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

Kodiak Ferry Dock and Terminal Improvements

NMFS Consultation Number: AKR-2015-9446

Action Agencies: Federal Highway Administration, Alaska Division
National Marine Fisheries Service (NMFS), Office of Protected Resources

Consultation By: NMFS, Alaska Region

Date Issued: 7/31/15

Approved by:

James W. Balsiger, Ph.D.
Administrator, Alaska Region

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

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ABBREVIATIONS AND TERMS

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AKR	Alaska Region
AMHS	Alaska Marine Highway System
BA	Biological Assessment
BMP	Best Management Practices
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
dB	Decibels
DOC	United States Department of Commerce
DOI	United States Department of the Interior
DOT	Alaska Department of Transportation & Public Facilities
DPS	Distinct Population Segment
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FHWA	Federal Highways Administration
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
m	Meter(s)
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
M/V	Motor Vessel
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
OPR	Office of Protected Resources
PCEs	Primary Constituent Elements
PRD	Protected Resources Division
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
rms	Root-Mean-Square

RPM	Reasonable and Prudent Measure
TL	Transmission Loss
TS	Threshold Shift
TTS	Temporary Threshold Shift
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
WDPS	Western Distinct Population Segment

1.0 INTRODUCTION AND CONSULTATION HISTORY

1.1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA), 16 U.S.C. § 1531 et seq., requires that each federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species, or destroy or adversely modify critical habitat of such species. When the action of a federal agency may adversely affect a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the species that may be affected. For the actions described in this opinion, the lead action agency is the Federal Highway Administration (FHWA), which is providing funding for the proposed action. In addition, the NMFS Office of Protected Resources - Permits and Conservation Division (NMFS OPR) proposes to issue a permit to the Alaska Department of Transportation and Public Facilities (DOT) to incidentally take marine mammals under the Marine Mammal Protection Act (MMPA) in association with this project. The consulting agency is the NMFS Alaska Region.

The FHWA requested formal consultation to address likely impacts of pile driving associated with improvements and repairs to the Kodiak Alaska Marine Highway System (AMHS) Ferry Dock and Terminal to listed marine species. The purpose of the project is to improve efficiency and safety of loading and disembarking passengers and vehicles.

1.2 CONSULTATION HISTORY

The FHWA initially determined that the proposed project was not likely to affect ESA-listed species and requested informal consultation regarding effects to humpback whales and western DPS Steller sea lions and their critical habitat on May 9, 2013. DOT served as FHWA's non-federal designee for the informal consultation. The informal consultation concluded on July 29, 2013, when NMFS issued a letter of concurrence agreeing with the FHWA determination.

However, contractors were unable to conduct the pile driving operations while adhering to marine mammal mitigation measures proposed by DOT in consultation with NMFS. Specifically, contracted marine mammal observers noted that Steller sea lions were often within 350 meters of the ferry terminal, which was the established marine mammal shutdown zone to avoid take of ESA-listed species. It became clear that work could not progress while following the mitigation measures.

In October 2014, DOT contacted NMFS to discuss options for revising the project description to allow completion of pile driving operations. DOT determined the mitigation measures were not feasible and notified NMFS that FHWA would seek incidental take authorization for harassment and possible injury of western DPS Steller sea lions. On November 14, 2014 and January 26, 2015, the FWHA, DOT, NMFS OPR, NMFS AKR, and project contractors met in person and via teleconference to discuss the project and the action agency's request for an Incidental Harassment Authorization (IHA), related incidental take statement (ITS), and potential mitigation measures.

On April 30, 2015, FHWA/DOT requested formal Section 7 consultation for the proposed project, including harassment (Level B) and injurious (Level A) take of western DPS Steller sea lions, and submitted a Biological Assessment (BA) for the proposed action. Effects to humpback whales and Steller sea lion critical habitat would continue to be covered by the 2013 informal consultation on this project (NMFS# AKR-2013-9277). NMFS AKR and NMFS OPR raised questions regarding the exposure analyses presented in the BA. FHWA/DOT submitted a revised BA on June 16, 2015. On June 23, 2015, NMFS OPR submitted to NMFS AKR a request for section 7 consultation for the proposed Incidental Harassment Authorization for the proposed action.

On July 1 and 8, 2015, NMFS AKR submitted 5 questions to FHWA/DOT regarding the supporting materials for assertions made in the revised BA. FHWA/DOT responded to these requests for information on July 10 and 15, 2015. Several email exchanges and phone conversations occurred after July 15 between NMFS and DOT regarding clarifications and requests for referenced materials.

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 ACTION AREA

"Action areas" are defined as "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(d)). The action area is distinct from, and larger than, the project footprint because some elements of the project may affect listed species some distance from the project footprint. The action area, therefore, extends out to a point where no measurable effects from the project are expected to occur.

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). The current in-water Level A (injury) threshold for impulse noise (e.g., impact pile driving) is 180 dB re 1 µPa for cetaceans (including the humpback whale) and 190 dB re1 µPa for pinnipeds (including the Steller sea lion). The current Level B (behavioral disruption) threshold for impulse noise is 160 dB 1 µPa for cetaceans and pinnipeds. The current threshold for continuous noise (e.g., vibratory pile driving) is 120 dB re 1 µPa. However, recent measurements taken in the action area suggest that the ambient background sound level is 125 dB re 1 µPa (PND 2015). Based on this information, the action area for the proposed project includes the area where Steller sea lions may be subjected to underwater project-related sound levels greater than background levels (i.e., above 125 dB re 1 µPa received sound level).

2.2 PROPOSED ACTION

The Kodiak Ferry Terminal at Pier 1 is located in the City of Kodiak, Alaska (Figure 1). Pier 1 is an active ferry terminal and multi-use dock located in Near Island Channel, which separates downtown Kodiak from Near Island (Figure 2). The channel is approximately 200 meters (656 feet) wide in the project area. Pier 1 is situated between a marine fuel service floating dock to the northeast (Petro Marine Services) and a pile-supported dock owned by a shore-based seafood processor to the southwest. Pier 1 is separated from that seafood processing dock by only about 15 meters (50 feet) (Figure 3).

The AMHS ferry *M/V Tustumena* docks at Pier 1 on its passage between Homer, Alaska, and the Aleutian Islands. Pier 1 is owned by the City of Kodiak and consists of a pile-supported timber U-shaped dock. In addition to the ferry operations, the dock is used for transfer of fuel to an upland bulk fuel storage facility owned by Petro Marine/Harbor Enterprises, which also owns the marine fueling facility located north of Pier 1 (Figure 3). The dock is also used for transfer of cargo. The FHWA states that the existing infrastructure and support facilities at Pier 1 are in need of replacement because of their age and deteriorated condition.

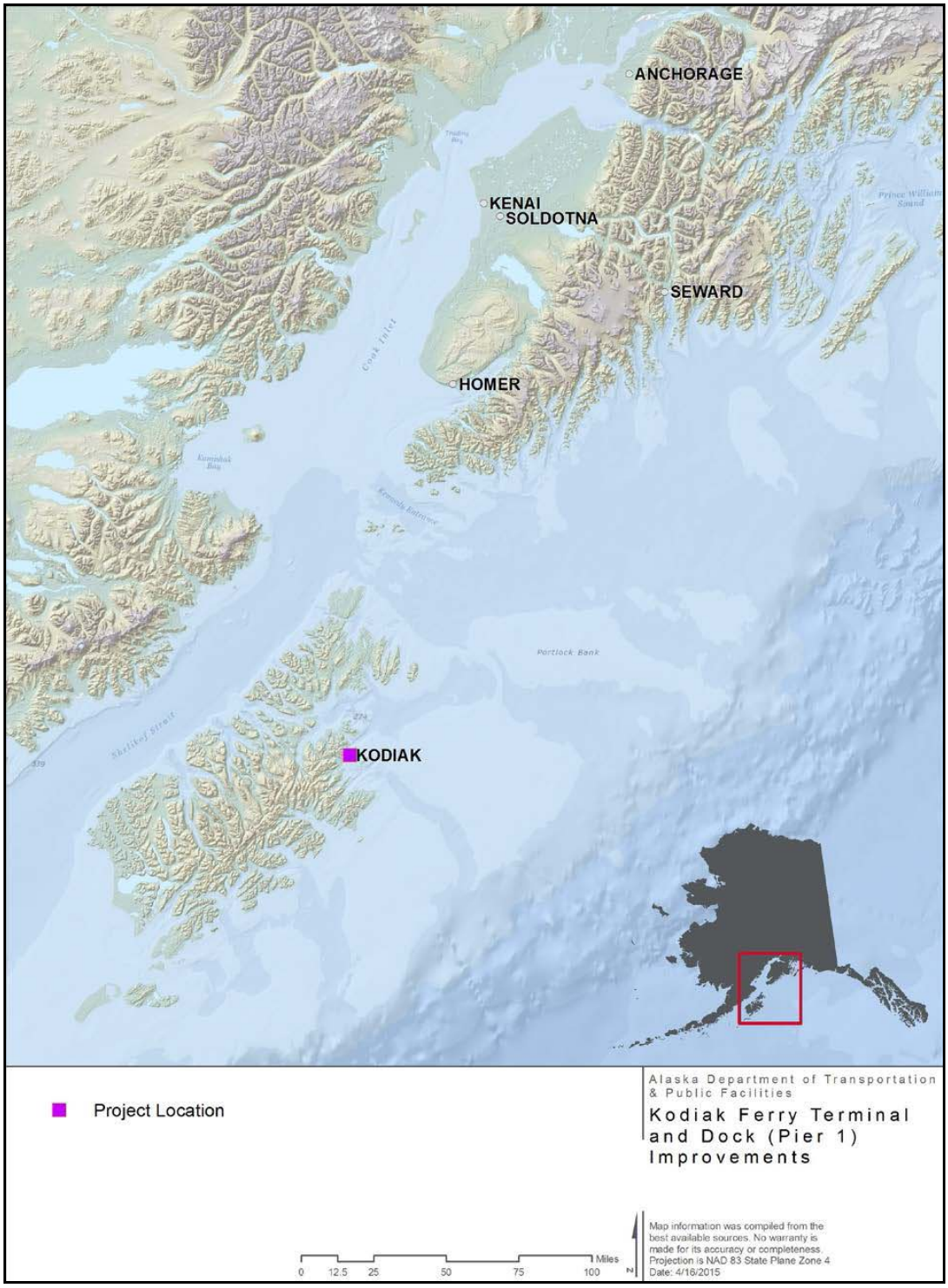

Figure 1. Map of the proposed project location.

