales have inner ears that appear to be specialized for low-frequency hearing. In a study of the morphology of the mysticete auditory apparatus, Ketten (1997) hypothesized that large mysticetes have acute infrasonic hearing.

Humpback whales produce a wide variety of sounds ranging from 20 Hz to 10 kHz. During the breeding season males sing long, complex songs, with frequencies in the 20-5000 Hz range and intensities as high as 181 dB (Payne 1970, Winn et al. 1970, Thompson et al. 1986). Source levels average 155 dB and range from 144 to 174 dB (Thompson et al. 1979). The songs appear to have an effective range of approximately 10 to 20 km. Animals in mating groups produce a variety of sounds (Tyack 1981, Silber 1986b).
Social sounds in breeding areas associated with aggressive behavior in male humpback whales are very different than songs and extend from 50 Hz to 10 kHz (or higher), with most energy in components below 3 kHz (Tyack and Whitehead 1983, Silber 1986a). These sounds appear to have an effective range of up to 9 km (Tyack and Whitehead 1983).

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

In summary, humpback whales produce at least three kinds of sounds:

1. Complex songs with components ranging from at least 20 Hz–24 kHz with estimated source levels from 144– 174 dB; these are mostly sung by males on the breeding grounds (Winn et al. 1970, Richardson et al. 1995, Au et al. 2000, Frazer and Mercado 2000, Au et al. 2006);
2. Social sounds in the breeding areas that extend from 50Hz – more than 10 kHz with most energy below 3kHz (Tyack and Whitehead 1983, Richardson et al. 1995); and
3. Feeding area vocalizations that are less frequent, but tend to be 20 Hz–2 kHz with estimated sources levels in excess of 175 dB re 1 Pa at 1m (Thompson et al. 1986, Richardson et al. 1995).

4.3.2 Status of WDPS Steller Sea Lions

The Steller sea lion (*Eumetopias jubatus*) is classified within the Order Carnivora, Suborder Pinnipedia, Family Otariidae, and Subfamily Otariinae. The Steller sea lion is the only extant species of the genus *Eumetopias*.

We used information available in the recent stock assessment report (Muto et al. 2018b), recovery plan (NMFS 2008a), status review (NMFS 1995), listing document (62 FR 24345), NMFS species information, and recent biological opinions to summarize the status of the species, as follows.

In the 1950s, the worldwide abundance of Steller sea lions was estimated at 240,000 to 300,000 animals, with a range that stretched across the Pacific Rim from southern California, Canada, Alaska, and into Russia and northern Japan. In the 1980s, annual rates of decline in the range of what is now recognized as the western population were as high as 15 percent. The worldwide

Steller sea lion population declined by over 50 percent in the 1980s, to approximately 116,000 animals (Loughlin 1992). By 1990, the U.S. portion of the population had declined by about 80 percent relative to the 1950s. On April 5, 1990, NMFS issued an emergency interim rule to list the Steller sea lion as threatened (55 FR 12645). On November 26, 1990, NMFS issued the final rule to list Steller sea lions as a threatened species under the ESA (55 FR 49204).

NMFS reclassified Steller sea lions as two distinct population segments under the ESA in 1997 based on demographic and genetic dissimilarities—the western and eastern stock (62 FR 24345 (NMFS 1997)) (NMFS 1997). At that time, the WDPS, extending from Japan around the Pacific Rim to Cape Suckling in Alaska (144° W; Figure 5), was listed as endangered due to its continued decline and lack of recovery (NMFS 1997).

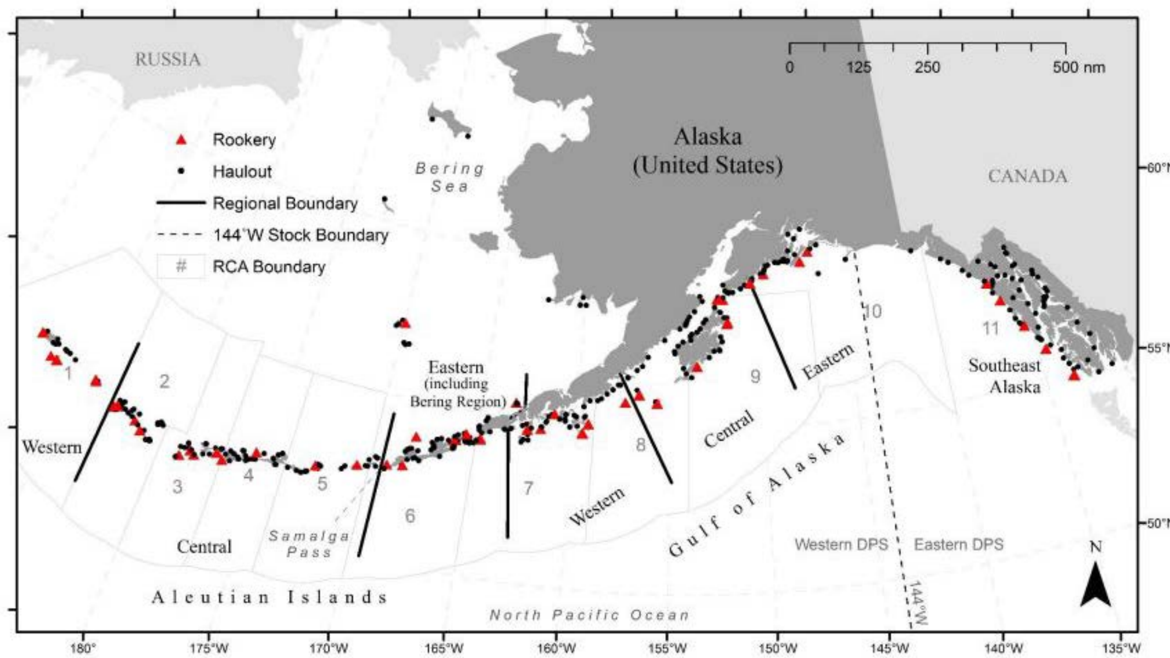

Figure 4. Map of Alaska showing the NMFS Steller sea lion survey regions, rookery, and haulout locations. The line (144°W) separating primary breeding rookeries of the eastern and western distinct population segments (EDPS vs WDPS) is also shown (Fritz et al. 2016).

The eastern Distinct Population Segment (EDPS), extending from Cape Suckling (144° W) east to British Columbia and south to California, was listed as threatened because of concern over WDPS animals ranging into the east, the larger decline overall in the U.S. population, human interactions, and the lack of recovery in California (NMFS 1997). The EDPS continued to recover, however, and NMFS removed the EDPS from the list of threatened species on November 4, 2013 (78 FR 66140 (NMFS 2013)), since the recovery criteria in the Steller Sea Lion Recovery Plan (NMFS 2008b) were achieved and the stock no longer met the definition of a threatened species under the ESA. Because the EDPS is no longer listed under the ESA, this Opinion does not analyze effects of the proposed action on that DPS.

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

More recently, WDPS Steller sea lions have shown an increasing trend in abundance in much of their range. The 2016 Stock Assessment Report for WDPS Steller sea lions indicates a minimum population estimate of 50,983 individuals (Muto et al. 2017b). The population trend of non-pup WDPS Steller sea lions from 2000-2014 varies regionally, from -8.71 percent per year in the Western Aleutians to +5.07 percent per year in the eastern Gulf of Alaska. Despite incomplete surveys conducted in 2006 and 2007, the available data indicate that overall WDPS Steller sea lions have at least been stable since 2004 (when the last complete assessment was done), although declines continue in the western Aleutian Islands. Overall, WDPS Steller sea lion pup and non-pups counts were estimated to be increasing at about 2 percent per year from 2000-2015 (Muto et al. 2017b).

4.3.2.1 Distribution

Movement of Steller sea lions between the WDPS and EDPS may affect population dynamics and patterns of underlying genetic variation. Studies have confirmed movement of animals across the 144° W boundary (Fritz et al. 2013), (Jemison et al. 2013), (Pitcher et al. 2007), and (Raum-Suryan et al. 2002). Jemison et al (2013) found regularly occurring temporary movements of WDPS Steller sea lions across the 144 W longitude boundary, and some WDPS females have given birth at White Sisters and Graves Rocks rookeries and have likely emigrated permanently. The vast majority of these sightings have been in northern Southeast Alaska, north of Frederick Sound. Fritz et al (2013) estimated an average annual breeding season movement of WDPS Steller sea lions to southeast Alaska of 917 animals.

Within the action area, Steller sea lions are anticipated to be predominantly from the EDPS; however, WDPS animals may be found there as well. Although there are no known Steller sea lion haulouts or rookeries directly inside the action area, the Benjamin Island haulout (over 25 km northwest of the action area) and Little Island (over 28 km northwest of the action area) are likely the predominant haulouts used by the Steller sea lions that are found transiting into and out of the action area. From 2000-2018, 280 unique branded individuals were documented at the Benjamin Island haulout. Of these, three individuals were from the WDPS and the remaining 277 were from the EDPS. During the same time period, 105 unique branded individuals were documented at the Little Island haulout. Of these, three individuals were from the WDPS and the remaining 102 were from the EDPS (personal communication, L. Jemison, ADF&G).

The proportion of western DPS Steller sea lion non-pups in the Lynn Canal region of the population mixing zone (northern–central Southeast Alaska) by birth region, age-class and maternal genetic lineage is 18.1% (Hastings et al. 2019). Birth regions consist of the Western Stock Region, those animals born in the new rookeries in the mixing zone of the Eastern Stock Region (Graves Rocks and White Sisters), or those born in southern Southeast Alaska (Forrester and Hazy rookeries)(Hastings et al. 2019).

Threats to the Species
Brief descriptions of threats to Steller sea lions follow. More detailed information can be found in the Steller sea lion Recovery Plan (available at: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf), the Stock Assessment Reports (available at: http://www.nmfs.noaa.gov/pr/sars/species.htm), and the most recent Alaska Groundfish Biological Opinion (NMFS 2014a).

Natural Threats

Killer Whale Predation
The Steller Sea Lion Recovery Plan (NMFS 2008b) ranked predation by killer whales as a potentially high threat to the recovery of the WDPS. Steller sea lions in both the eastern and western stocks are eaten by killer whales (Dahlheim and White 2010).

Relative to other WDPS sub-regions, transient killer whale abundance and predation on Steller sea lions has been well studied in the Prince William Sound and Kenai Fjords portion of the eastern GOA. Steller sea lions represented 33% and 5% of the remains found in deceased killer whale stomachs in the GOA, depending on the specific study results (Heise et al. 2003). The abundance of transient killer whales in the eastern GOA was estimated to be 18 (Matkin et al. 2012). Nineteen transient killer whales were identified in Kenai Fjords from 2000 through 2005 and killer whale predation on six pup and three juvenile Steller sea lions was observed. It has been estimated that 11% of the Steller sea lion pups born at the Chiswell Island rookery (in the Kenai Fjords area) were preyed upon by killer whales from 2000 through 2005. GOA transient killer whales were concluded to have a minor impact on the recovery of the sea lions in the area (Maniscalco et al. 2007). Steller sea lion pup mortality was studied using remote video at Chiswell Island. Pup mortality up to 2.5 months postpartum averaged 15.4%, with causes varying greatly across years (2001–2007). They noted that high surf conditions and killer whale predation accounted for over half the mortalities. Even at this level of pup mortality, the Chiswell Island Steller sea lion population has increased (Maniscalco et al. 2008).