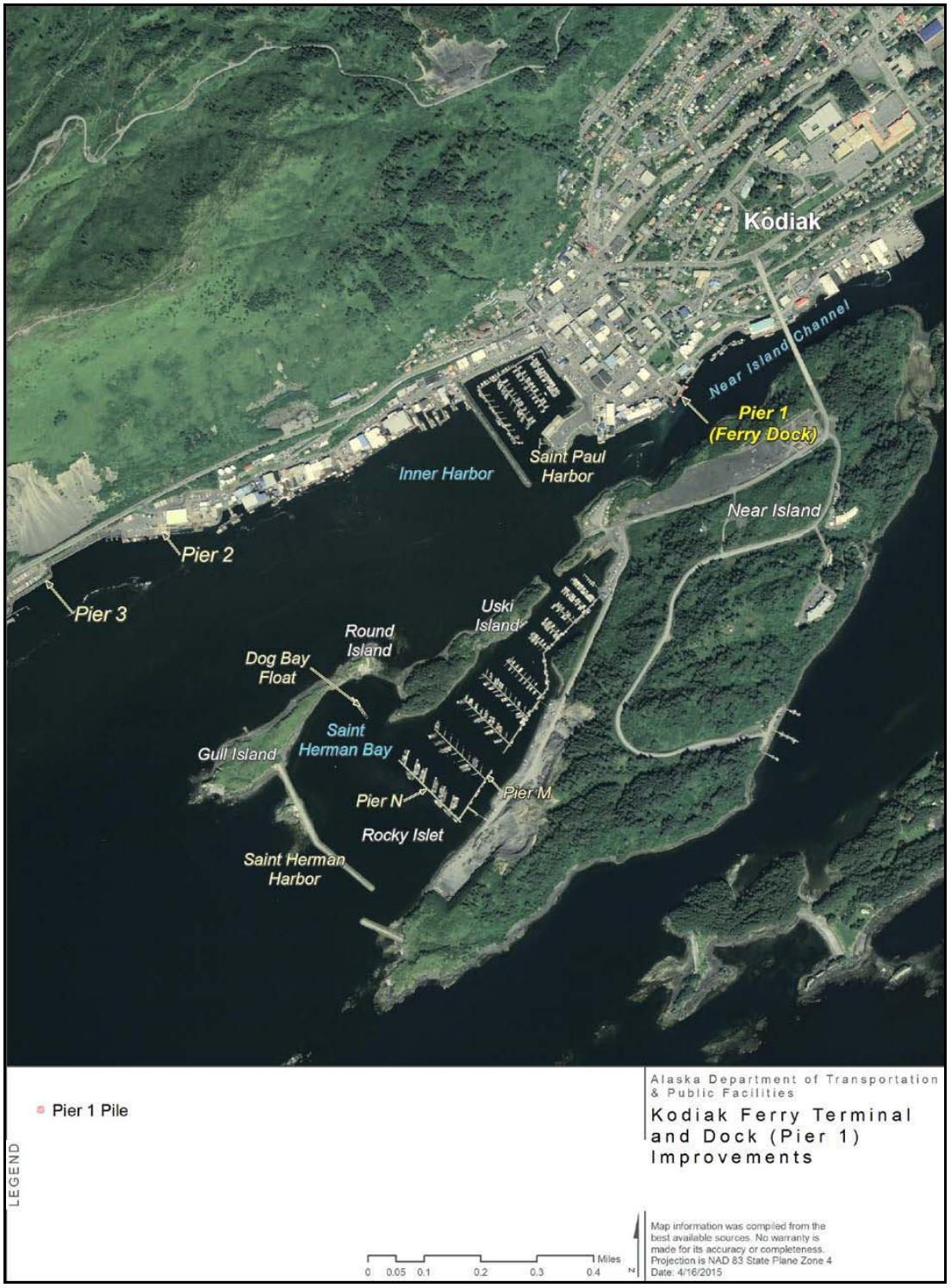

Figure 2. Image showing the location of the proposed project in the city of Kodiak, on the north side of the Near Island Channel.

Figure 3. Image showing the proposed project location (Pier 1) relative to a seafood processing dock and fuel dock.

DOT operates the AMHS to provide safe, reliable, and efficient transportation of people, goods, and vehicles. To maintain and improve service, DOT conducts construction, repair, and maintenance activities as part of regular operations. The proposed action will address the repair and maintenance needs of the Kodiak AMHS Ferry Terminal.

The Pier 1 dock is approximately 50 years old and nearing the end of its service life. The purpose of the project is to replace the existing ferry terminal and dock with an updated, modern structure and associated mooring and fender systems that will improve the *M/V Tustumena's* operations. The project will improve efficiency and safety of loading and disembarking passengers and vehicles.

The proposed action includes removal of the existing timber dock and piles, and installation of the new dock, including mooring and fender systems. No dredging is proposed as part of this project. Demolition and construction activities will require both land-based and marine-based staging areas and construction equipment. While work is conducted in the water, anchored barges will be used to stage construction equipment. Portions of the existing Pier 1 dock will be demolished prior to portions of the new dock being constructed. Temporary steel H-piles will be installed to support temporary work structures. The new dock will be supported by round steel piles, and dock fenders will include round steel piles and timber piles. The proposed action will require an estimated 120 days total of pile extraction and installation, including 80 days of vibratory extraction and installation, 60 days of down-hole drilling, and 22 days of impact hammering. Note that these estimates are the number of days when each activity may occur at some point during the day. The estimated total hours of pile installation for each activity is detailed below (Table 1).

Specific overwater portions of the existing timber dock will be demolished and removed. Construction details for demolition are the responsibility of the construction contractor and cannot be fully defined at this time; however, dock elements proposed for removal will likely be placed in an excavator, if accessible to land-based equipment, or within a material barge alongside a transfer barge, scow, or floating tug-mounted derrick. Material will then likely be transferred to one of the existing transfer facilities in the vicinity or to an approved landfill.

The existing dock consists of an estimated 156 vertical 13-inch diameter timber piles, 40 timber-battered piles, and 14 16-inch diameter steel fender piles. All piles, decking, and other existing dock materials will be removed. The exact method for pile extraction will be determined by the contractor. It is anticipated that when possible, existing piles will be extracted by lifting them directly with a crane. A vibratory hammer will be used only if necessary to extract piles that cannot be directly lifted. Removal of each old pile is estimated to require 5 minutes of vibratory hammer use, if necessary. Under the worst-case scenario, if all old piles are removed by using the vibratory hammer, it will require a total time of about 17.5 hours (Table 1).

Table 1. Number and type of pilings to be used in the proposed action, including the estimated number of hours required for pile driving and extraction.

Pile Type	Number of Piles	Vibratory Hammer		Down-hole Drill		Impact Hammer	
		Number of piles	Hours required	Number of piles	Hours required	Number of piles	Hours required
13-inch timber extraction	196	196	16	0	0	0	0
16-inch steel extraction	14	14	2	0	0	0	0
Temporary steel H or pipe Installation	88	88	15	0	0	0	0
Temporary steel H or pipe extraction	88	88	8	0	0	0	0
Permanent 24-inch steel Installation	88	88	15	88	440	88	2
Permanent 18-inch steel Installation	10	10	2	0	0	0	0
Permanent 16-inch timber Installation	8	8	2	0	0	0	0
Total Hours		--	60	--	440	--	2
Total Hours with 25% contingency		--	75	--	550	--	3

The exact means and methods for pile installation will be determined by the contractor; however, a few options are available within a general framework. Temporary steel pipe or H-piles will be installed to ensure proper placement and alignment of permanent piles during installation of the permanent steel piles. Three temporary piles will be driven with a vibratory hammer for each temporary false work structure. Temporary piles will be driven 3-9 meters (10-30 feet) through the overburden sediment layer, but are not expected to penetrate into the bedrock. A vibratory hammer will be used to remove the temporary piles, which will then be reinstalled at a new location. Individual temporary piles will be driven and removed an estimated 88 times. It is estimated that it will take 10 minutes of vibratory pile driving per temporary pile for installation and 5 minutes each for extraction, for a total of 15 minutes of vibratory pile driving per temporary pile. For 88 temporary piles, this is an estimated 22 hours of total time using active vibratory equipment (Table 1). Note that a 25 percent contingency has been added to the total duration.

A total of 106 new permanent piles will be installed as part of the proposed action. The new terminal and dock will be supported by approximately 88 round, 24-inch diameter steel piles. The 24-inch steel piles will be driven 10-30 feet (3-9 meters) through the sediment layer and 4.5 meters (15 feet) into the bedrock. Dock fenders will be supported atop 10 round, 18-inch diameter steel piles. In addition, 8 round, 16-inch timber piles, which are somewhat variable in size from about 16 inches at the butt (top) to about 12 inches at the tip (bottom), will be installed as fender piles along the north side of the dock. Both the steel and timber fender piles will be driven with a vibratory hammer to approximately 7 meters (22 feet) embedment, or to refusal. The sequence for installing the permanent 24-inch piles will begin with insertion through overlying sediment with a vibratory hammer for about 10 minutes per pile. Next, a hole will be drilled in the underlying bedrock by using a down-hole drill/hammer. A down-hole hammer is a drill bit that drills through the sediment and a pulse mechanism that functions at the bottom of the hole, using a pulsing bit to break up the harder materials or rock to allow removal of the fragments and insertion of the pile. The head extends so that the drilling takes place below the pile. Drill cuttings are expelled from the top of the pile as dust or mud. It is estimated that drilling piles through the layered bedrock will take about 5 hours per pile. Two to five blows of an impact hammer will be used to confirm that piles are set into bedrock (impact proofing), for an expected maximum time of 1 minute of impact hammering per pile (Table 1). When the impact hammer is employed for proofing, a pile cap or cushion will be placed between the impact hammer and the pile.