Other studies in the Kenai Fjords/Prince William Sound region have also found evidence for high levels of juvenile Steller sea lion mortality. Based on data collected post-mortem from juvenile Steller sea lions implanted with life history tags, 12 of 36 juvenile Steller sea lions were confirmed dead, at least 11 of which were likely killed by predators (Horning and Mellish 2012). Horning and Mellish (2012) estimated that over half of juvenile Steller sea lions in this region are consumed by predators before age 4 yr. They suggested that low juvenile survival due to predation, rather than low natality, may be the primary impediment to recovery of the WDPS of Steller sea lions in the Kenai Fjords/Prince William Sound region.

Shark Predation
Steller sea lions may also be attacked by sharks, though little supporting evidence exists. The Steller Sea Lion Recovery Plan did not rank shark predation as a threat to the recovery of the WDPS (NMFS 2008b). Sleeper shark and sea lion home ranges overlap (Hulbert et al. 2006). A significant increase in the relative abundance of sleeper sharks occurred during 1989–2000 in the central GOA; however, samples of 198 sleeper shark stomachs found no evidence of Steller sea lion predation (Sigler et al. 2006). Sigler *et al.* (2006) sampled sleeper shark stomachs collected in the GOA near sea lion rookeries when pups may be most vulnerable to predation (i.e., first

water entrance and weaning) and found that fish and cephalopods were the dominant prey. Tissues of marine mammals were found in 15 percent of the shark stomachs, but no Steller sea lion tissues were detected (Sigler et al. 2006). One study suggests that predation on Steller sea lions by sleeper sharks may be occurring: approximately 27% of observed events of predation on juvenile Steller sea lions could be attributed to Pacific sleeper sharks. Although these observations do not constitute proof of attacks on live Steller sea lions by Pacific sleeper sharks, these data indicate that Pacific sleeper sharks could be considered as a possible source of mortality of juvenile Steller sea lions in the GOA and Prince William Sound (Horning 2014).

Disease and Parasites
The Steller Sea Lion Recovery Plan (NMFS 2008b) ranked diseases and parasites as a low threat to the recovery of the WDPS. There is no new information on disease in the WDPS relative to the information in the BiOp for the Fishery Management Plan (FMP) for the Gulf of Alaska (FMP BiOp) (NMFS 2010).

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

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

<u>Anthropogenic Threats</u>

Fishing Gear and Marine Debris Entanglement

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked interactions with fishing gear and marine debris as a low threat to the recovery of the WDPS. Helker *et al.* (2015) report 352 cases of serious injuries to EDPS Steller sea lions from interactions with fishing gear between 2009 and 2013, mostly from troll gear and other marine debris. Raum-Suryan *et al.* (2009) found 386 animals either entangled in marine debris or having ingested fishing gear over the period 2000-2007 in Southeast Alaska and northern British Columbia.

The estimated mean annual mortality and serious injury rate in U.S. commercial fisheries in 2011-2015 is 31 Steller sea lions from the WDPS (31 from observer data + 0.2 from stranding data). No observers have been assigned to several fisheries that are known to interact with WDPS Steller sea lions; thus, the estimated mortality and serious injury is likely an underestimate of the actual level (Muto et al. 2018).

Competition between Commercial Fishing and Steller Sea Lions for Prey Species

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked competition with fisheries for prey as a potentially high threat to the recovery of the WDPS. Substantial scientific debate surrounds the question about the impact of potential competition between fisheries and Steller sea lions. It is generally well accepted that commercial fisheries target several important Steller sea lion prey species (NRC 2003) including salmon species, Pacific cod, Atka mackerel, pollock, and others. These fisheries could be reducing sea lion prey biomass and quality at regional and/or local spatial and temporal scales such that sea lion survival and reproduction are reduced. NMFS (2014) analyzes this threat in detail.

Subsistence/Native Harvest

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked subsistence harvest as a low threat to the recovery of the WDPS. The most recent subsistence harvest data were collected by the Alaska Department of Fish and Game through 2008 and by the Ecosystem Conservation Office of the Aleut Community of St. Paul through 2009. The mean annual subsistence take from the WDPS in Alaska over the 5-year period from 2004 through 2008, combined with the mean take over the 2005–2009 period from St. Paul, was 199 Steller sea lions/year (Muto et al. 2018a).

Illegal Shooting

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked illegal shooting as a low threat to the recovery of the WDPS. Illegal shooting of sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as threatened under the ESA in 1990. The NMFS Alaska Stranding Program documents 60 Steller sea lions with suspected or confirmed firearm injuries from 2000 – 2016 in Southeast Alaska (NMFS 2017b).

On November 6, 2018, two men were sentenced in federal court for harassing and killing Steller sea lions with shotguns. The sentencing case as the result of a federal investigation after 15 Steller Sea lions were found dead along the sand bars at the mouth of Copper River during the opening of the 2015 Copper River salmon gillnet season.

Mortality and Disturbance from Research Activities

The Steller Sea Lion Recovery Plan (NMFS 2008) ranked effects from research activities as a low threat to the recovery of the WDPS. Mortalities may occur incidental to marine mammal research activities authorized under ESA and MMPA permits issued to a variety of government, academic, and other research organizations. Between 2011 and 2015, there were three mortalities resulting from research on the WDPS of Steller sea lions (Muto et al 2018).

Vessel Disturbance

Vessel traffic, in the form of sea lion research, tourism, and other marine vessel traffic, may disrupt sea lion feeding, breeding, or aspects of sea lion behavior. The Steller Sea Lion Recovery Plan (NMFS 2008) ranked disturbance from these sources as a low threat to the recovery of the WDPS. Disturbance from these sources are not likely having population level effects in the WDPS.

Risk of Vessel Strike

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

Toxic Substances

The Steller Sea Lion Recovery Plan ranked the threat of toxic substances as medium (NMFS 2008). The risk of spills associated with this project is being well-mitigated, and sediment testing for this project indicates contaminant levels are below thresholds of concern (PND Engineers, 2018).

Climate Change and Ocean Acidification

Marine ecosystems are susceptible to impacts from climate change and ocean acidification linked to increasing global anthropogenic CO_2 emissions. As discussed in the Groundfish Fisheries Management Plan Opinion (FMP)(NMFS 2010), there is strong evidence that ocean pH is decreasing, ocean temperatures are increasing, and that this warming is accentuated in the Arctic. Scientists are working to understand the impacts of these changes to marine ecosystems; however, the extent and timescale over which WDPS Steller sea lions may be affected by these changes is unknown. Readers are referred to the discussion on climate change in Section 4.1.6 of the Groundfish FMP Opinion (NMFS 2010) and to the discussion on ocean acidification in Section 7.3 of the Final Environmental Impact Statement for the Steller sea lion protection measures (NMFS 2014c).

Reproduction and Growth

Detectable changes in a population's birth rate may provide insight into the nature of the factors controlling Steller sea lion population dynamics. While this has been broadly recognized and the focus of many studies, few empirical data exist to directly infer birth rate in wild Steller sea lions. The best data for inferring WDPS Steller sea lion birth rate are available for the central Gulf of Alaska (GOA) where collections from the 1970s and 1980s provide direct measurements and a basis for comparing birth rates in the central GOA over time. The numerous models developed from these historic collections yield generally consistent results: the decline of Steller sea lions in the central GOA in the 1980s was driven by low juvenile survival and the continued decline in the 1990s was likely driven by reduced birth rate.

Several models have demonstrated the relevance of spatial heterogeneity in vital rates (birth rate, death rate, population growth rate) among subpopulations in the WDPS of Steller sea lion. As such, vital rates from one Steller sea lion subpopulation may not be applicable to another, especially where the rate and direction of population growth diverge. Another common conclusion from the age-structured modeling studies is that the fraction of juveniles in the non-pup counts is an important variable for inferring changes in vital rates over time (Muto et al. 2017b). Many studies have concluded that the available count data do not provide insight into the relative contribution of survival and birth rate in current Steller sea lion population trends. However, Holmes *et al.* (Holmes 2007) included information on changes in the juvenile fraction of the population to help estimate vital rate changes in the central GOA sea lion population. This information improves the ability to estimate vital rate changes in the absence of sightings of known–age individuals.

The best available data from the eastern GOA suggest that birth rate is similar to pre-decline birth rates, while the best available data from the central GOA suggest that the birth rate continues to decline steadily relative to 1976 levels. Therefore, birth rate, an important parameter driving population trends, is not consistent across the WDPS and is highest in the eastern portion of the WDPS Steller sea lion range (Muto et al. 2017b)

Feeding and Prey Selection

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

The seasonal ecology of Steller sea lions in Southeast Alaska has been studied by relating the distribution of sea lions to prey availability (Womble et al. 2005, Womble et al. 2009). Figure 6 depicts a likely seasonal foraging strategy for Steller sea lions in Southeast Alaska. These results suggest that seasonally aggregated high-energy prey species, such as eulachon and herring in late spring and salmon in summer and fall, influence the seasonal distribution of Steller sea lions in some areas of Southeast Alaska. Similarly, the Status Review of Southeast Alaska Pacific Herring (NMFS 2014d) generalizes that sea lions forage on herring aggregations in winter, on spawning herring and eulachon in spring, and on various other species throughout the year. Herring fishery managers use the presence of sea lions on the spring spawning grounds as an indicator that spawning is imminent, even though herring are in deeper adjacent waters for weeks prior to sea lion arrival (Kruse 2000).

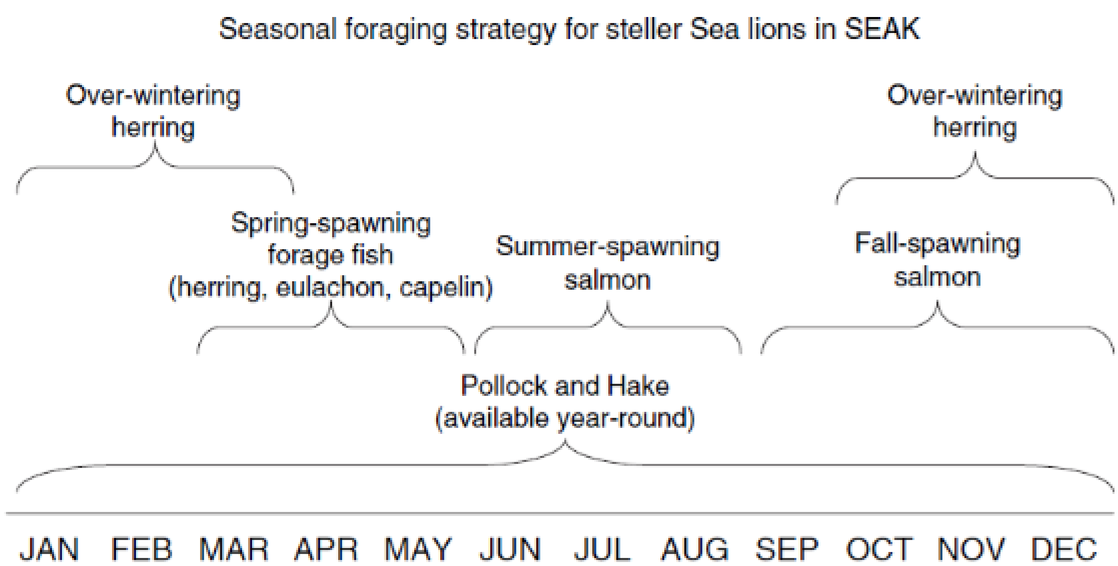

Figure 5. Seasonal foraging ecology of SSL. Reproduced with permission from Womble et al. 2009.