All permanent 18-inch steel piles and all 16-inch timber piles will be driven into the marine sediment using a vibratory hammer. It is anticipated that it will take about 10 minutes of vibratory driving to install each permanent 18-inch steel pile and all timber piles (Table 1).

Reconstruction of the existing facilities with new pile-supported structures will increase the footprint of the existing dock from 1,128 square meters (12,150 square feet) to approximately 1,709 square meters (18,400 square feet). This expanded dock area will provide additional, secure staging for vehicles and passengers (Figure 4). The increased dock footprint will largely result from widening the north side, where vehicles drive to access the ferry. The new dock face will be about 8.5 meters (28 feet) longer, in a direction parallel to the shoreline. A covered walkway will be constructed along the west side of the dock. A new fire protection and potable water line will supply the new dock, including a hydrant near the head of the dock. This hydrant will be connected to the buried main under Marine Way.

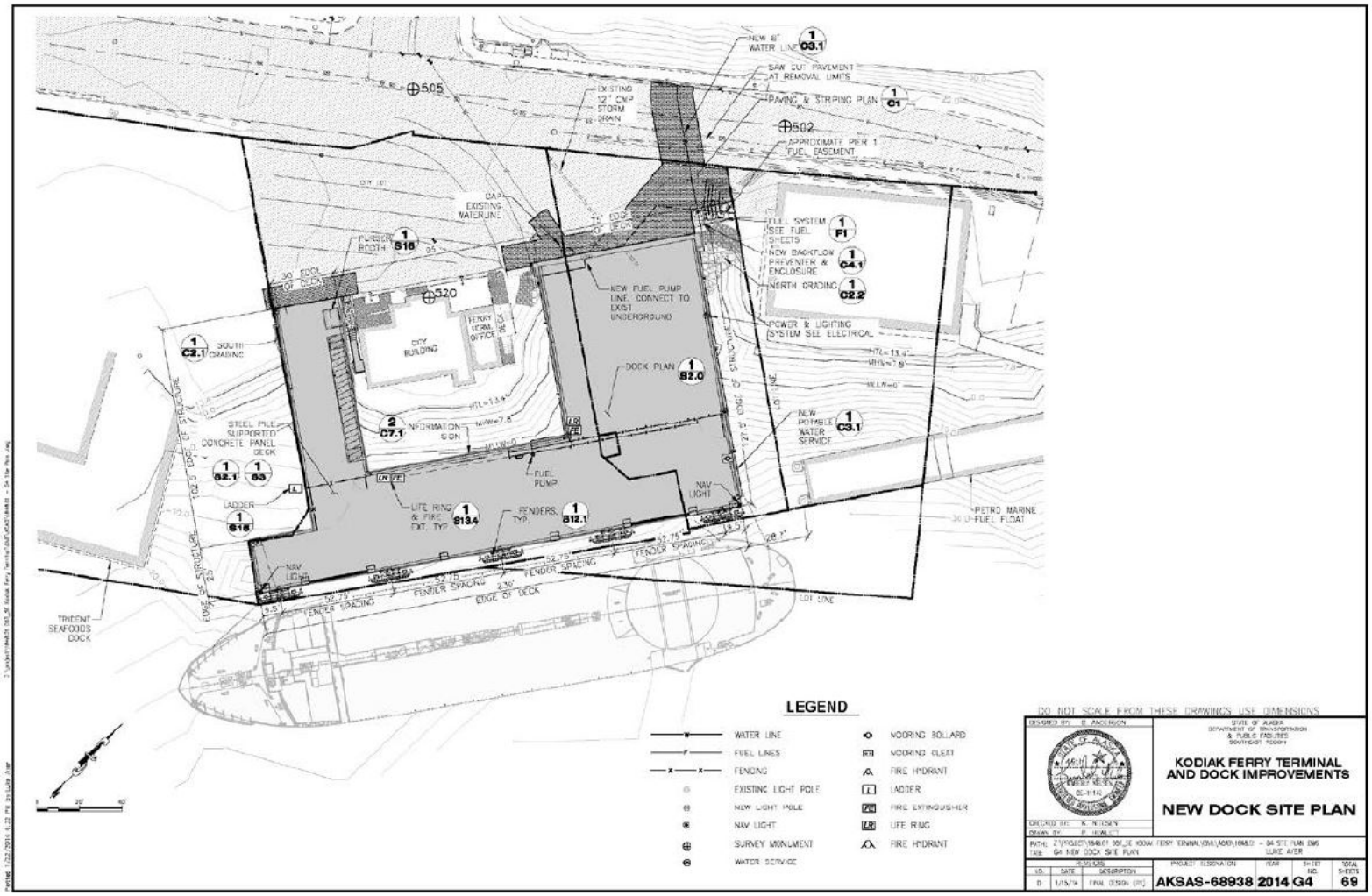

Figure 4. The new dock site plan for the Kodiak Ferry Terminal Improvements project.

Approximately 38 cubic meters (50 cubic yards) of rock armoring will be placed below the high tide line along the shoreline of the new dock. During placement of rock armoring, temporary erosion control and stabilization measures (Best Management Practices [BMPs]) will be used to prevent erosion of soils and transportation of sediment beyond the immediate construction site. Specific BMPs will be determined by the contractor but could include work during low tides, or the use of silt fencing or fabric along nearshore areas sloping toward the harbor. Portions of the new decking will consist of pre-cast concrete pile caps and deck panels supported atop the new steel pilings.

Ferry operations at the existing Pier 1 dock will be disrupted temporarily during construction of the new facility. Ferry operations will likely be temporarily relocated to the City Dock (Pier 2) (Figure 2) that currently accommodates ferry and cruise ship traffic. The *M/V Kennicott* currently docks at Pier 2, and the pier can accommodate the *M/V Tustumena*.

2.2.1 Proposed Mitigation Measures

A number of mitigation measures or construction techniques will be employed to minimize effects to listed species and designated critical habitat. The mitigation measures for the project include the observation of marine mammal monitoring zones during all pile driving (the sizes of which are based on FHWA/DOT's analysis of sound transmission loss from pile driving, discussed in section 5.2.1 below); "soft starts" or ramp-up procedures designed to allow marine mammals to leave the project area before pile-driving noise reaches thresholds for harassment; the use of sound attenuation devices (e.g., pile caps) when using impact hammers; and sequencing work (when possible) to proof piles nearest the seafood processing dock when the dock is less busy or not operating and sea lion attendance is expected to be lowest. The adjacent seafood plant is generally less busy after 15 November and shuts down for a few weeks in late December and early January. These mitigation measures will decrease the likelihood that Steller sea lions will be exposed to sound pressure levels that may result in harassment.

<u>General Construction Mitigation Measures:</u>

- All exposed project slopes and fills that are susceptible to erosion will be stabilized in accordance with the project-specific Water Quality Control Plan
- If contaminated or hazardous materials are encountered during construction, all work in the vicinity of the contaminated site will be stopped until the Alaska Department of Environmental Conservation (ADEC) is contacted and a corrective action plan is approved by ADEC and implemented.
- Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., will be checked regularly for drips or leaks, and will be maintained and stored properly to prevent spills.
- The Contractor will provide and maintain a spill clean-up kit on-site at all times, to be implemented as part of the Spill Prevention, Control, and Countermeasure Plan, as well

as the Hazardous Material Control Plan in the event of a spill or if any oil products is observed in the water.

- Work in waters of the U.S. will be conducted in accordance with the terms and conditions of the United State Army Corps of Engineers (USACE) permit obtained for the project (Permit File Number 2012-769).
- Fill material will consist of rock fill that is free of fine sediments to the extent practical, to reduce suspended materials from entering the water column during tidal cycles. Fill material shall also be free of invasive marine and terrestrial vegetation species.
- As recommended by ADF&G, to minimize impacts to pink salmon fry and coho salmon smolt, the contractor will refrain from impact pile driving from 01 May through 30 June, within the 12-hour period beginning daily at the start of civil dawn. If impact pile driving occurs from 01 May though 30 June, it will occur in the evenings during daylight hours, after the 12-hour period that begins at civil dawn.

Pile Removal and Installation Mitigation Measures:

- The new pier design considered a variety of alternatives to minimize impacts to the aquatic environment. The preliminary project design included more than 160 permanent 24-inch piles, and was later revised to significantly to reduce the number of required piles. The selected alternative consists of a design that incorporates the smallest-diameter piles practicable while still minimizing the overall number of piles. This design was selected to minimize noise impacts associated with larger piles.
- Direct pull methods to remove piles will be used to minimize noise levels as much as possible. The vibratory hammer will be used only when needed.
- Vibratory hammers and down-hole drilling methods will be used to install piles; the impact hammer will be used only to ensure the piles are secure (proofed) in bedrock.
- Sound attenuation measures such as pile caps will be used on all impact pile-driving activities. Micarta pile caps will be used with all impact pile driving.
- Before impact or vibratory pile-driving occurs, the contractor will employ a soft start or ramp-up procedures. These procedures will be used at the beginning of each pile installation to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy. Procedures will follow these general guidelines:
    - The soft start requires pile-driving operators to initiate noise from vibratory hammers for 15 seconds, followed by a 1-minute waiting period. The procedure will be repeated two additional times.

  - For impact driving, operators will be required to provide an initial set of three strikes from the impact hammer, followed by a 1-minute waiting period, then two subsequent three–strike sets.

- Qualified Protected Species Observers (PSOs) will be employed for marine mammal monitoring.

Marine Mammal Monitoring:

- A trained or experienced observer will be present during all pile installation, down-hole drilling, and pile-extraction operations (Figure 5).
- Monitoring for marine mammals will take place for at least 30 minutes prior to pile installation, down-hole drilling, and pile-extraction operations.
- Observer must be able to positively identify the marine mammals in the area and have prior training or expertise in monitoring and surveying marine mammals, with credentials available for review.
- Observers must maintain verbal contact with construction personnel to immediately call for a halt in impact pile driving operations to avoid exposures.
- NMFS must be provided with a report of all marine mammal sightings during the project once construction is complete.

The PSO will begin observations 30 minutes prior to the start of pile installation or extraction, and will continue to observe for 20 minutes after completion of pile installation or extraction. A second PSO will be available to observe during alternate shifts of 4-6 hours each day to prevent fatigue. Each PSO will also provide scheduled breaks to the other PSO during the 4-6 hour shifts. When not providing a break, the alternate PSO will conduct visual surveys of the greater Kodiak Harbor area (including the Dog Bay haulout) to monitor the general distribution of sea lions (e.g., to monitor changes in the number of sea lions at the haulout, which may influence the number of individual sea lions in the project vicinity). Each PSO will be trained and provided with reference materials to ensure standardized and accurate observations and data collection. Considerations will include:

- Heights and locations of the observation platforms, to maximize fields of view and distances
- Ability to see the entire 1,150-meter (3,773-foot) (Figure 5) marine mammal monitoring zone
- Safety of the PSO, construction crews, and other people present at the project

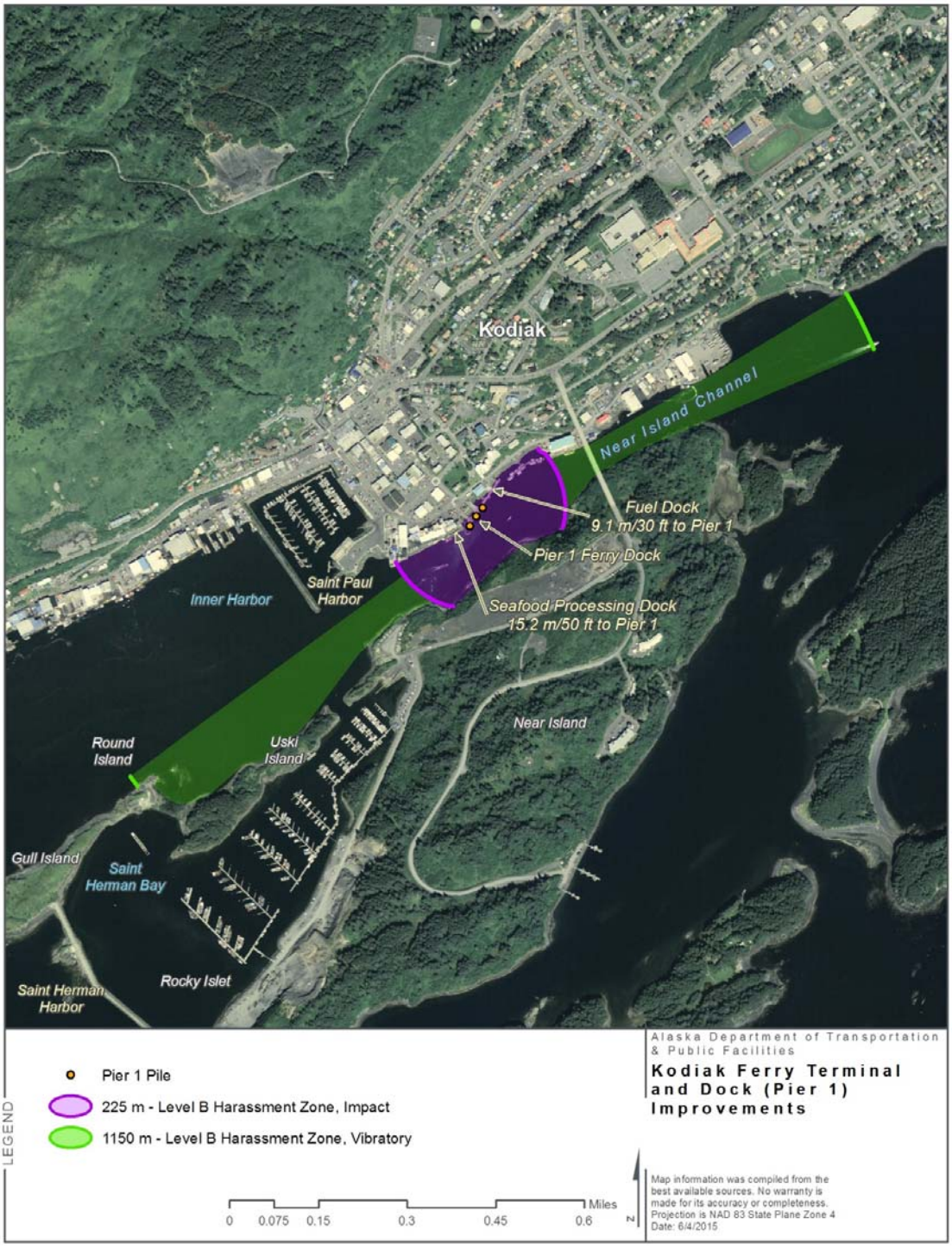

Figure 5. Aerial photograph showing the 225 m and 1,150 m marine mammal monitoring zones.

Specific aspects and protocols of observations:

- Monitoring distances will be measured with range finders and marked with buoys as needed
- Distances to animals will be based on the best estimate of the PSO, relative to known distances to objects in the vicinity of the PSO
- Bearings to animals will be determined by using a compass

Pre-activity monitoring:

- The 1,150-meter (3,773-foot) (Figure 5) monitoring zone (which encompasses the injury threshold/Level A harassment zone, based on FHWA/DOT's analysis discussed in section 5.2.1 below) will be monitored for 30 minutes prior to in-water pile installation or extraction.
- If a Steller sea lion is present within the 190 dB rms injury (Level A) zone (approximately 4.4 m for impact pile driving of 24-inch steel piles) during impact pile driving operations, ramping up may be employed to encourage animals to vacate the immediate area, but full pile driving operations will be delayed until the animal(s) leaves the Level A harassment zone. Activity will begin only after PSO has determined that the animal(s) has moved outside the injury zone(s).
- If a humpback whale is present in the 1,150-meter (3,773-foot) (Figure 5) marine mammal monitoring zone, ramping up will be delayed until the animal(s) leaves the zone. Ramping up will begin only after PSO has determined that, through sighting, the animal(s) has moved outside the zone.

Active Construction Monitoring:

- The 1,150-meter (3,773-foot) (Figure 5) monitoring zone will be observed and relevant environmental conditions, construction activity, descriptions of takes, and wildlife sightings will be recorded. Shutdown zones will be implemented as warranted.

Post-Activity Monitoring:

- Monitoring of the Level A and Level B harassment zones will continue for 20 minutes following the completion of the activity.

Data Collection:
NMFS OPR requires that the PSO use NMFS-approved sighting forms, and that the following information be collected on the sighting forms:

- Date and time that pile installation or removal begins or ends
- Construction activities occurring during each observation period

- Weather (wind, precipitation, fog)
- Tide state and water currents
- Visibility
- Species, numbers, and (if possible) sex and age class of marine mammals
- Marine mammal behavior patterns observed, including bearing and direction of travel, and if possible, any correlation to the type of construction activity
- Distance from pile installation/removal activities to marine mammals
- Other human activity in the area including commercial fish processing activity of adjacent facilities
- Statement from alternate PSO regarding localized population distribution and counts as well as other observations of adjacent and surrounding properties and activities.

To the extent practicable, the PSOs will record behavioral observations that may make it possible to determine if the same or different individuals are being "taken" as a result of project activities over the course of a day. It is anticipated that sea lions will enter and exit the project area multiple times throughout the course of each day limiting the PSO's ability to determine if multiple takes are being applied to the same individual. To this effect, the number of "takes" documented per day will be capped at 40 – the estimated number of unique individual sea lions likely to pass through Near Island Channel each day.

Reporting:
A draft report will be submitted to NMFS within 90 calendar days of the completion of marine mammal monitoring. A final report will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft report from NMFS. In general, reporting will include:

- Descriptions of any observable marine mammal behavior in the s monitoring zones
- Actions performed to minimize impacts to marine mammals
- Times when work was stopped and resumed due to presence of marine mammals
- Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, and behavioral reactions within the 4.4-m (13-foot) (190 dB rms isopleth) pile driving injury zone as well as the 1,150-m (3,377-foot) (125 dB rms isopleth), 225-m (738-foot) (160 dB rms isopleth) (Figure 5), and 3-m (10-foot) monitoring zones

<u>Implementation of Shutdown Zones:</u>

- During impact pile driving, the shutdown zone shall include all areas where the underwater SPLs are anticipated to equal or exceed the injury threshold (Level A) criteria for pinnipeds (190 dB rms isopleth; 4.4 meters or 13 feet), and cetaceans (180 dB rms isopleth; 15 meters or 50 feet). If a Steller sea lion approaches or enters the impact pile driving injury (Level A) zone, pile driving will cease as soon as practicable.
    - If an individual approaches the 4.4-m injury (Level A) zone during impact pile driving, pile installation will be halted to try to avoid injury (Level A exposure). However, it is possible that Level A exposure of sea lions may occur during impact pile driving, despite best efforts to avoid such exposure to injurious sound pressure levels. If a Steller sea lion is observed approaching or entering the Level A harassment zone, shutdown will occur immediately, and a Level A exposure will be recorded (if the sea lion enters the 190 dB rms isopleth) and behaviors documented. Sea lion behaviors will be recorded at all times during monitoring.
- During vibratory pile installation and removal, the monitoring zone (125 dB rms isopleth) will extend to 1,150 meters (3,773 feet) for all marine mammals under the jurisdiction of NMFS. When project piles are being driven exclusively by impact hammers, the monitoring zone (160 dB rms isopleth) will extend 225 meters (737 feet) for all marine mammals under NMFS's jurisdiction. During periods when drilling or impact pile driving and vibratory installation/removal occur concurrently, the 1,150 meter (3,773 feet) zone will be the default for marine mammal monitoring efforts.
- During vibratory installation/removal, if a Steller sea lion is observed entering the 1,150-meter (3,773-foot) monitoring zone, a disturbance (Level B) exposure will be recorded and behaviors documented. That pile segment will be completed without cessation. Similarly, during exclusive impact driving, if a Steller sea lion is observed entering the 225-meter (737 foot) noise monitoring zone, a disturbance exposure will be recorded and pile driving will continue.
- If a humpback whale is observed approaching the 1,150-meter (3,773-foot) monitoring zone during vibratory installation, all pile installation and removal activities will be shut down. Similarly, during impact pile driving, if a humpback is observed approaching the 225-meter (737 foot) monitoring zone, all impact pile driving activities will be shut down until the animal leaves the area of its own accord.