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

Diving and Social Behavior

Steller sea lions are very vocal marine mammals. Roaring males often bob their heads up and down when vocalizing. Adult males have been observed aggressively defending territories. Steller sea lions gather on haulouts year-round and rookeries during the breeding season and regularly travel as far as 250 miles to forage for seasonal prey. However, females with pups likely forage much closer to their rookery. Diving is generally to depths of 600 feet or less and diving duration is usually 2 minutes or less.

Vocalization and Hearing

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2016b). Steller sea lions have similar hearing thresholds in-air and underwater to other otariids. In-air hearing ranges from 0.250-30 kHz, with their best hearing sensitivity at 5-14.1 kHz (Mulsow and Reichmuth 2010). An underwater audiogram shows the typical mammalian U-shape. Higher hearing thresholds, indicating poorer sensitivity, were observed for signals below 16 kHz and above 25 kHz (Kastelein et al. 2005).

5 ENVIRONMENTAL BASELINE

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

5.1 Stressors on Mexico DPS Humpback Whales

Disturbance and risk of vessel strike from transiting vessels, competition for prey, effects from climate change, risk of entanglement, and the risk of oil spills (or other hazardous materials) could be sources of stress to humpback whales in the action area. A short description and summary of the effects of these stressors are presented below. More detailed analyses are available in the most recent humpback whale recovery plan (NMFS 1991b) and ESA Status Review (Bettridge et al. 2015).

5.1.1 Vessel Disturbance and Strike

Vessel-based recreational activities, commercial fishing, shipping, whale-watching, the Alaska Marine Highway System (AMHS), and general transportation occur within the action area regularly. 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 long
- Most collisions occur at speeds over 13 knots
- Most collisions occur between May and September
- Calves and juveniles appear to be at higher risk of collisions than adult whales

Further, the authors used previous locations of whale strikes to produce a kernel density estimation. The high risk areas shown in red in Figure 7 are also popular whale-watching destinations (Neilson et al. 2012). Although some of the risk factors for ship strike exist in Auke Bay (there are many vessel transits between May-Sept, with vessels less than 49 feet traveling over 13 knots), the action area is not identified as an area of high risk in this analysis.

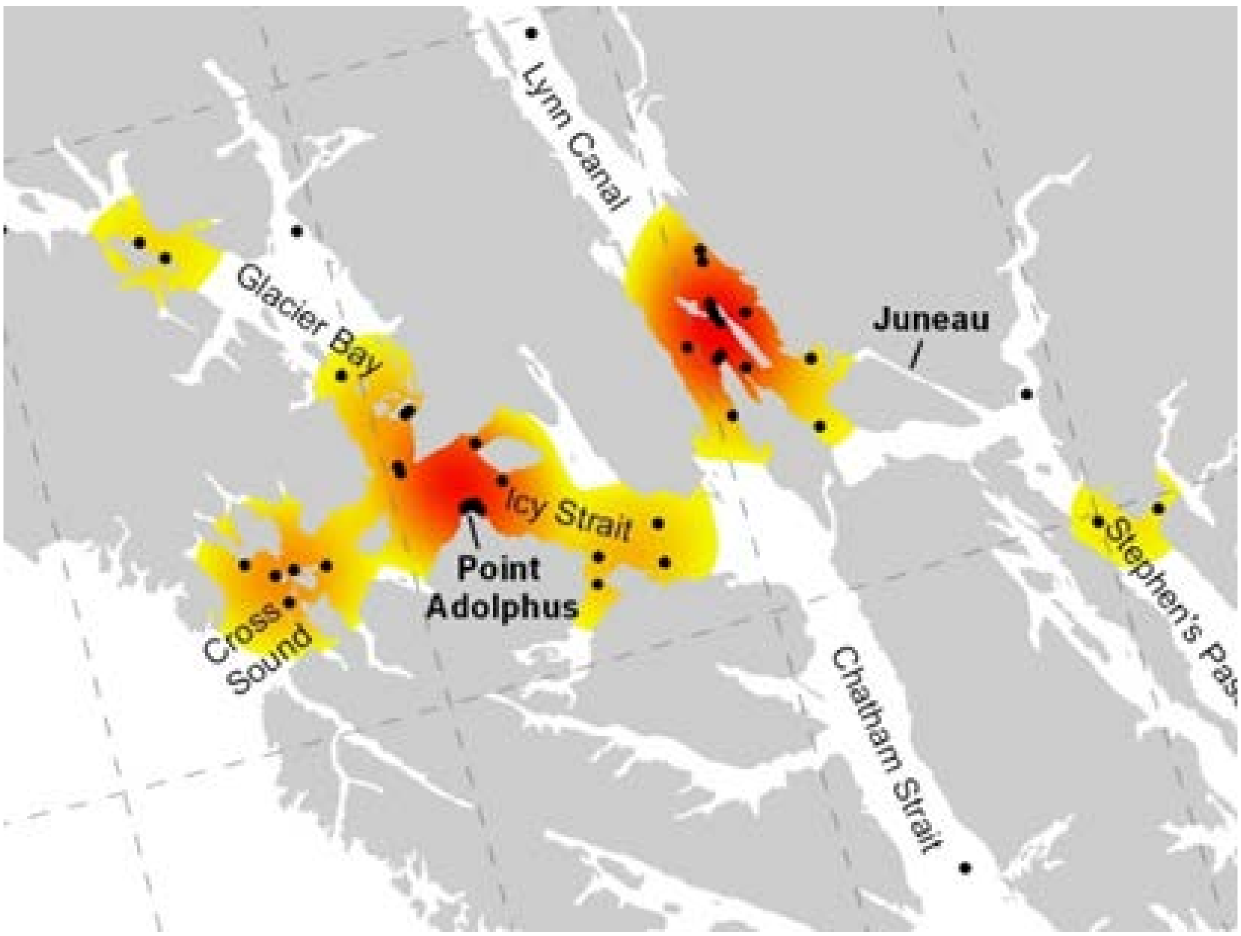

Figure 6. High Risk Areas for Vessel Strike in northern Southeast Alaska. Used with permission from (Neilson et al. 2012).

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

a. Not approach within 100 yards of a humpback whale, or cause a vessel or other object to approach within 100 yards of a humpback whale,

b. Not place vessel in the path of oncoming humpback whales causing them to surface within 100 yards of vessel,
c. Not disrupt the normal behavior or prior activity of a whale, and
d. Operate vessel at a slow, safe speed when near a humpback whale. Safe speed is defined in regulation (see 33 CFR § 83.06).

Since 2011, cruise lines, pilots, NMFS, and National Park Service (NPS) biologists have worked together to produce weekly whale sightings maps to improve situational awareness for cruise ships and state ferries in Southeast Alaska. In 2016, NMFS and NPS launched Whale Alert, 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.

In addition to these voluntary marine mammal viewing guidelines, many of the marine mammal viewing tour boats voluntarily subscribe to even stricter approach guidelines by participating in the Whale SENSE program. NMFS implemented Whale SENSE Alaska in 2015, which is 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/.

5.1.2 Competition for Prey

Competition for prey between humpback whales, other marine life, and humans may exist. Humpback whales feed on schooling fish, including species that are harvested by humans commercially or for personal use. Given the recent positive abundance trends for humpback whales discussed in Section 4.3.1.2 and the relatively small scale of the action area compared to commercial and personal use fishing grounds, NMFS expects any competition for prey in the action area to be minor.

5.1.3 Climate Change

Overwhelming data indicate the planet is warming (IPCC 2014), which poses a threat to most Arctic and Subarctic marine mammals.

Climate change has the potential to impact species abundance, geographic distribution, migration patterns, timing of seasonal activities (IPCC 2014), and species viability into the future. Climate change is also expected to result in the expansion of low oxygen zones in the marine environment(Gilly et al. 2013) Though predicting the precise consequences of climate change on highly mobile marine species, such as many of those considered in this opinion, is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring.

The indirect effects of climate change would result from changes in the distribution of temperatures suitable for the distribution and abundance of prey and the distribution and abundance of competitors or predators. For example, variations in the localized recruitment of herring in or near the action area caused by climate change could change the distribution and localized abundance of humpback whales. However, we have no information to indicate that this has happened to date. Warmer waters could favor productivity of some species of forage fish, but the impact on recruitment of important prey fish of humpback whales is unpredictable.

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

5.1.4 Entanglement

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

Entangled marine mammals may drown or starve due to being restricted by gear, suffer physical trauma and systemic infections, or be hit by vessels due to an inability to avoid them. Entanglement can include many different gear interaction scenarios, but the following have occurred with humpback whales:

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

The NMFS Alaska Marine Mammal Stranding Network database has records of 199 large whale entanglements between 1990 and 2016. Of these, 67% were humpback whales. Most humpbacks get entangled with gear between the beginning of June and the beginning of September, when they are on their nearshore foraging grounds in Alaska waters. Between 1990 and 2016, 29% of humpback entanglements were with pot gear and 37% with gillnet gear. Longline gear comprised only 1–2% of all humpback fishing gear interactions.

5.1.5 Pollution

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

According to the ADEC’s most recent list of impaired waterbodies, there are no impaired waterbodies in the action area[1]. However, marine water quality in the action area can be affected by discharges from shipyard and other industrial activity, treated sewer system outflows, vessels operating in marine waters, and sediment runoff from paved surfaces and disturbed areas (HDR 2017).

A search of the ADEC Contaminated sites database[2] showed that there are four land-based active contaminated sites in the vicinity of Auke Bay. These include the FAA Coghlan Island station site (Hazard ID 4176); a failed 550-gallon underground home heating oil tank (Hazard ID 4536); the Glacier Highway Battery Dump Site (Hazard ID 4636); and the Auke Bay RV Park (Hazard ID 26824). Clean-up is in progress at the four sites.

5.2 Stressors on WDPS Steller Sea Lions

Disturbance from vessel transit, competition for prey, effects from climate change, risk of entanglement, and the risk of oil spills (or other hazardous materials) could be sources of stress to Steller sea lions in the action area. Short descriptions and summaries of the effects of these stressors are presented below. A more detailed analysis is available in a recent biological Opinion of the effects of Alaska Groundfish fisheries (NMFS 2014) and the SSL recovery plan (NMFS 2008).

5.2.1 Vessel Disturbance and Strike

Vessel-based recreational activities, commercial and charter fishing, shipping, and general transportation occur within the action area regularly. All of which increase ambient in-air and underwater noise and pose risk of vessel-whale collisions. NMFS provides a voluntary framework for vessel operators to follow a code of conduct to reduce marine mammal interactions including:

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

These guidelines can be viewed at https://alaskafisheries.noaa.gov/pr/mm-viewing-guide.

[1] ADEC. Division of Water. Impaired Waters Map. Available at http://www.arcgis.com/home/webmap/viewer.html?webmap=5987f5c7a33846b19b9097dddcf8332a accessed December 2018.

[2] ADEC. Division of Spill Prevention and Response. Contaminated Sites Map. Available at http://www.arcgis.com/home/webmap/viewer.html?webmap=315240bfbaf84aa0b8272ad1cef3cad3&center=-131.656975,55.344914&level=15&marker=-131.656975,55.344914,,Click%20on%20arrow%20to%20get%20information%20about%20this%20site accessed December 2018.

Although there are documented occurrences of Steller sea lions being struck by vessels in Southeast Alaska (see Section 4.3.2), vessel strike has not been documented in the action area and is not considered a major threat to Steller sea lions.