<u>Additional Potential Mitigation Measures During Impact Pile Driving:</u>
Currently, vessels making deliveries to the adjacent seafood processing plant tie up at the dock on their starboard sides, with their sterns to the northeast, oriented toward the Pier 1 dock. If delivering vessels were able to tie up on their port sides, with their sterns toward the southwest, away from Pier 1, the distance between the area of attraction for sea lions (the stern, where fish may be available) and Pier 1 would be reduced by the length of the vessel (up to 100 feet or more). Therefore, port-side dockings would effectively minimize the presence of Steller sea lions

in proximity to Pier 1 during off-loading of fish at the dock, particularly in relation to the impact pile-driving injury threshold (Level A) zone.

Initial discussions with staff at the seafood processing facility indicated that reversing the typical docking orientation of delivering vessels may be an option, for some vessels, during the short periods of time when impact pile driving is planned. Further discussions and coordination are anticipated (FHWA and DOT 2015).

Another mitigation option relates to the potential for alternative docking sites for vessels awaiting off-loading at the dock. At certain busy times during the year, multiple vessels may wait in line for their turn to make fish deliveries to the dock. Often, the vessels "raft up" out from the dock by tying up to one another, port to starboard, into the channel. This additional activity and the presence of multiple sources of food can increase the number of sea lions attracted to the processing plant and the Pier 1 area. If alternative dock space were available in another place, such as at Pier 2 or Oscar's Dock in St. Paul Harbor (both City of Kodiak-owned facilities), vessel captains may choose to tie up in a less-congested area, reducing the attraction of sea lions to the seafood processing dock and Pier 1. Further discussions regarding the feasibility of this potential mitigation measure are anticipated to occur between DOT and the seafood processing facility. DOT will work with staff at the facility prior to and during construction to implement these measures, as reasonably practicable.

3.0 STATUS OF LISTED SPECIES

3.1 STELLER SEA LION (*EUMETOPIAS JUBATUS*)

Population Structure/Status. There are two Steller sea lion populations in Alaska: the western DPS is listed as endangered, and generally occurs west of Cape Suckling, and the eastern DPS generally occurs east of Cape Suckling, Alaska (144°W longitude). However, large movements by individual Steller sea lions on either side of the 144°W longitude demarcation are not rare, and western DPS individuals are expected to occur in Southeast Alaska north of Sumner Strait (Jemison et al. 2013, NMFS 2013). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late-May to early-July) (Jemison et al. 2013, Allen and Angliss 2014). Most Steller sea lions in the action area for the proposed action are expected to be from the western DPS (Jemison et al. 2013).

The Steller sea lion was listed as a threatened species under the ESA in 1990 following declines of 63% on certain rookeries since 1985, and declines of 82% since 1960 (NMFS 2012). In 1997, NMFS reclassified the Steller sea lion into the two current DPSs and designated the western DPS as endangered (May 5, 1997; 62 FR 24345). A number of protective measures were implemented to aid recovery (NMFS 2012), and between the 1970s and 2002 the eastern DPS Steller sea lion population increased on average by 3.1% per year (Pitcher et al. 2007), which is one factor that led to NMFS's decision to delist the eastern DPS (November 4, 2013; 78 FR 66140).

The most recent comprehensive estimate (pups and non-pups) for the western DPS abundance in Alaska is 52,209 sea lions based on aerial surveys of non-pups conducted in June and July 2008-2011, and aerial and ground-based pup counts conducted in June and July 2009-2011 (Allen and Angliss 2014). The western DPS declined in abundance by about 70% between the late 1970s and 1990, with evidence that the decline had begun even earlier. Factors that may have contributed to this decline include 1) incidental take in fisheries, 2) legal and illegal shooting, 3) predation, 4) contaminants, 5) disease, and 6) climate change (NMFS 2008). Although Steller sea lion abundance continues to decline in the western Aleutians, numbers are thought to be increasing in the eastern part of the western DPS range, including in the action area (DeMaster 2011).

Description/Natural History. Steller sea lions range throughout the North Pacific Ocean from Japan, east to Alaska, and south to central California (Loughlin et al. 1984). They range north to the Bering Strait, with significant numbers at haul outs on St. Lawrence Island in the spring and fall (Kenyon and Rice 1961, Sheffield and Jemison 2010). Breeding range extends along the northern edge of the North Pacific Ocean from the Kuril Islands, Japan, through the Aleutian Islands and Southeast Alaska, south to California (Loughlin et al. 1984). Steller sea lions, the largest of the eared seals (*Otariidae*), currently have a worldwide population estimated at 142,360-157,498 animals (Allen and Angliss 2014). Historically, Steller sea lion abundance was

significantly greater with an estimated worldwide population of 245,000 to 290,000 animals in the late 1970s (Loughlin et al. 1984).

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

WDPS Steller sea lions frequently occur in Kodiak Harbor and the action area. Many individual sea lions have become habituated to human activity in the Kodiak harbor/port area and utilize an artificial haulout float called Dog Bay Float located in St. Herman Harbor, about 1,300 meters (4,300 feet) from Pier 1. Though the haulout is visible from Pier 1, particularly during higher tides, this haulout is not federally designated as a "major haulout" and is not considered Steller sea lion critical habitat. A section from an old floating breakwater, the float was relocated to Dog Bay in 2000 to serve as a dedicated sea lion haulout (Figure 6). It serves its purpose of reducing sea lion-human conflicts in Kodiak's docks and harbors by providing an undisturbed haulout location and reducing the numbers of sea lions that haul out on vessel moorage floats.

Figure 6. Steller sea lions hauled out on the Dog Bay Float in St. Herman Harbor, near the action area. Photo provided by HDR.

Counts of sea lions hauled out on the Dog Bay Float provide an index of the number of Steller sea lions in the harbor area. Because this float is not considered an official haulout by NMFS, few standardized surveys to count sea lions have been conducted. Surveys from 2004 through

2006 indicated peak winter (October-April) counts ranging from 27 to 33 animals (Wynne et al. 2011). Counts from February 2015 during a site visit by HDR biologists ranged from approximately 28 to 45 sea lions on the float (FHWA and DOT 2015). During this visit, age classes of sea lions included juveniles, subadults, and adults, including about five mature bulls (FHWA and DOT 2015).

Abundant and predictable sources of food for sea lions in the Kodiak area include fishing boats and tenders and the many seafood processing facilities that accept transfers of fish from offloading vessels. Sea lions have become accustomed to depredating fishing gear and raiding fishing vessels during fishing and offloading (Figure 7**)**, and they follow potential sources of food around the harbors and docks.

Figure 7. Steller sea lions on and near a commercial fishing vessel delivering fish to a processing facility adjacent to Pier 1 (FHWA and DOT 2015).

The number of sea lions in the waters near Pier 1 varies depending on the season and presence of commercial fishing vessels unloading their catch at the dock immediately adjacent to Pier 1. During the February 2015 site visit by HDR biologists, zero to approximately 25 sea lions were observed at one time in the Pier 1 Project area. Approximately 22 of those sea lions were subadults that were foraging on schooling fishes in the area and were not interacting with the

fishing vessels offloading at the seafood processing dock at the time. The stern trawler offloading at the adjacent seafood processing plant during this period was attended by three mature bull sea lions, which constantly swam back and forth behind the stern watching for an opportunity to gain access. This particular trawler slid a vertical steel plate into position forward of the stern ramp, preventing sea lions from boarding the vessel (FHWA and DOT 2015).

Adult female Steller sea lions in a more natural situation do not generally eat every day, but tend to forage every 1-2 days and return to haulouts to rest between foraging trips (Merrick and Loughlin 1997, Rehberg et al. 2009). The foraging habits of sea lions using the Dog Bay Float and Kodiak harbor/port area are not well known, but it is reasonable to assume that given the abundance of readily available food, not every sea lion in the area visits the adjacent seafood processing plant every day. Based on numbers at the Dog Bay Float and sea lion behavior, it is estimated that about 40 unique individual sea lions likely pass through Near Island Channel each day (FHWA and DOT 2015).

Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (Pitcher and Calkins 1981, Gisiner 1985), and exhibit high site fidelity (Sandegren 1970). During the breeding season some juveniles and non-breeding adults occur at or near the rookeries, but most are on haulouts (Raum-Suryan et al. 2002, Call and Loughlin 2005).

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

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. Loud anthropogenic sounds can interfere with Steller sea lion auditory capabilities. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, which likely can hear frequencies between 0.1 and 40 kHz in water (NOAA 2013).Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 to 25 kHz (Kastelein et al. 2005), and in the air between 0.25 to 30 kHz (Mulsow and Reichmuth 2010).

Stressors. Between 2007-2011, there were incidental serious injuries and mortalities of western Steller sea lions observed in the following fisheries: Bering Sea/Aleutian Islands Atka mackerel trawl, Bering Sea/Aleutian Islands flatfish trawl, Bering Sea/Aleutian Islands Pacific cod trawl, Bering Sea/Aleutian Islands pollock trawl, and Gulf of Alaska Pacific cod longline (Allen and Angliss 2014). In addition, observers monitoring the Prince William Sound salmon drift gillnet fishery in 1990 and 1991 recorded 2 Steller sea lion mortalities in 1991, extrapolated to 29 (95% CI: 1-108) kills for the entire fishery (Wynne et al. 1992). The combined average annual

mortality estimate in observed fisheries is 29.6 (CV = 0.49) western DPS Steller sea lions (Allen and Angliss 2014).

Entanglement or other interactions with fishing gear is another source of Steller sea lion mortality or injury. From 2007 to 2011, there were four confirmed fishery-related Steller sea lion strandings in the range of the western DPS (Allen and Angliss 2014). Fishery-related strandings during 2007-2011 result in an estimated annual mortality of 0.8 western DPS Steller sea lions. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported (Allen and Angliss 2014). Based on observer data (29.6) and stranding data (0.8), the minimum estimated mortality rate incidental to commercial and recreational fisheries is 30.4 (Allen and Angliss 2014).

The mean annual subsistence take by Alaska Natives (harvested plus struck-and-lost) from this DPS from 2004 through 2008, combined with the mean take over the 2007-2011 period from St. Paul, was 199 western DPS Steller sea lions/year (Allen and Angliss 2014).

Reports from the NMFS stranding database of Steller sea lions entangled in marine debris or with injuries caused by other types of human interaction are another source of mortality data. From 2007 to 2011, one animal possessed a circumferential neck entanglement of unknown marine debris, and presented with a gaff puncture wound. The mean annual mortality and serious injury from other sources of human interactions for 2007-2011 is 0.4 individuals.

Records from NMFS Office of Law Enforcement indicate that there were two cases of illegal shootings of Steller sea lions in the Kodiak area in 1998, both of which were successfully prosecuted. There were no cases of successfully prosecuted illegal shootings between 1999 and 2003 (Allen and Angliss 2014).

Mortalities may occasionally occur incidental to marine mammal research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. However, between 2006-2010, there were zero reported mortalities resulting from research on western DPS Steller sea lions (Allen and Angliss 2014).

Nutritional stress related to competition with commercial fisheries or environmental change, predation by killer whales, and environmental variability have also been identified as potentially important stressors affecting recovery (Allen and Angliss 2014).

Critical Habitat. NMFS designated Steller sea lion critical habitat on August 27, 1993 (58 CFR 45269). Steller sea lion critical habitat in Western Alaska includes a 20 nautical mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas (Figure 8).

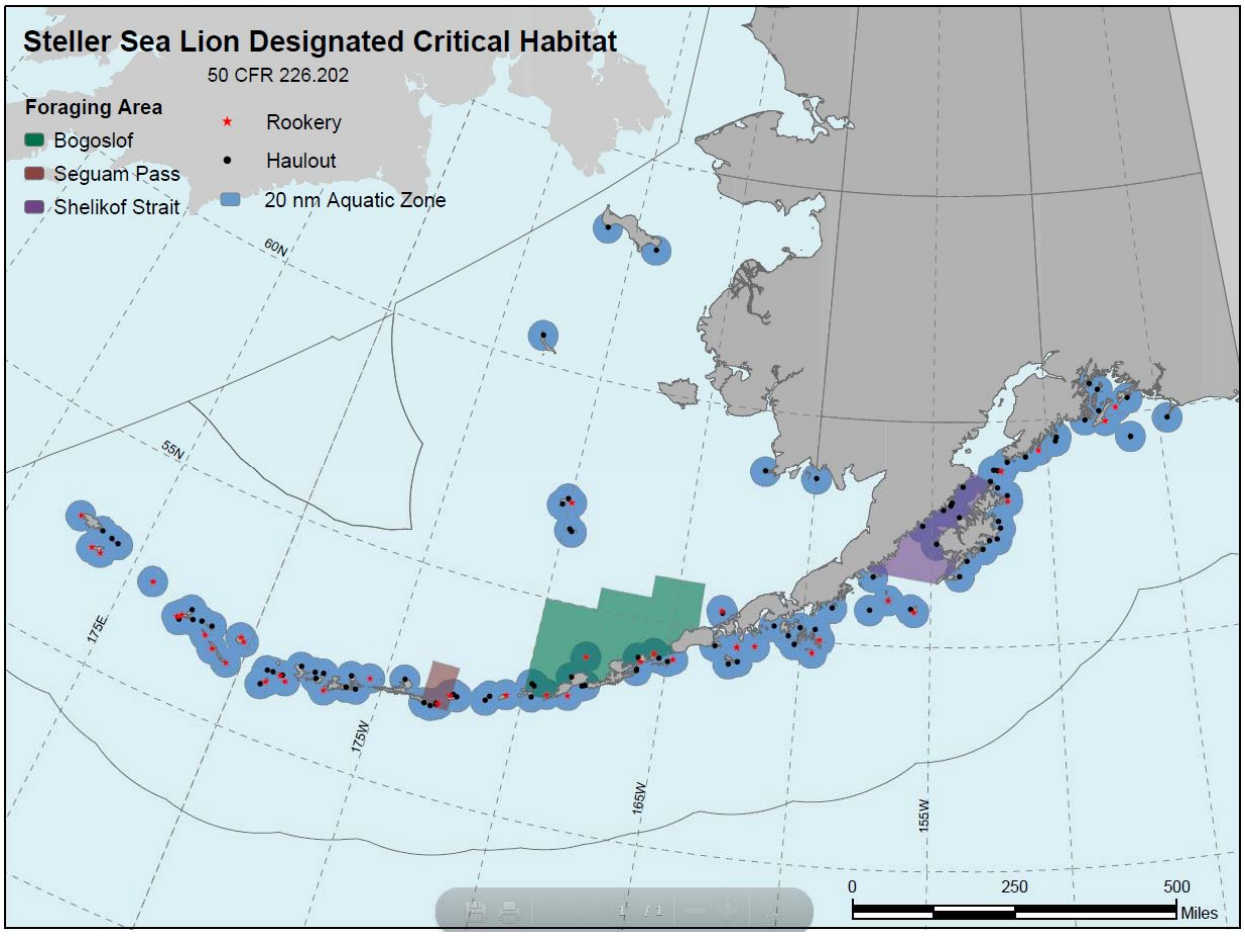

Figure 8. Designated Steller sea lion critical habitat in Western Alaska.

The areas designated as critical habitat for the Steller sea lion were determined using the best information available at the time, including information on land use patterns, the extent of foraging trips, and the availability of prey items. Particular attention was paid to life history traits and the areas where animals haul out to rest, pup, nurse their pups, mate, and molt.

3.2 SPECIES NOT CONSIDERED IN THIS BIOLOGICAL OPINION

Steller sea lion critical habitat and endangered humpback whales were considered in the letter of concurrence for this action issued on July 29, 2013 (NMFS# AKR-2013-9277). In that letter, NMFS concurred with the FHWA's determinations that the action is not likely to adversely affect Steller sea lion critical habitat or endangered humpback whales. NMFS is aware of no new information that would alter our concurrence with those determinations.

4.0 ENVIRONMENTAL BASELINE

The Environmental Baseline is an analysis of the effects of past and ongoing human-caused and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. Environmental baselines for Biological Opinions include past and present impacts of all state, federal, 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 that are contemporaneous with the consultation in process (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 Act.

4.1 CLIMATE CHANGE

Since the 1950s the atmosphere and oceans have warmed, snow and sea ice have diminished, sea level has risen, and concentrations of greenhouse gases have increased (IPCC 2013). The time period 1983-2012 was likely the warmest 30-year period in the Northern Hemisphere in the last 1400 years (IPCC 2013). This warming is thought to lead to increased decadal and inter-annual variability, and increases in extreme weather events (IPCC 2013). The likelihood of further global-scale changes in weather and climate events is virtually certain (Overland and Wang 2007, IPCC 2013, Salinger et al. 2013).

Effects to marine ecosystems from increased atmospheric CO_2 and climate change include ocean acidification, expanded oligotrophic gyres, shifts in temperature, circulation, stratification, and nutrient input (Doney et al. 2012). Altered oceanic circulation and warming cause reduced subsurface oxygen concentrations (Keeling et al. 2010). These large-scale shifts have the potential to disrupt existing trophic pathways as change cascades from primary producers to top level predators (Doney et al. 2012, Salinger et al. 2013).

The strongest warming is expected in the north, exceeding the estimate for mean global warming by a factor or 3, due in part to the "ice-albedo feedback," whereby as the reflective areas of Arctic ice and snow retreat, the earth absorbs more heat, accentuating the warming (NRC 2012). Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (NRC 2013).

The effects of climate change could include changes in the distribution of temperatures suitable for rearing young, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

4.2 OCEANOGRAPHIC DYNAMICS AND PHYSICAL PROCESSES

Climate and other physical forcing can impact ecosystem functions through oceanic, atmospheric, and terrestrial processes, such as changes in ocean temperature, chemistry, currents, storminess, and freshwater runoff. Physical forcing changes may occur on interannual (El Niño and La Niña), decadal regime shifts, or longer (global climate change) timescales. These changes influence the distribution and abundance of marine mammals, salmon, and their prey species.

Climatic shifts in the Gulf of Alaska in the twentieth century are often correlated with significant changes in species distribution and abundance, which can affect fisheries and industry and other species that depend on fish (Overland and Wang 2007, Hollowed et al. 2013). Fish species have expanded their ranges north in the Gulf of Alaska in response to warming conditions (Mueter et al. 2009). Ecosystem modelling of the relative effects of fishing, climate conditions, and predator-prey interactions on species in different trophic levels has not led to clear determination of the relative impacts of drivers on species abundance (Gaichas et al. 2011). No single forcing mechanism (fishing history, climate conditions, or predator-prey interactions) explains all species dynamics simultaneously, suggesting that there is no single primary driver of the ecosystem (Gaichas et al. 2011).

4.3 HUMAN IMPACTS TO LISTED SPECIES IN THE ACTION AREA

In addition to climate change (described above) there are ongoing human activities in the action area that impact western DPS Steller sea lions. These human-caused stressors include marine vessels, pollution, noise (aircraft, pile driving, seismic operations, blasting, dredging, etc.), and land-based disturbance.

4.3.1 Marine Vessel Activity

Ferries, fishing vessels and tenders, barges, tugboats, and other commercial and recreational vessels use Pier 1 and the nearby channel to access harbors, fuel docks, processing plants, and other commercial facilities. Although risk of ship strike has not been identified as a significant concern for Steller sea lions (Loughlin and York 2000), the Recovery Plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated (e.g., near rookeries or haulouts) (NMFS 2008).

Another stressor associated with marine vessel activity is noise. Ambient noise levels in the action area have been measured at 125 dB re 1 μPa or greater (PND 2015), exceeding the NMFS acoustic threshold of concern for continuous noise (120 dB re 1 μPa). Steller sea lions remaining in the Kodiak Harbor area may have become habituated to sound levels greater than the thresholds of concern (see the "Existing Noise Levels in the Action Area" section below).

4.3.2 Pollution

A number of intentional and accidental discharges of contaminants pollute the marine waters of Alaska annually. Intentional sources of pollution discharge include wastewater of various treatment levels, stormwater runoff, and vessel discharges.