5.2.2 Competition for Prey

Competition for prey species could exist between Steller sea lions and other marine life and Steller sea lions and commercial fishing. NMFS (2008) noted there are commercial fisheries that target key Steller sea lion prey, including Pacific cod, salmon, and herring in the eastern portion of their range. It was recognized that in some regions, fishery management measures appear to have reduced this potential competition (e.g., no trawl zones and gear restrictions on various fisheries in southeast Alaska) and in others a very broad distribution of prey and a lack of seasonal overlap between fisheries and prey preference by sea lions may minimize competition as well. Given the recent abundance trends discussed above in Section 4.3.2 and the relatively small scale of the action area compared to nearby fishing grounds, NMFS expects any competition for prey in the action area to be minor.

5.2.3 Climate Change

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

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

5.2.4 Entanglement

Although the Steller Sea Lion Recovery Plan (NMFS 2008b) ranked interactions with fishing gear and marine debris as a low threat to the recovery of the western DPS, it is likely that many entangled sea lions may be unable to swim to shore once entangled, may die at sea, and may not be available to count (Loughlin 1986, Raum-Suryan et al. 2009). Based on data collected by ADF&G and NMFS, Helker *et al.* (2016) reported Steller sea lions to be the most common species of human-caused mortality and serious injury between 2011 and 2015. There were 468 cases of serious injuries to eastern DPS Steller sea lions from interactions with fishing gear and marine debris. While these cases are attributed to the eastern DPS because they occurred east of 144° W, eastern and western DPS animals overlap in Southeast Alaska, and these takes may have been western DPS animals. Raum-Suryan et al. (2009) observed a minimum of 386 animals either entangled in marine debris or having ingested fishing gear over the period 2000-2007 in Southeast Alaska and northern British Columbia. Over the same period, there were 241 cases of mortality and serious injury reported for the western DPS: 31 in U.S. commercial fisheries, 1.4 in unknown fisheries (commercial, recreational, or subsistence), 2 in marine debris, 2.6 due to other causes (arrow strike, entangled in hatchery net, illegal shooting, research), and 204 in subsistence harvest. These animals mostly interacted with observed trawl (13) longline (2.8) troll (1), and gillnet (15) fisheries, typically resulting in death (Muto et al. 2018b).

The minimum estimated mortality rate of western Steller sea lions incidental to all U.S. commercial fisheries is 32 sea lions per year, based on PSO data (31) and stranding data (1.4) where PSO data were not available. Several fisheries that are known to interact with the western DPS have not been observed reaching the minimum estimated mortality rate (Muto et al. 2018b).

5.2.5 Pollution

The risk of oil spills or other hazardous materials to Steller sea lions is similar to humpback whales. For more information, please see Section 5.1.5 above.

6 EFFECTS OF THE ACTION

Per 50 CFR 402.02, "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.
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.

6.1 Project Stressors

Based on our review of the Biological Assessment (ADOT&PF 2017a), the IHA application (ADOT&PF 2017b), the proposed notice for issuing the IHA (NMFS 2018), personal communications, and other available literature as referenced in this Opinion, our analysis recognizes that the proposed construction activities during the Statter Harbor Improvement Project may cause these primary stressors:

1. in-water sound fields produced by impulsive noise sources such as: impact pile driving and blasting;
2. in-water sound fields produced by continuous noise sources such as: vibratory pile removal, vibratory pile driving, dredging, drilling, and vessels;
3. in-air sound fields produced by impulsive noise sources such as: impact pile driving and blasting;
4. risk of vessels striking marine mammals;
5. seafloor disturbance from drilling activities, pile driving and placement of fill; and
6. indirect effects such as: increased disturbance from whale watching vessels.

Most of the analysis and discussion of effects to WDPS Steller sea lions and Mexico DPS humpback whales from this action will focus on exposure to in water impulsive and continuous noise sources because these stressors will likely have the most direct impacts on listed species.

6.1.1 Stressors Not Likely to Adversely Affect ESA-listed Species

Based on a review of available information, we determined which of the possible stressors may occur, but for which the likely effects are improbable or minimal.

6.1.1.1 In-Air Noise

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

- 100 dB re $20\mu Pa_{rms}$ for non-harbor seal pinnipeds

Temporary fill will be placed to confine the blasts and mitigate noise from the blasting portion of this project. While WDPS Steller sea lions may be exposed to in-air noise from the pile driving activities, a standard sound attenuation model suggests that sound generated from impact pile driving would attenuate to the 100db rms criterion within 158 feet from the pile, and in-air noise from vibratory driving would fall below 100 db rms threshold altogether (NMFS 2017a). Since 100 bd is below the level that could harm Steller sea lions, this in-air noise impact is expected to be minimal. There are no surveyed haulouts within the action area, and any WDPS Steller sea lions exposed to the project sound would only be exposed after swimming into the action area. Any WDPS Steller sea lion close enough to the sound source to be considered a 'take' from in-air noise associated with pile driving would already have been accounted for by in-water take, or avoided due to the proposed mitigation measures.

6.1.1.2 Vessel strike

The possibility of vessel strike associated with the proposed action is extremely unlikely. Tug towing operations for construction occur at relatively low speed limits (5 knots), and the maximum transit speed for tug and barge is anticipated to be 8–10 knots. Once vessels get to the construction site, they will be anchored. Skiffs may transport workers very short distances and low speeds from shore to the work platform. Due to the common presence of commercial and recreational vessels in the action area and habituation of marine mammals to regular vessel traffic, the use of slow-moving tugboats and barges associated with construction of the project is not anticipated to adversely affect ESA-listed species.

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

Although Statter Harbor has high volumes of vessel traffic, the likelihood of a vessel strike as a result of the proposed action is low. When vessels are required to transport workers to the work platform, they will be transported by skiff at low speeds across very short distances from the shore. In addition, all vessels will be required to observe the Alaska humpback whale approach regulations (100 yards), which will further reduce the likelihood of interactions.
In general, the association in space and time of project-related vessels and humpback whales and Steller sea lions is highly unlikely because 1) vessel traffic associated with the proposed action will be minimal, and 2) the duration of operations is limited to fall and winter months when the majority of humpbacks migrate from the area. In addition, NMFS's regulations for approaching humpback whales require that vessels not approach within 100 yards. All of these factors limit the risk of strike. We conclude the probability of strike occurring is extremely unlikely and

therefore effects are minor.

6.1.1.3 Disturbance to seafloor

A Sampling and Analysis Plan was developed for the dredge area and was implemented in October of 2016. The sample results indicated the material did not contain any contaminants above the regulatory screening levels and thus is suitable for in-water disposal. USACE issued a determination of in-water suitability of disposal materials under POA-2008-782-M4 (PND Engineers 2018b).

Neither the Auke Bay coastline nor the submerged habitats in the Statter Harbor action area are pristine marine environments, however the Dredge Material Characterization Report (Appendix C of CBJ D&H IHA Request (PND Engineers 2018a)) that summarizes testing results from the 2015 sampling program found that all contaminants of concern are below Alaska Department of Environmental Conservation (ADEC) screening levels (PND Engineers 2018b).

During drilling, pile removal, and pile installation, a temporary and localized increase in turbidity and sedimentation near the seafloor is possible in the immediate area surrounding each 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).

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 driving operations at a moderate to rapid rate depending on tidal stage.

Therefore, the impact from increased turbidity levels would be negligible to humpback whales and Steller sea lions, 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.

6.1.1.4 Indirect effects of increased disturbance from whale watching vessels

Although the project does not propose to increase the number of whale watching vessels in the area, the new staging areas and separate launch facilities propose to alleviate current congestion and separate conflicting uses by providing a separate moorage for the existing commercial sightseeing fleet. The new moorage facility is specifically intended to serve the existing commercial fleet, including whale-watching, sightseeing and charters. This action is expected to increase efficiency and could ultimately make it easier for more whale-watching boats to function out of the harbor and/or for boats to operate more efficiently and run more tours from the harbor. Juneau-area humpback whales already experience relatively high levels of vessel activity from the existing whale-watching and charter industries and any increase to the overall vessel traffic near humpback whales and Steller sea lions could contribute to impacts to listed humpback whales and Steller sea lions through increased noise, harassment, displacement, pollution, etc.; however, these incremental effects are not likely to be measurable or distinguishable from existing impacts because they are so few in number the addition of added vessels, cumulatively, would only be a minor increase.

6.1.2 Stressors Likely to Adversely Affect ESA-listed Species

The following stressors are likely to adversely affect Mexico DPS humpback whales and WDPS Steller sea lions: underwater noise from pile removal, blasting, pile driving, rock drilling, and dredge and fill operations. These stressors will be analyzed below in the *Exposure Analysis.*

6.1.2.1 Acoustic thresholds

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

Non-explosive Sources

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871). NMFS recently developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS; Level A harassment), also known as permanent or temporary hearing loss (81 FR 51694). 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[3], expressed in root mean square[4] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA):

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous 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 2016b). 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 4. PTS Onset Acoustic Thresholds for Level A Harassment (NMFS 2016b).

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

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

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

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

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

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

Explosive Sources

Based on the best available science for explosive sources, NMFS uses the acoustic and pressure thresholds indicated in Table 5 to predict the onset of behavioral harassment, PTS, tissue damage, and mortality:

Table 5. Explosive acoustic and pressure thresholds for marine mammals.

Group	Level B harassment		Level A harassment	Serious injury		Mortality
	Behavioral (multiple detonations)	TTS	PTS	Gastro-intestinal tract	Lung	
Low-freq cetacean	163 dB SEL	168 dB SEL or 213 dB SPL_{pk}	183 dB SEL or 219 dB SPL_{pk}	237 dB SPL	$39.1M^{1/3}(1+[D/10.081])^{1/2}$ Pa-sec	$91.4M^{1/3}(1+[D/10.081])^{1/2}$

Group	Level B harassment		Level A harassment	Serious injury		Mortality
	Behavioral (multiple detonations)	TTS	PTS	Gastro-intestinal tract	Lung	
Otariidae	183 dB SEL	188 dB SEL or 226 dB_{pk}	203 dB SEL or 232 dB SPL_{pk}			Pa-sec
M = mass of the animals in kg D = depth of animal in m						

In addition, NMFS uses the following thresholds for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance under section 3(18)(A)(ii) of the MMPA:

- 100 dB re $20\mu Pa_{rms}$ for non-harbor seal pinnipeds

The MMPA defines “harassment” as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 USC § 1362(18)(A)).

While the ESA does not define “harass,” NMFS recently 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).

As described below, we anticipate that exposures to listed marine mammals from noise associated with the proposed action may result in disturbance and potential injury. Due to the use of mitigation measures discussed in detail in Section 2.1.2 above, it is unlikely but possible that PTS could occur from blasting. CBJ D&H is requesting authorization of Level A takes associated with the blasting activities, but no mortalities are anticipated.

6.2 Exposure Analysis

As discussed in the *Approach to the Assessment* section of this Opinion, exposure analyses are designed to identify the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence. In this step of our analysis, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to an action's effects, and the populations or subpopulations those individuals represent.

As discussed in Section 2.1.2 above, PND proposed mitigation measures as part of the proposed action that should avoid or minimize exposure of Mexico DPS humpback whales and WDPS Steller sea lions to stressors. The monitoring zones shown in Table 1 enable PSOs to be aware of and communicate the presence of marine mammals in the action area outside the shutdown zone and prepare for a potential cease of activity should an animal approach the shutdown zone. For blasting, the TTS zone (also known as the Level B harassment zone) will be monitored for a minimum of 30 minutes prior to detonating the blasts. If a marine mammal is sighted within the TTS zone, blasting will be delayed until the zone is clear of marine mammals for 30 minutes.