Domestic, municipal, and industrial wastewater discharges in Alaska are managed and permitted (Alaska Pollutant Discharge Elimination System) by the State of Alaska Department of Environmental Conservation.

Stormwater runoff has the potential to carry numerous pollutants from communities in coastal Alaska into the marine waters nearby. Runoff can include pollution coming from streets, construction and industrial areas, and airports. Runoff can also carry hazardous materials from spills and contaminated sites into coastal marine waters.

4.3.3 Existing Noise Levels in the Action Area

Levels of anthropogenic (human-caused) sound can vary dramatically depending on the season, type of activity, and local conditions. These noise sources include transportation, dredging, and construction (Richardson et al. 1995). Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (Richardson et al. 1995, NRC 2003, Horowitz and Jasny 2007). Much of this increase is due to increased shipping as ships become more numerous and of larger tonnage (NRC 2003).

Even though sound is attenuated by the water surface, aircraft noise can be loud underwater when jet aircraft are directly overhead (Blackwell and Greene 2002), and aircraft can potentially harass pinnipeds at haulouts and rookeries.

4.3.4 Land Disturbance

Disturbance from land-based human activities can result in harm and harassment of Steller sea lions at haulouts, rookeries, and in nearshore waters. Coastal development and recreational activities are two potential sources of land-based disturbance to marine mammals.

Coastal development has resulted in both the loss and alteration of nearshore marine mammal habitat and changes in habitat quality due to vessel traffic, noise, and pollution. Increased development may prevent marine mammals from reaching or using important feeding, breeding, and resting areas. Pile driving and other sounds associated with harbor and dock construction are a common source of marine in-water noise that is a potential acoustic stressor for marine mammals in Alaska.

Humans engaged in recreational activities on or in Alaska's marine waters and shorelines can cause disturbance and other impacts to ESA-listed marine mammals. Groups of foraging or resting marine mammals are particularly vulnerable to harassment.

5.0 EFFECTS OF THE PROPOSED ACTION

In this section of the Biological Opinion, NMFS assesses the probable effects of the proposed action on western DPS Steller sea lions. The purpose of the assessment is to determine the direct and indirect effects that may appreciably reduce their likelihood of surviving and recovering in the wild.

5.1 APPROACH TO THE ASSESSMENT

NMFS generally approaches jeopardy analyses through several steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect effects on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, which includes changes in the spatial extent over time. The second step identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (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 an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we evaluate the available literature to determine how those listed resources are likely to respond given their exposure (our *response analyses*).

The final steps of our analyses — establishing the risks those responses pose to listed resources — are different for listed species and designated critical habitat (our *risk analyses*). Our assessments begin by identifying the probable risks to the individual organisms that are likely to be exposed to an action's effects (we measure these risks using an individual's "fitness" or the individual's probability of surviving and reproducing).

When listed animals exposed to an action's effects are expected to experience reductions in fitness, we would expect the action to reduce the abundance, reproduction rates, or growth rates (or variance in these measures) of the populations the individuals represent (Stearns 1992). Reductions in one or more of these variables (or one of the variables we derive from them) is a necessary condition for reductions in a population's viability, which is itself a necessary condition for reductions in a species' viability. On the other hand, when listed animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent (Stearns 1992, Anderson 2000).

If we conclude that western DPS Steller sea lions are not likely to experience reductions in their fitness, we would conclude our assessment. If, however, we conclude that listed animals are likely to experience reductions in their fitness, we would analyze the consequences of this reduction on the viability of the populations the individuals represent (measured using changes

in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of Listed Species* sections of this opinion) as our point of reference. Finally, we consider the consequences of any changes in population viability on the viability of the species those populations comprise. Changes in a species' reproduction, numbers, or distribution are used to estimate the species' viability. In this step of our analyses, we use the species' status (established in the *Status of the Species* section of this opinion) as our point of reference.

5.2 POTENTIAL EFFECTS OF THE PROPOSED ACTION

The following descriptions summarize aspects of the potential stressors from the proposed action that pose potential risks to ESA-listed species under NMFS's authority. We follow these summaries by identifying the co-occurrence of listed species with these effects and the nature of that co-occurrence (our *exposure analyses*). Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we evaluate the available literature to determine how those listed resources are likely to respond given their exposure (our *response analyses*).

5.2.1 Acoustic Disturbance/Noise from Pile Driving and Removal

Possible impacts to marine mammals exposed to loud underwater or in-air noise include mortality (directly from the noise, or indirectly from a reaction to the noise), injury, and disturbance ranging from severe (e.g., abandonment of vital habitat) to mild (e.g., startle response).

Since 1997 NMFS has used 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). The current in-water Level A (injury) threshold for impulse noise is 180 decibels re 1 μPa for cetaceans and 190 decibels re1 μPa for pinnipeds. The current in-water Level B (behavioral disruption) threshold for impulse noise (e.g., impact pile driving) is 160 decibels re 1 μPa for cetaceans and pinnipeds. The current in-water threshold for continuous noise for cetaceans and pinnipeds is 120 decibels re 1 μPa. In-air acoustic thresholds for pinnipeds are 90 decibels re 1 μPa for harbor seals, and 100 decibels re 1 μPa for all other pinnipeds.

The significance of potential impacts of noise to marine mammals is dependent on a number of factors including the magnitude of sound pressure levels, species receiving the sound, exposure type (e.g., continuous vs. pulse), duration, site characteristics, species' auditory characteristics, and individual marine mammal characteristics (e.g., habituation, season, motivation) (Dazey et al. 2012, Ellison et al. 2012).

In-Water Noise

Some of the in-water sound source levels from pile driving and extraction in the proposed action are capable of injuring marine mammals at short distances (Table 2). These activities will generate noise loud enough to harm and harass WDPS Steller sea lions. Noise has the potential to disrupt essential behaviors, resulting in highly variable impacts on individuals, groups, or populations. Acoustic disturbance can harass marine mammals and cause them to alter their behavior and move away from preferred habitat (Baker and Herman 1989, Parks et al. 2007), potentially resulting in increased energy expenditure and elevated stress to individuals.

Table 2. Conservative estimates for underwater sound levels (decibels) generated during pile extraction and installation (adapted from the FHWA/DOT Biological Assessment).

Method, pile type	Sound Level (dB re 1 µPa)			Literature Source	
	Peak SPL	rms SPL	SEL	Author & Year	Page Number
Vibratory Hammer					
Timber pile extraction (12-inch)	164	152 (16 meters; 52.5 feet)	--	(Laughlin 2011)	1, 2
24-inch steel piles	190	162	170	(Laughlin 2005;2010b)	1, 2
18-inch steel piles	190	162	170	*Conservatively estimated to be the same as driving 24-inch piles.*	--
16-inch timber piles	190	162	170	*Conservatively estimated to be the same as driving 24-inch piles.*	--
Down-hole Drill					
24-inch steel piles	--	160 (3 meters; 9.8 feet)	--	(URS 2011)	9
Impact Hammer					
24-inch steel piles					
Without caps	212	189	181	(Laughlin 2005)	7.42
With Micarta caps	--	183	--	(Laughlin 2006)	1, 23

NOTE: Distance from the noise source is 10 meters (33 feet) unless otherwise specified. SEL = sound exposure level.

The FHWA/DOT BA and supplemental materials estimate a sound source level of 189 dB rms at 1 m or less for impact pile driving of 24-inch steel pilings for the proposed action. This estimate is based on measurements taken from a range of previous similar pile driving projects: Amorco wharf repair, peak sound = 190 dB rms at 1 m (ICF 2012); Tongue Point pier construction, peak sound = 189 dB rms at 10 m, average sound = 188 dB at 10 m (ICF 2012); Conoco-Phillips Rodeo, California dock repair, 189-188 dB rms at 10 m (ICF 2012); SR 520 Seattle test pile project, peak sound = 186 dB at 10 m, average sound = 165-183 dB at 10 m (ICF 2012); Geyserville Bridge, Russian River, California, 175 dB rms at 10 m (ICF 2012). Amorco wharf repair sound levels are thought to be higher than the proposed action because those pilings were driven into hard substrate, whereas the Kodiak Pier 1 pilings will be driven into a softer

substrate. FHWA/DOT assumes that the Tongue Point pier construction is the most analogous project to the proposed action due to similarities in salt-water content, water depths, surrounding bathymetry, and positioning with respect to open water bodies and surrounding land masses.

In addition to pile cushions regularly used by operators to protect against metal-on-metal impact damage to pile driving equipment, FHWA/DOT will require that Micarta pile caps be used to attenuate sound during impact pile driving for the proposed action. No direct measurements of sound reduction resulting from the use of Micarta caps on 24-inch steel pilings are found; therefore, FHWA/DOT extrapolated existing information on use of caps on 12-inch steel pilings (Laughlin 2006). The reported 7-8 dB reduction in sound level from the use of Micarta caps (Laughlin 2006) represents a 4-5% reduction. Similar proportion reductions from use of Micarta caps on 24-inch pilings, assuming an average 189 dB rms, would be an 8-9 dB reduction. However, FHWA/DOT conservatively estimated a 6 dB reduction, resulting in an estimated 183 dB sound source level for impact pile driving using Micarta pile caps for the proposed action.

FHWA/DOT estimate the source sound level for vibratory pile driving of 24-inch steel pilings in the proposed action will be 162 dB or less. This estimate was based primarily on measurements taken during vibratory pile driving of 24-inch steel pilings in Friday Harbor, Washington (Laughlin 2010b). In addition, measurements taken under similar conditions using a vibratory hammer to drive 24-inch steel pilings in Sacramento River (157 dB rms at 10 m, and 159 dB rms at 6 m) and the at the Trinidad Pier reconstruction in Humboldt Bay, California (typical rms = 160 dB rms at 10 m) were less than 162 dB (ICF 2012).