6.2.1 Exposure to noise from Phase III A non-explosive activities

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

Temporarily elevated underwater noise during pile driving activities (including vibratory pile driving and removal, impact pile driving, socketing, and anchoring) 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 non-explosive activities because shutdown zones will be implemented (Table 1 and Figure 2) and the marine mammal monitoring plan in the *Mitigation Measures* 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 listed marine mammals will be behaviorally harassed or incur some degree of hearing impairment; 2) the area that will be ensonified above these levels in a day; 3) the expected density or occurrence of listed marine mammals within these ensonified areas; and 4) and the number of days of activities.

6.2.1.1 Distances to Level A and Level B Sound Thresholds

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

<u>Level B Harassment</u>

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. 2007b, Ellison et al. 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor 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 continuous or non-impulsive (*e.g.*, vibratory pile-driving, drilling) and above 160 dB re 1 μPa rms for non-explosive impulsive (*e.g.*, impact pile-driving) or intermittent (*e.g.*, scientific sonar) sources (see Table 4).

CBJ D&H's proposed construction activity for Phase III A includes the use of continuous (vibratory pile driving and drilling) and possible impulsive (impact pile driving) sources, and therefore the 120 and 160 dB re 1 μPa rms thresholds for Level B behavioral harassment are applicable.

Level A Harassment

NMFS's Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2016b) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups based on hearing sensitivity as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). CBJ D&H's proposed activity includes the use of non-impulsive (vibratory pile driving and drilling) and possible impulsive (impact pile driving) sources. The Level A thresholds for the onset of PTS are provided in Table 4 and are applicable here.

Calculating the ensonified area

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

When the NMFS Technical Guidance (NMFS 2016b) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, NMFS developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. Because of some of the assumptions included in the methods used for these tools, it's anticipated that isopleths produced are typically going to be overestimates to some degree, which may result in an overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available. For stationary sources, the NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would not incur PTS. When using the subset of variables from the NMF User Spreadsheet shown in Table 6, the calculated isopleths are summarized below in Table 7.

Table 6. NMFS User Spreadsheet Inputs.

Spreadsheet Tab Used	Timber removal	Steel removal	Dredging
	A.1: Vibratory Pile Driving	**A.1: Vibratory Pile Driving**	**A: Stationary: Non-impulsive, Continuous**
Source Level (Single Strike/shot SEL)			
Source Level (RMS SPL)	152	156.2	150.5
Weighting Factor Adjustment (kHz)	2.5	2.5	2
a) Number of strikes/detonations in 1 h			
a) Activity Duration (h) within 24-h period			11
Propagation (xLogR)	15	15	15
Distance of source level measurement (m)+	10	7	1
# of piles/shots in a 24 h period	16	4	
Duration to drive (remove) a single pile (min)	20	20	

Table 7. NMFS User Spreadsheet Generated Outputs

User Spreadsheet Output		
Activity	**PTS Isopleth (meters)**	
	Low-Frequency Cetaceans	**Otariid Pinnipeds**
Timber removal	5.2	0.2
Steel Removal	2.8	0.1
Dredging	0.7	0.0
	Level B Behavioral Harassment Isopleth (meters)	
Timber removal	1359.36	
Steel removal	1813.14	
Dredging	107.98	

Vibratory removal

The closest known measurements of vibratory pile removal similar to this project are from the Kake Ferry Terminal project for vibratory extraction of an 18-in steel pile. The extraction of 18-in steel pipe pile using a vibratory hammer resulted in underwater noise levels reaching 156.2 dB RMS at 7 m (Denes et al. 2016). The pile diameters for the proposed project are smaller, thus the use of noise levels associated with the pile extraction at Kake may be somewhat conservative. For timber pile removal, the Seattle Pier 62/63 sound source verification report contains an appendix with source measurements at different distances for 63 individual pile removals (WSDOT, 2015). When the data are normalized to 10 m, the median source level is 152 dB RMS at 10 m.

Dredging

For dredging, sound source data was used from bucket dredging operations in Cook Inlet, Alaska (Dickerson et al. 2001). Dredging in that project consisted of six distinct events, including the bucket striking the channel bottom, bucket digging, winch in/out as the bucket is lowered/raised, dumping of the material on the barge and emptying the barge at the disposal site. Although the waveform of the bucket strike has a high peak sound pressure with rapid rise time and rapid decay (characteristics typical of an impulsive sound source), the duration of the source signal was longer than what is often considered for an impulsive sound source, about 50 seconds, which is the approximate duration of one continuous noise signal from the dredging equipment. The events following the initial waveform impulse were of longer duration and were non-impulsive in form and therefore dredging was analyzed as a continuous source. Dickerson et al (2001) took 104 SPL rms measurements for the first five distinct phases of the dredging cycle and averaged them, including the impulse in the waveform of the dredge making contact with the substrate. These averages were distance corrected to determine an average SPL of 150.5 dB rms at 1 m for the bucket dredging process, with an assumed maximum duration of up to 50 seconds of non-impulsive, continuous noise.

6.2.2 Exposure to noise from Phase III A blasting activities

NMFS computed cumulative sound exposure impact zones from blasting information provided by PND (Alaska Seismic & Environmental, 2018). Peak source levels of the confined blasts were calculated based on Hempet et al. (2007), using a distance of eight feet and a weight of 95 pounds for a single charge. The total charge weight is defined as the product of the single charge weight and the number of charges. For the Statter Harbor Project, the number of charges is 75. Explosive energy was then computed from peak pressure of the single maximum charge, using the pressure and time relationship of a shock wave found in Urick (1983). Due to time and spatial separation of each single charge by a distance of eight feet, the accumulation of acoustic energy is added sequentially, assuming the transmission loss follows cylindrical spreading within the matrix of charges. The SEL from each charge at its source can then be calculated, followed by the received SEL from each charge. Since the charges will be deployed in a grid of 8 ft by 8 ft apart, the received SELs from different charges to a given point will vary depending on the distance of the charges. Without specific information regarding the layout of the charges, the modeling assumes a grid of 8 by 9 charges with an additional three charges located in the three peripheral locations. Among the various total sound exposure levels calculated, the largest value, SELtotal (max) is selected to calculate the impact range. Using the pressure versus time relationship above, the frequency spectrum of the explosion can be computed by taking the Fourier transform of the pressure (Weston, 1960). Frequency specific transmission loss of acoustic energy due to absorption is computed using the absorption coefficient, α (dB/km), summarized by François and Garrison (1982a, b). Seawater properties for computing sound speed and absorption coefficient were based on NMFS Alaska Fisheries Science Center report of mean measurements in Auke Bay (Sturdevant and Landingham, 1993). The transmission loss that is required for the received levels to reach below the specific SELthresholds were calculated using the sonar equation:

$$TL = SELtotal(m) – SELthreshold$$

where SELthreshold is the Level A harassment threshold of marine mammals. The distances, R, where such transmission loss is achieved were computed numerically by combining both geometric transmission loss, and transmission loss due to frequency-specific absorption. A spreading coefficient of 20 is assumed to account for acoustic energy loss from the sediment into the water column.

PR1 modeled the Statter Harbor detonation impact zone using USACE's nominal curve fit, and included frequency weighting using spectral analysis of exponential decaying functions, and frequency-specific absorption (Guan 2018). The following inputs were used to calculate the zones in Table 8:

Single charge SEL: 226.21 dB re 1 µPa^2-s.

Cumulative SEL for outer charges: 235.08 – 236.02 re 1 µPa^2-s
The highest cumulative SEL of 236.02 re 1 µPa^2-s was used for impact zone modeling.

SPL_pk at source: 265.3 dB re 1 µPa

Frequency weighted source SELcum (dB re 1 µPa^2-s):

LF	OW
234.71	230.67

The outputs from this model are summarized in Table 8 below.

Table 8. Modeling Results – Impact Zones (m) for blasting

Species	Mortality	Lung injury	GI Tract injury	PTS: SELcum	PTS: SPLpk	TTS: SELcum	TTS: SPLpk
Humpback whale	3.9975	9.3445	26.0142	380	206.64	2120	412.3
Steller sea lion	13.9502	32.6100	26.0142	20	93	280	92.302

Table 8 shows the isopleths in meters for mortality, injury (lung and gastro-intestinal tract), Level A harassment (PTS), and Level B harassment (TTS) associated with blasting activities for both humpback whales and Steller sea lions in the action area.

6.2.3 Exposure to noise from Phase III B and Phase IV activities

6.2.3.1 Down-Hole Drilling

The closest known measurements of down-hole drilling similar to this project are from the Kodiak ferry terminal reconstruction project (Denes et al. 2016). The source level was measured to be 171.5 dB at 12.9 m and was found to drop off to <120 dB at 4.25 miles (6.846 km). This sound source verification (SSV) is for 24-in steel piles, but will be applied to both 24 and 16-in piles for the Statter Harbor project. The Denes et al. study used the 90th percentile to calculate the 120dB isopleth. However, in a previous consultation, (PND Engineers 2018c) an email between PND and NMFS concluded it was more appropriate to use the 5,050m mean distance instead.

6.2.3.2 Vibratory Pile Driving

The closest known measurements of vibratory pile driving comparable to the 16-in steel piles used in Phase IIIB of this project are from the Kake Ferry Terminal project for vibratory extraction of an 18-in steel pile. The extraction of 18-in steel pipe pile using a vibratory hammer resulted in underwater noise levels reaching 156.2 dB RMS at 7 m (Denes et al. 2016). The pile diameters for the proposed Statter Harbor project are smaller, thus the use of noise levels associated with the pile extraction at Kake may be somewhat conservative, but are the levels that will be used here.

For 24-inch piles sound source data was used for 24-inch piles driven in Kodiak, Alaska (Denes et al. 2016). According to the study the installation of 24-inch steel pipe piles using a vibratory hammer resulted in underwater noise levels reaching 160.6 dB rms at 9.9 m.

6.2.3.3 Impact Pile Driving

For both 16 and 24-inch piles, sound source data was used for 24-inch piles driven in Kodiak, Alaska (Denes et al. 2016). According to the study the installation of 24-inch steel pipe piles using a vibratory hammer resulted in underwater noise levels reaching 180.1 dB rms at 9.9 m.

The practical spreading model was used by PND to generate the Level B harassment zones for piling and drilling activities during Phase IIIB and Phase IV. Practical spreading, a form of transmission loss, is described in detail below.

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

$$TL = B * \log10(R_1/R_2), \text{ where}$$
R_1 = the distance of the modeled SPL from the driven pile, and
R_2 = the distance from the driven pile of the initial measurement.

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

Utilizing the practical spreading loss model, underwater noise will fall below the behavioral effects threshold of 120 dB rms for marine mammals at a maximum radial distance of 1,820 meters for vibratory pile driving of 16-in steel piles, and 5,050 meters for both vibratory pile driving of 24-in piles and for drilling. Underwater noise will fall below the behavioral effect threshold of 160 dB rms for marine mammals at a maximum radial distance of 220 meters for impact pile driving. Thus, the Level B harassment zones are established (Table 9) for each of these sound sources. Beyond these distances, NMFS anticipates no behavioral disturbance to listed marine mammals.

Table 9. Phase III B and Phase IV Level B zones calculated using the practical spreading model.

Source	Level B Zones (meters)
Vibratory Pile Driving	
24-inch steel installation (6 piles)	5,050
16-inch steel installation (20 piles)	1,820
Impact Pile Driving	
24 and 16-inch installation (26 piles)	220
Socketing Pile Installation (Drilling)	
24 and 16-inch steel installation (26 piles)	5,050

6.2.4 Exposure to noise from Phase III C activities

In-water fill placement activities (including the placement of the MSE wall and kayak ramp) are assumed to have similar noise levels to dredging activities, and a similar shutdown zone of 108 m (see Table 7) because they utilize similar (or identical) equipment performing similar (or identical) activities. In the event that in-water work is required during this phase of the project, CBJ D&H will employ the mitigation measures and shutdown zones listed in Section 2.1.2.2.

NMFS has determined that if the appropriate mitigation measures listed in Section 2.1.2.2 are employed, the construction activities would be shut down before exposure of the marine mammal to the stressor, and this phase of the project is not likely to adversely affect Mexico DPS humpback whales or WDPS Steller sea lions.

6.2.5 Estimating marine mammal occurrence

Information about the presence, density, or group dynamics of marine mammals informs the take calculations in Section 10. Reliable densities are not available for Statter Harbor or the Auke Bay area. Generalized densities for the North Pacific would not be applicable given the high variability in occurrence and density at specific inlets and harbors. Therefore, the applicant consulted opportunistic sightings data from oceanographic surveys in Auke Bay and sightings from the Auke Bay Marine Station observation pier for this specific harbor to arrive at a number of animals expected to occur within the harbor per day (PND Engineers 2018b). NMFS agrees with these numbers. For humpback whales, it is assumed that a maximum of two animals per day are likely to occur in the action area. For Steller sea lions, the potential maximum daily occurrence of animals is 121 individuals within the harbor.

6.3 Response Analysis

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

6.3.1 Responses to major noise sources

Loud underwater noise can result in physical effects on the marine environment that can affect marine organisms. Possible responses by Mexico DPS humpback whales and WDPS Steller sea lions to the impulsive and continuous sound produced by pile installation and removal, drilling, dredge and fill activities, and blasting include:

- Physical Response
  - Auditory threshold shifts (or hearing loss)
  - 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

As described in the *Exposure Analysis*, Mexico DPS humpback whales and WDPS Steller sea lions are anticipated to occur in the action area and are anticipated to overlap with noise associated with pile installation/pile driving and removal, drilling, blasting, and dredge and fill activities. We assume that some individuals are likely to be exposed and respond to these impulsive and continuous noise sources.

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

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

The effects of pile installation, pile removal, drilling, or dredging on marine mammals are dependent on several factors, including the type and depth of the animal; the pile size and type, and the intensity and duration of the pile removal or dredging sound; the substrate; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile removal and dredging activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the frequency, received level, and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. The characteristics of dredging noise are such that there is a clear impulse peak from the impact of the dredge making contact with the substrate, but then there is a prolonged period of sound which is the noise of the continual operation of the dredge delving the sediment. As such, dredging is treated in this analysis as a continuous source despite the impulse at the beginning of the waveform characterizing dredging noise. In addition, substrates that are soft (e.g., sand) would absorb or attenuate the sound more readily than hard substrates (e.g., rock), which may reflect the acoustic wave. Soft porous substrates would also likely require less time to extract the pile or dredge the substrate, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

6.3.1.1 Physical Responses

Auditory Threshold Shifts

Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak et al. 1999). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time(Southall et al. 2007a). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges(Kryter 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (i.e., tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall et al., 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury(Ward 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals—PTS data exists only for a single harbor seal(Kastak et al. 2008)—but are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several dB above that which induces mild TTS: a 40-dB threshold shift approximates PTS onset(Kryter et al. 1966), whereas a 6-dB threshold shift approximates TTS onset (e.g., Southall et al., 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as bombs) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall et al., 2007). Generally, given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur. This premise holds true for the proposed action.

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (i.e., recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from minimal to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts.

Humpback whales and Steller sea lions have the potential to experience auditory threshold shifts due to project activities in the action area. As discussed throughout the *Response Analysis* of this Opinion, we expect individuals may experience TTS (and potentially for Steller sea lions to experience PTS during blasting). The thresholds for the Statter Harbor project are shown in Tables 7, 8, and 9. These instances of exposure assume a uniform distribution of animals and do not account for avoidance. The implementation of mitigation measures to reduce exposure to high levels of noise related to the Statter Harbor project, the short duration of construction activities, and movement of animals reduce the likelihood that exposure to project related noise would cause a behavioral response that may affect vital functions (reproduction or survival), or would result in temporary threshold shift (TTS) or permanent threshold shift (PTS).

Non-auditory Physiological effects

In addition to PTS and TTS, there is a potential for non-auditory physiological effects or injuries that might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (e.g., change in dive profile as a result of an avoidance reaction) caused by exposure to sound. These impacts can include neurological effects, internal bubble formation, resonance effects, and other types of organ or tissue damage (Cox et al. 2006). The CBJ D&H's activities involve the use of explosives, which have been associated with these types of effects. The underwater explosion will send a shock wave and blast noise through the water, release gaseous by-products, create an oscillating bubble, and cause a plume of water to shoot up from the water surface. The shock wave and blast noise are of most concern to marine animals. The effects of an underwater explosion on a marine mammal depends on many factors, including the size, type, and depth of both the animal and the explosive charge; the depth of the water column; and the standoff distance between the charge and the animal, as well as the sound propagation properties of the environment. Potential impacts can range from brief effects (such as behavioral disturbance), tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (DON 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality can be a result of individual or cumulative sublethal injuries (DoN, 2001). Immediate lethal injury would be a result of massive trauma to internal organs as a direct result of proximity to the point of detonation (DoN 2001). Generally, the higher the level of impulse and pressure level exposure, the more severe the impact to an individual.

Injuries resulting from a shock wave take place at boundaries between tissues of different density. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface . Gas-containing organs, particularly the lungs and gastrointestinal (GI) tract, are especially susceptible (Yelverton et al. 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe GI tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton et al., 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury . Sound-related damage associated with blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten 1995). Sound-related trauma can be lethal or sublethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten 1995).

The above discussion concerning underwater explosions only pertains to open water detonations in a free field without mitigation. However, given the low weight of the charges and small size of the detonation (relative to the large open water detonations just discussed) in conjunction with monitoring and mitigation measures discussed in Section 2.1.2, the CBJ D&H’s two blasting events are not likely to have any of the injury or mortality effects just described on marine mammals in the project vicinity. Instead, NMFS considers that the CBJ D&H's blasts are most likely to cause behavioral harassment and may cause TTS in a few individual marine mammals, as discussed below.

Stress Response

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 (Seyle 1950). 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.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (Moberg 1987). Increases in the circulation of glucocorticoids are also equated with stress (Romano et al. 2004).

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 (Holberton et al. 1996). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Romano et al. 2002) and, more rarely, studied in wild populations. Rolland et al.

(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. 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).

Humpback whales and Steller sea lions have the potential to experience non-auditory physiological effects due to project activities in the Statter Harbor project action area. As discussed throughout the *Response Analysis* of this opinion, we expect individuals may experience TTS (and potentially for Steller sea lions to experience PTS during blasting), may experience masking, and may exhibit behavioral responses from project activities. Therefore, we expect ESA-listed whales and pinnipeds may experience stress responses. If whales and pinnipeds are not displaced and remain in a stressful environment (within the ZOI pile driving activities, e.g.), we expect the stress response will dissipate shortly after the cessation of pile driving. Similarly, if whales or pinnipeds are exposed to sounds from the construction activities, we expect a stress response could accompany a brief startle response. However, in any of the above scenarios, we do not expect significant or long-term harm to individuals from a stress response.

6.3.1.2 Behavioral Responses

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

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

Auditory Masking

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

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

For the pile driving/removal sound generated from the proposed construction activities, sound will consist of low frequency impulsive and continuous noise depending on if they are using an impact or vibratory hammer. Lower frequency anthropogenic sounds are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. This could affect communication signals used by low frequency mysticetes when they occur near the noise 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). However, marine mammals are thought to be able to compensate for masking by adjusting their acoustic behavior by shifting call frequencies, and/or increasing call volume and vocalization rates. For example, blue whales are found to increase call rates when exposed to seismic survey noise in the St. Lawrence Estuary (Di Lorio and Clark. 2010). In addition, the sound localization abilities of marine mammals suggest that, if signal and noise come from different directions, masking would not be as severe as the usual types of masking studies might suggest (Richardson et al. 1995).

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

Noise from pile driving/removal and drilling activity is relatively short-term. It is possible that pile driving/removal and drilling noise resulting from this proposed action may mask acoustic signals important to western DPS Steller sea lions and Mexico DPS humpback whales, but the short-term duration, limited affected area, and pauses between operations would limit the impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for in Tables 7, 8, and 9, and which have already been taken into account in the exposure analysis.

Habituation

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. It is important to note that habituation is appropriately considered as a “progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,” rather than as, more generally, moderation in response to human disturbance (Bejder et al. 2009). 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. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson et al., 1995; NRC 2003; Wartzok et al., 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997). Observed responses of wild marine mammals to loud, intermittent sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Richardson et al., 1995).

This information indicates marine mammal tolerance of underwater sounds, and we anticipate that some humpback whales and Steller sea lions exposed to low frequency underwater sounds from construction activities in the action area may tolerate construction and/or demolition noise and show no apparent response. More information is needed in order to determine if the learned processes of habituation or sensitization are occurring over time as animals experience repeated exposures.

Change in dive, respiration, or feeding behavior

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

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

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

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

As a result of using this kind of analyses to consider humpback whales' and Steller sea lions' behavioral decisions, we would expect these animals to continue foraging in the face of moderate levels of disturbance. For example, humpback whales, which only feed during part of the year and must satisfy their annual energetic needs during the foraging season, may continue foraging in the face of disturbance in the action area. Similarly, a humpback cow accompanied by her calf is less likely to flee or abandon an area at the cost of her calf's survival. By extension, we assume that animals that choose to continue their pre-disturbance behavior would have to cope with the costs of doing so, which will usually involve physiological stress responses and the associated energetic costs (Frid and Dill. 2002, MMS 2008). Therefore, it is likely some change in dive, respiration, or feeding behavior of WDPS Steller sea lions and Mexico DPS humpback whales may occur in the action area, but we do not expect much change in these behaviors.

Change in vocalizations

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

In addition to these behavioral responses, whales alter their vocal communications when exposed to anthropogenic sounds. Communication is an important component of the daily activity of animals and ultimately contributes to their survival and reproductive success. Animals communicate to find food (Marler et al. 1986, Elowson et al. 1991), acquire mates (Ryan 1985), assess other members of their species (Parker 1974, Owings et al. 2002), evade predators (Greig-smith 1980), and defend resources (Zuberbuhler et al. 1997). Human activities that impair an animal's ability to communicate effectively might have significant effects on the survival and reproductive performance of animals experiencing the impairment.

At the same time, most animals that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability of their vocalizations in the face of temporary changes in background noise (Cody and Brown 1969, Brumm 2004, Patricelli and Blickley 2006). A few studies have demonstrated that marine mammals make the same kind of vocal adjustments in the face of high levels of background noise. For example, two studies reported that some mysticete whales stopped vocalizing – that is, adjusted the temporal delivery of their vocalizations – when exposed to active sonar (Miller et al. 2000, Melcon et al. 2012). Melcón et al. (2012) reported that during 110 of the 395 d-calls (associated with foraging behavior) they recorded during mid-frequency active sonar transmissions, blue whales stopped vocalizing at received levels ranging from 85 to 145 dB, presumably in response to the sonar transmissions. These d-calls are believed to attract other individuals to feeding grounds or maintain cohesion within foraging groups (Oleson et al. 2007).

Humpback whales have been observed to increase the length of their songs in the presence of potentially masking signals (Miller et al. 2000, Fristrup et al. 2003). Change in humpback vocalization may happen within the project area, but to a minimal extent due to the mitigation measures put in place to reduce in-water noise.

Avoidance or displacement

Avoidance is the displacement of an individual from an area or migration path because of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson et al., 1995). For example, gray whales (*Eschrictius robustus*) are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme et al. 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (e.g., Bowles et al., 1994). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (Blackwell et al. 2004).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (e.g., directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Avoidance is one of many behavioral responses whales and Steller sea lions exhibit when exposed to pile driving/removal, blasting, dredge and fill, and drilling noise. Other behavioral responses include evasive behavior to escape exposure or continued exposure to a sound that is painful, noxious, or that they perceive as threatening, which we would assume would be accompanied by acute stress physiology; increased vigilance of an acoustic stimulus, which would alter their time budget (that is, during the time they are vigilant, they are not engaged in other behavior); and continued pre-disturbance behavior with the physiological consequences of continued exposure. This avoidance behavior is expected to occur with the Steller sea lions in the action area.

Vigilance

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (i.e., when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (Beauchamp and Livoreil 1997). In addition, chronic disturbance can cause population declines through reduction of fitness (e.g., decline in body condition) and subsequent reduction in reproductive success, survival, or both (Harrington and Veitch 1992). However, Ridgway et al. (Ridgway et al. 2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Humpback whales and Steller sea lions have the potential to exhibit each of these behavioral responses (auditory interference (masking); tolerance or habituation; change in dive, respiration, or feeding behavior; change in vocalizations; avoidance or displacement; increased vigilance) due to project activities in the action area.

6.3.2 Anticipated Effects on Habitat

The proposed activities at the project area would not result in permanent negative impacts to habitats used directly by marine mammals, but may have potential short-term impacts to food sources, such as forage fish, and may affect acoustic habitat. There are no known foraging hotspots or other ocean bottom structure of significant biological importance to Steller sea lions present in the marine waters of the action area during the construction window. There is an occurrence of foraging in the action area for humpback whales. While humpbacks are known to feed in Statter Harbor, this is a small portion of the overall area designated as important. The small portion of the area affected by the construction noise, in conjunction with the short temporal scale of construction activity, make it unlikely the effects of the construction will significantly alter the foraging habitat of humpbacks in Southeast Alaska. Therefore, the main impact issue associated with the proposed action would be temporarily elevated sound levels and the associated direct effects on marine mammals, as discussed previously in this document. The primary potential acoustic impacts to marine mammal habitat are associated with elevated sound levels produced by pile installation, pile removal, dredging, and blasting in the area.

Short-term turbidity increases would likely occur during in-water construction work, including pile driving and pile removal. The physical resuspension of sediments could produce localized turbidity plumes that could last from a few minutes to several hours. In general, turbidity associated with pile installation is expected to be localized to about a 25 ft radius around the pile (Everitt et al. 1980). Contaminated sediments are not expected at the project site but any that do occur would be tightly bound to the sediment matrix. Because of the relatively small work area, any increase in turbidity would be limited to the immediate vicinity of the project site and adjacent portion of the bay. There is little potential for pinnipeds or cetaceans to be exposed to increased turbidity during construction operations. Therefore, exposure to re-suspended contaminants is expected to be negligible since sediments would not be ingested and any contaminants would be tightly bound to them.

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

6.3.3 In-water Construction Effects on Potential Prey (Fish)

Construction activities would produce continuous (i.e., vibratory pile driving and removal, drilling, and dredging) and impulsive (impact pile driving and blasting) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of impulsive sounds such as pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (Scholik and Yan 2001, 2002; Popper and Hastings 2009). Sound pulses at received levels of 160 dB may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson et al., 1992; Skalski et al., 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality.

The most likely impact to fish from pile installation/removal and dredging activities in the action area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution, and behavior is anticipated. While impacts from blasting to fish are more severe, including barotrauma and mortality, the blast will last approximately one second on each of the two days, making the duration of this impact short term. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the short timeframe for the project.

6.3.4 Effects on Potential Fish Foraging Habitat

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

Given the short daily duration of sound associated with individual construction activities and the relatively small areas being affected, the proposed action is not likely to have a permanent, adverse effect on any fish habitat, or populations of fish species. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

6.3.5 Responses to vessel traffic and noise

Mexico DPS humpback whales and WDPS Steller sea lions are anticipated to occur in the action area and are anticipated to overlap with noise associated with vessel transit. We assume that some individuals are likely to be exposed and respond to this continuous noise source.

Materials and equipment would be transported to the project site by barge. While work is conducted in the water, anchored barges will be used to stage construction materials and equipment. Vessel speed, course changes, and sounds associated with their engines may be considered stressors to listed humpback whales.

We anticipate low level exposure of short-term duration to listed marine mammals from vessel noise. If animals do respond, they may exhibit slight deflection from the noise source, 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 animals. The nature and duration of response is not anticipated to be a significant disruption of important behavioral patterns such as feeding or resting. During the period of construction, the action area is not considered high quality habitat for humpback whales or Steller sea lions, so avoidance of the area is not likely to adversely affect these species**.**

The small number of vessels involved in the action, the short duration of exposure due to the transitory nature, and vessels following the Alaska Humpback Whale Approach Regulations and marine mammal code of conduct should prevent close approaches and additional harassment of Steller sea lions and humpback whales. The impact of vessel traffic on Mexico DPS humpback whales and WDPS Steller sea lions is not anticipated to reach the level of harassment under the ESA.

7 CUMULATIVE EFFECTS

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

Climate change, as well as some continuing and future non-Federal activities expected to contribute to climate change, are reasonably certain to occur within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 5.0).

There are currently no other known or anticipated state or private activities reasonably certain to occur in the action area that may affect listed species and are not subject to section 7 consultation. We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 5 of this opinion). While the proposed project is designed to relieve current user congestion within the harbor, it is not anticipated to result in an increase in marine traffic in the action area. We expect fisheries, harvest, noise, pollutants and discharges, scientific research, and ship strike will continue into the future. We expect moratoria on commercial whaling and bans on commercial sealing will remain in place, aiding in the recovery of ESA-listed whales and pinnipeds.

8 INTEGRATION AND SYNTHESIS

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

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

8.1 WDPS Steller Sea Lion Risk Analysis

The Steller sea lion recovery plan (NMFS 2008) lists recovery criteria that should be accomplished in order to downlist the WDPS from endangered to threatened and to delist the WDPS. More details and exact specifications can be found in the plan, but these criteria generally include an increased population size, requirements that any two adjacent sub-regions cannot be declining significantly, reducing the threats to sea lion foraging habitat, reducing intentional killing and overutilization, and others. NMFS concludes that WDPS Steller sea lion response from the proposed activities will not impede progress towards these recovery criteria due to the low anticipated level of harassment, no anticipated injury or mortality, and no significant effects to habitat.

Exposure to in-air noise, vessel noise from transit, disturbance to the seafloor, potential for increased disturbance from whale watching vessels and potential for vessel strike may occur, but these are likely to be negligible due to the small marginal increase in such activities relative to the environmental baseline, mitigation measures in place to reduce approach distances, and the transitory nature of vessels and construction activities. Adverse effects from vessel strike are very unlikely because of the few additional vessels introduced by the action and the unlikelihood of these type of interactions.

Steller sea lions' probable response to this project (pile driving and removal, drilling, blasting and dredge and fill activities) after implementation of the mitigations measures in Section 2.1.2 includes brief startle reactions or short-term behavioral modification, such as those listed in Section 6.3.1.2. These reactions and behavioral changes are expected to subside quickly when the exposures cease. The primary mechanism by which these behavioral changes could affect the fitness of individual animals is through the animals' energy budget, time budget, or both (see Section 6.3.1.2). Even if some WDPS Steller sea lions were exposed to the stressors from construction activities associated with this project, the individual and cumulative energy costs of the behavioral responses are not likely to reduce the energy budgets of Steller sea lions, and their probable exposure to noise sources is not likely to reduce their fitness because project related noise is relatively short-term, in a limited affected area, and pauses between operations would limit the impacts.

Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (NMFS 2008a). The endangered WDPS Steller sea lion population is increasing at 2.17 percent per year. NMFS does not anticipate any effects from this action on the reproductive success of Steller sea lions. As discussed in the *Description of the Action* section, this action area does not overlap with sea lion rookeries. As a result, the probable responses to this project are not likely to reduce the current or expected future reproductive success of WDPS Steller sea lions or reduce the rates at which they grow, mature, or become reproductively active.

Commercial fishing likely affects prey availability throughout much of the WDPS’s range, and causes a small number of direct mortalities each year. Predation has been considered a potentially high level threat to this DPS, and may remain so. Subsistence hunting occurs at fairly low levels for this DPS. Illegal harvest is also a continuing threat, but it probably does not occur at levels that are preventing recovery. Ship strikes do not seem to be of concern for this species due to its maneuverability and agility in water. Despite exposure to construction activities and ferry and vessel operations for decades, the increase in the number of WDPS Steller sea lions suggests that the stress regime these sea lions are exposed to has not prevented them from increasing their numbers and expanding their use of the action area.

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

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

8.2 Mexico DPS Humpback Whale Risk Analysis

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

Exposure to in-air noise, vessel noise from transit, disturbance to the seafloor, potential for increased disturbance from whale watching vessels and potential for vessel strike may occur, but these are likely to be negligible due to the small marginal increase in such activities relative to the environmental baseline, mitigation measures in place to reduce approach distances, and the transitory nature of vessels and construction activities. Adverse effects from vessel strike are very unlikely because of the few additional vessels introduced by the action and the unlikelihood of these type of interactions.

Humpback whales' probable response to the proposed action includes brief startle reactions or short-term behavioral modification. These reactions and behavioral changes are expected to subside quickly when the exposures cease. The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animals' energy budget, time budget, or both (the two are related because foraging requires time). Large whales such as humpbacks have an 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. The individual and cumulative energy costs of the behavioral responses discussed are not likely to reduce the energy budgets of humpback whales, and their probable exposure to noise sources is not likely to reduce their fitness.

As discussed in the *Description of the Action* and *Status of the Species* sections, this action does not overlap in space or time with humpback whale breeding. Some Mexico DPS humpback whales feed in Southeast Alaska in the summer months, but they migrate to Mexican waters for breeding and calving in winter months. As a result, the probable responses to the proposed action are not likely to reduce the current or expected future reproductive success of Mexico DPS humpback whales or reduce the rates at which they grow, mature, or become reproductively active. Noise from the proposed action could discourage Mexico DPS whales from feeding in the action area during some construction activities, but humpback whale feeding in the action area is not common, and any such effects would be brief and the affected whales would likely find other comparable foraging opportunities in the vicinity.

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 implementation of mitigation measures to reduce exposure to high levels of sound reduce the likelihood that exposure would cause a behavioral response that may affect vital functions, or cause TTS or PTS. Cumulative effects of future state or private activities in the action area are likely to affect humpback whales at a level comparable to present.

The strongest evidence supporting the conclusion that the proposed action will likely have minimal impact on Mexico DPS humpback whales is the estimated annual growth rate of the humpback whale populations in the North Pacific (5-7%). While there is no accurate estimate of the maximum productivity rate for humpback whales, it is assumed to be 7% (Wade and Angliss 1997, Allen and Angliss 2015). Despite exposure to pile driving operations for decades, a small number of humpback whale entanglements in fishing gear, a subsistence take of one humpback whale in 2006, and a humpback whale taken illegally near Toksook Bay in western Alaska in 2016, this increase in the number of listed whales suggests that the stress regime these whales are exposed to has not prevented them from increasing their numbers.

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

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 WDPS Steller sea lions (*Eumetopias jubatus*) or Mexico DPS humpback whales (*Megaptera novaeangliae*).

With respect to sperm whales (*Physeter macrocephalus*) and Steller sea lion critical habitat, all potential effects from the action are either discountable or insignificant, and therefore the proposed action is not likely to adversely affect sperm whales or Steller sea lion critical habitat.

10 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (16 USC § 1532(19)). “Incidental take” is defined as take that results from, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR 402.02). Based on recent NMFS guidance, the term “harass” under the ESA means to: “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (Wieting 2016). The MMPA defines “harassment” as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 U.S.C. §1362(18)(A)). For this consultation, USACE and PR1 anticipate that any take will be by harassment only.

Under the terms of Section 7(b)(4) and Section 7(o)(2) of the ESA, taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the taking must first be authorized by Section 101(a)(5) of the MMPA. Accordingly, the terms of this incidental take statement and the exemption from Section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here. Absent such authorization, this incidental take statement is inoperative.

The terms and conditions described below are nondiscretionary. USACE and PR1 have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, USACE and PR1 must monitor and report the progress of the action and its impact on the species as specified in the ITS (50 CFR 402.14(i)(3)). If USACE or PR1 (1) fails to require the authorization holder to adhere to the terms and conditions of the ITS through enforceable terms that are added to the authorization, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

10.1 Amount or Extent of Take

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

10.1.1 WDPS Steller Sea Lions

Based on the distances to Level A and Level B sound thresholds calculated in Section 6.2.1.1, and the estimate of marine mammal occurrence calculated in Section 6.2.5 of the *Exposure Analysis* for the proposed activities, we expect a maximum of 6,638 Steller sea lions may be behaviorally harassed by noise from pile installation/removal, blasting, and dredge and fill activities.

<u>Phase III A</u>
It is estimated that a maximum of 121 Steller sea lions may be seen in Statter Harbor within one day. A maximum take of 121 animals per day for 10 days of pile removal is 1,210 Steller sea lions. Given the size of the Level B zone for dredging (108 m), it is possible Steller sea lions may approach the source vessel. However, given the small size of the zone, the applicant reduced the number of animals expected to be sighted daily within the Level B isopleth to be 10 animals per day. However, animals are only expected to be seen so close to the source every other day, resulting in 225 estimated exposures of Steller sea lions from dredging. For blasting, the size of the TTS zone (92 m) increased from the distance used in the proposed IHA. Therefore, a maximum of 106 Steller sea lions are assumed to be within the zone for two days of blasting, resulting in a potential Level B take by TTS of 212 Steller sea lions. No more than 15 Steller sea lions are assumed to be within range of the PTS blasting isopleth (46m which has been conservatively doubled to 92m), resulting in a total of 30 potential Level A takes of Steller sea lions from blasting. While it is conservative to assume this many Steller sea lions may occur close the blast source, they are regularly seen in the area and the explosives need to be detonated within a certain number of hours after being planted. It is possible that Steller sea lions could approach the source and the detonation could no longer be delayed, exposing Steller sea lions to sound levels that may induce PTS. This adds to a total of 1,677 takes of Steller sea lions.

<u>Phase III B</u>
Assuming 121 Steller sea lion takes per day, the total number of Steller sea lion takes for 23 days of work is 2,783 Steller sea lions. No Level A harassment takes are anticipated for Steller sea lions as the Level A harassment zones are small and shutdown measures can be implemented prior to Steller sea lions entering any Level A harassment zone.

Phase III C
There is no take anticipated for Phase III C (see Section 6.2.4 for effects analysis).

<u>Phase IV</u>
Assuming 121 Steller sea lion takes per day, the total number of Steller sea lion takes for 18 days of work is 2,178 Steller sea lions. No Level A harassment takes are anticipated for Steller sea lions as the Level A harassment zones are small and shutdown measures can be implemented prior to Steller sea lions entering any Level A harassment zone.

We assume that 18.1% of those 6,638 individuals, (1,202) are from the WDPS, and of these we expect 5 Level A takes and 1,197 Level B takes. We are reasonably certain this take will occur.

10.1.2 Mexico DPS Humpback Whales

Based on the distances to Level A and Level B sound thresholds calculated in Section 6.2.1.1, and the estimate of marine mammal occurrence calculated in Section 6.2.5 of the *Exposure Analysis* for the proposed activities, we expect a maximum of 188 humpback whales may be behaviorally harassed by noise from pile installation/removal, blasting, and dredge and fill activities.

<u>Phase III A</u>
Based on the size of the harassment zone for dredging, in combination with the mitigation measures outlined in Section 2.1.2, the applicant does not expect humpback whales to approach the dredging vessel and therefore is not requesting authorization for take of humpback whales from dredging. Because of the nature of blasting, there is no behavioral threshold associated with the activity, but TTS, which is a form of Level B harassment take, may occur. With a maximum take of two animals per day, multiplied by a maximum of 10 days of pile removal and two days of blasting (TTS), the total amount of Level B takes of humpback whale for this phase is 24.

<u>Phase III B</u>
Work is expected to occur over 23 days and will involve a mixture of vibratory pile driving and drilling each day. Based on the available information and the extent of the Level B harassment zone it is estimated up to 4 humpback whales could be exposed to elevated noise during each day of pile driving and drilling. Using a daily potential maximum rate of four humpback whales per day, the project could take up to 92 humpback whales. No authorization of Level A harassment takes were requested for humpback whales as the Level A harassment zones are small and shutdown measures can be implemented prior to any humpback whales entering Level A harassment zones.

Phase III C
There is no take anticipated for Phase III C (see Section 6.2.4 for effects analysis).

<u>Phase IV</u>
Assuming 4 humpback whale takes per day, the total number of humpback whale takes for 18 days of work is 72 humpback whales. No Level A harassment takes are anticipated as the Level A harassment zones are small and shutdown measures can be implemented prior to humpback whales entering any Level A harassment zone.

We assume that 6.1% (11) of those individuals are from the Mexico DPS, and we expect all 11 to be Level B take. We are reasonably certain this take will occur.

10.2 Effect of the Take

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

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

10.3 Reasonable and Prudent Measures (RPMs)

"Reasonable and prudent measures" are those actions necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take. (50 CFR 402.02). These are nondiscretionary measures.

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 Western DPS Steller sea lions resulting from the proposed action.

1. This ITS is valid only for the activities described in this Opinion, and which have been authorized under section 101(a)(5) of the MMPA.
2. The taking of Mexico DPS humpback whales and Western DPS Steller sea lions 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.
3. USACE and PR1 will implement a monitoring program that includes all items described in the mitigation measures section of this Opinion (Section 2.1.2) and allows NMFS AKR to evaluate the exposure estimates contained in this Opinion and that underlie this ITS.
4. USACE and PR1 will submit a final report to NMFS AKR that evaluates the mitigation measures and the results of the monitoring program.

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) to apply.

In order to be exempt from the prohibitions of section 9 of the ESA, USACE and PR1 must comply with the following terms and conditions, which implement the RPMs described above and the mitigation measures set forth in Section 2.1.2 of this Opinion. USACE and PR1 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).

Partial compliance with these terms and conditions may result in more take than anticipated, and may invalidate this take exemption. These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

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

1. USACE and NMFS PR1 shall require their permitted operators to possess a current and valid Incidental Harassment Authorization issued by NMFS under section 101(a)(5) of the MMPA, and any take must occur in compliance with all terms, conditions, and requirements included in such authorizations.

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

A. Conduct the action as described in this document including all mitigation measures and observation and shut-down zones.

B. The taking of any marine mammal in a manner other than that described in this ITS must be reported immediately to NMFS AKR, Protected Resources Division at 907-586-7638.

C. In the event that the proposed action causes a take of a marine mammal that results in a serious injury or mortality (e.g. ship-strike, stranding, and/or entanglement), immediately cease operations and immediately report the incident to NMFS AKR, Protected Resources Division at 907-586-7638 and/or by email to Jon.Kurland@noaa.gov, David.Gann@noaa.gov, the NMFS Alaska Regional Stranding Coordinator at 907-271-3448 or Barbara.Mahoney@noaa.gov, and NMFS Permits, Conservation and Education Division at 301-427-8401 or Sara.Young@noaa.gov.

   Following a prohibited take, USACE will be required to reinitiate consultation under 50 CFR 402.16, and any subsequent activities causing incidental take will not be exempt from the take prohibitions of ESA section 9. NMFS will work with USACE to determine what is necessary to minimize the likelihood of further prohibited take and ensure ESA compliance.

To carry out RPM #3, USACE, NMFS PR1, or their authorization holder must undertake the following:

A. The impact zones must be fully observed by qualified PSOs during all in-water work, in order to document observed incidents of harassment as described in the mitigation measures associated with this action.

B. If take of Steller sea lions or humpback whales approaches the number of takes authorized in the ITS, USACE will notify NMFS by email, attn: David.Gann@noaa.gov and request reinitiation of consultation

To carry out RPM #4, USACE, NMFS PR1, or their authorization holder must undertake the following:

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

B. Submit a project specific report within 90 days of the conclusion of the project that analyzes and summarizes marine mammal interactions during this project to the Protected Resources Division, NMFS by email to David.Gann@noaa.gov. This report must contain the following information:

   - Date and time that monitored activity begins or ends;

- Construction activities occurring during each observation period;
- Weather parameters (e.g., percent cover, visibility);
- Water conditions (e.g., sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from construction activity;
- Distance from construction activities to marine mammals and distance from the marine mammals to the observation point;
- Locations of all marine mammal observations; and
- Other human activity in the area.

11 CONSERVATION RECOMMENDATIONS

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

1. Disposal of any fish, shellfish, or other animal, or waste parts of fish, shellfish, or other animal, in or around Statter Harbor system waters, should be prohibited 48 hours prior to blasting activities so as to not attract Steller sea lions and other pinnipeds such as harbor seals. Heavy duty plastic insulated waste bins should be installed at all designated fish cleaning stations in Statter Harbor in order to prevent ESA-listed marine mammals from becoming habituated to the area during construction activities, and permanently after project completion.
2. CBJ D&H should install informational signs designed by NMFS but constructed and supplied by CBJ D&H with a public message about Alaska Humpback Whale Approach Regulations. These signs should be located near where whale watching vessels dock. NMFS expects this effort will minimize harassment of humpback whales by informing tourists of the importance of these regulations, thereby decreasing the pressure on whale watching companies to be aggressive in pursuit of whales in the action area, not only for the duration of this project, but also into the future.
3. 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://alaskafisheries.noaa.gov/pr/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, USACE and NMFS PR1 should notify NMFS of any conservation recommendations they implement in their final action.

12 REINITIATION OF CONSULTATION

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

13 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

Utility

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

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-Opinions/. The format and name adhere to conventional standards for style.

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.

Objectivity

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

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

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

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

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