To determine the distances to in-water NMFS acoustic thresholds of concern (160 dB for pinnipeds and cetaceans for implusive sound [impact hammer]; 125 dB, or ambient sound in the action area, for pinnipeds and cetaceans for continuous sound [vibratory hammer]), FHWA/DOT used a transmission loss formula TL = xlog10 (R/10), where R is the distance from the source assuming the near-source levels are measured at 10 meters. NMFS typically recommends a default practical spreading loss of 15 dB per tenfold increase in distance. However, for this analysis for the proposed action, a TL of 17log10 (i.e., a 17 dB loss per tenfold increase in distance) was used for impact pile driving, and a TL of 18log10 was used for vibratory pile driving. These changes from the NMFS recommendation were based on measurements taken at previous pile driving projects ranging from 17log 10 to 29log 10 (ICF 2012). FHWA/DOT assumed that measurements taken during pile driving at the Bangor Trident Wharf (17log 10 for impact, 18log 10 for vibratory) (Illingworth & Rodkin 2013) were most similar to conditions of the proposed action, and used these same values in the spreading loss model. Based on the estimated transmission loss and the sound source levels described above, FHWA/DOT estimate a 225-meter 160 dB isopleth for impact pile driving, and a 1150-meter 125 dB isopleth for vibratory pile driving during the proposed action.

In-Air Noise

The proposed action includes direct pulling and possibly vibratory removal of 13-inch timber and 16-inch steel piles, vibratory driving and removal of temporary steel pipe or H-piles, vibratory driving and down-hole drilling to install permanent 24-inch hollow steel piles, and vibratory driving of 18-inch steel and 12- to 16-inch timber piles. Each 24-inch-diameter permanent pile will also be subject to a few blows from an impact hammer for proofing.

No in-air data are available for vibratory removal of piles, so it is conservatively assumed that vibratory removal of piles will produce the same source level as vibratory installation. Vibratory extraction of 13-inch timber and 16-inch steel piles will therefore be estimated to generate the same sound as installation of 18-inch steel piles as described below (87.5 dB rms at 15 meters [49 feet]; Table 3).

No unweighted in-air data are available for vibratory installation of steel H-piles; therefore, vibratory driving of the temporary steel pipe or H-piles will be conservatively estimated to generate the same sound as installation of 18-inch steel piles as described below (87.5 dB rms at 15 meters [49 feet]; Table 3). Similarly, no unweighted in-air data are available for vibratory installation of 24-inch steel piles; however, in-air measurements during vibratory installation of 30-inch steel piles averaged 96.5 dB rms at 15 meters (49 feet) (Laughlin 2010a). Vibratory installation of 24-inch steel piles will therefore be conservatively estimated to generate 96.5 dB rms at 15 meters (49 feet; Table 3).

In-air measurement during vibratory installation of an 18-inch steel pile was 87.5 dB rms at 15 meters (49 feet) (Laughlin 2010a). No unweighted in-air data are available for vibratory installation of 12-inch timber piles; therefore, vibratory installation of 12-inch timber piles will be conservatively estimated to generate the same sound as installation of 18-inch steel piles (Table 3).

No unweighted in-air data are available for down-hole drilling to secure 24-inch piles into bedrock. Sound will be substantially muted because the drill will be located within and below the pile shaft and drilling/hammering will begin at least 3 to 9 meters (10 to 30 feet) below the marine floor. In-air sound will be conservatively estimated to be the same as from impact hammering (98 dB rms at 15 meters [49 feet]; Table 3).

Unweighted in-air measurements during impact installation of 24-inch steel piles ranged from 97 to 98 dB rms at 15 meters (49 feet) (Magnoni et al. 2014). The source level for impact driving 24-inch steel piles is therefore assumed to be 98 dB rms at 15 meters (49 feet; Table 3). While these levels exceed the NMFS acoustic thresholds of concern for harbor seals (90 dB), they do not exceed the non-harbor seal pinniped thresholds (100 dB).

Table 3. Estimates for in-air sound levels (decibels) that will be generated during piling extraction and driving during the proposed action.

Method, pile type	Sound level dB rms
Vibratory Hammer	
Timber pile extraction	87.5
Steel pile extraction	87.5
Temporary steel pipe or H-piles	87.5
24-inch steel piles	96.5
18-inch steel piles	87.5
12-inch timber piles	87.5
Down-hole Drill	
24-inch steel piles	98
Impact Hammer	
24-inch steel piles	98

NOTE: Distance from the noise source is 15 meters (50 feet).

5.2.2 Turbidity/Sedimentation

During installation of piles, a temporary and localized increase in turbidity near the seafloor is possible in the immediate area surrounding each driven pile. Turbidity may also result from placement of rock armoring along the shoreline. Due to the general lack of high silt content in the sediments within the construction footprint, such turbidity is unlikely to measurably affect ESA-listed species, or their prey, in the action area.

There is potential that the project could result in degradation of water quality due to release of sediments during placement of rock armoring along the shoreline, and the potential discharge of sediment-laden stormwater from upland areas. However, little upland soil disturbance is anticipated with this activity. Actions specified in the Water Quality Control Plan and associated best management practices will limit sedimentation. Therefore, any water quality changes due to upland-related actions are likely to be minor and temporary.

5.2.3 Risk of Ship Strike and Disturbance from Tug and Barge Operations

Tug boats may be used in conjunction with barges to deliver materials to the Pier 1 project site. Tug boats will follow well-established, frequently utilized navigation lanes in Kodiak harbor.

Vessels transiting the marine environment have the potential to collide with, or strike, marine mammals (Laist et al. 2001, Jensen and Silber 2003). The probability of strike events depends on the frequency, speed, and route of the marine vessels, as well as distribution of marine mammals in the area. Although risk of ship strike has not been identified as a significant concern for Steller sea lions (Loughlin and York 2000), the Recovery Plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated (e.g., near rookeries or haulouts) (NMFS 2008). The California sea

lion, a similar species, has been observed with propeller strike injuries (Goldstein et al. 1999), indicating that individual Steller sea lions could be impacted as well.

Due to the common presence of commercial and recreational vessels in the action area and habituation of marine mammals to such heavy vessel traffic, the use of slow-moving tugs and barges associated with construction of the Pier 1 Project is not anticipated to adversely affect ESA-listed species.

When in operation, tugs may produce underwater sounds that exceed the continuous sound disturbance threshold for marine mammals (120 dB rms). Continuous sounds for tugs pulling barges have been reported to range from 145 to 182 dB rms re 1 μPa-m at 1 meter (3.3 feet) from the source (Richardson et al. 1995, Kipple and Gabriele 2004, URS 2007).

Though ESA-listed marine mammals might be exposed to noises that exceed the 120 dB rms disturbance criterion during use of tug boats and barges, it is unlikely that any individual will exhibit substantial behavioral modification that will harass that individual. Marine mammals are currently exposed to such sounds and continue to use the waters of Near Island Channel. This is particularly the case for Steller sea lions, which appear attracted to vessels as a food source. Given the transitory nature of tugs, any disturbance to a particular individual will be limited in space and time. The Kodiak harbor/port area, and the action area specifically, is frequently traversed by barges, tug boats, and commercial vessels and tenders, and navigation lanes are frequently subject to dredging, an activity that produces underwater noise. These ongoing uses and activities contribute to elevated background levels of noise in the action area. Such activities, which are commonly associated with the Pier 1 action area, add to the baseline, and influence ambient noise levels, masking sounds of project-related vessel use.

Based on the reported in-water noise levels for similar tug operations (145 to 160 dB rms) (URS 2007), tugs are not likely produce sounds that exceed 180 or 190 dB rms at 1 meter (3.3 feet) from the source during the proposed action. Therefore, they do not represent an acoustic injury concern for pinnipeds or cetaceans.

5.2.4 Risk of Spills/Pollutants

A Spill Prevention, Control, and Countermeasure Plan, Hazardous Material Control Plan, Water Quality Control Plan, and other best management practices will be implemented during construction to prevent contaminants from entering the water column. Plans will be in place and materials available for spill prevention and cleanup activities at the marine terminal to limit potential contamination. Construction will be conducted in accordance with the Clean Water Act Section 404 permit previously obtained for the Pier 1 Project, to minimize potential construction-related impacts on water quality.

5.2.5 Interrelated/Interdependent Effects

An interdependent activity is one that has no independent utility apart from the proposed action (50 CFR §402.02). An interrelated activity is one that is part of a larger action and depends on the larger action for its justification (50 CFR §402.02); the proposed action itself can be part of a larger action. While DOT is currently developing a design study report to replace the existing M/V *Tustumena* ferry vessel, the proposed replacement of the existing timber pile dock will occur independent of the ferry replacement. For this reason, the Pier 1 Project is neither interdependent nor interrelated to the ferry replacement.

An existing fuel header on the Pier 1 dock currently accommodates barge deliveries of fuel to Petro Marine's tanks in the uplands. Petro Marine plans to build a header at a new facility adjacent to the Pier 1 site to receive fuel, which will result in abandonment of the existing Pier 1 header. While future construction of a new Petro Marine facility is neither interdependent nor interrelated to the proposed action, if construction of the new facility does not occur prior to the Pier 1 Project, DOT will construct a temporary Petro Marine fuel header to allow for continued fuel delivery during the Pier 1 Project. The temporary header will likely be constructed on land, in the parking area to the north of the dock. No in-water construction will occur associated with this action, and all construction will take place in uplands that are currently developed. With implementation of spill control and containment measures, and best management practices to prevent sedimentation from entering waters of Kodiak harbor/port, no impact to WDPS Steller sea lions is anticipated due to this activity.

No other interrelated or interdependent actions have been identified as associated with the proposed action.

5.3 POTENTIAL EXPOSURE OF WDPS STELLER SEA LIONS

Exposure analyses have three purposes in consultations. First, we conduct exposure analyses to identify the physical, chemical, and biotic phenomena produced by an action. Second, we conduct these analyses to estimate the spatial and temporal distribution of those phenomena in the environment. Third, we conduct exposure analyses to estimate any overlap between the stressors and threatened and endangered species and designated critical habitat in space and time. To fulfill the purposes of this last part of these analyses, we try to identify the number, age, gender, and condition of the individuals that are likely to be exposed, the populations those individuals represent, the duration of any exposure, the frequency of that exposure, and exposure concentrations.

While WDPS Steller sea lions continue to experience declines in the western portion of their range, they are relatively common in Kodiak Harbor and the action area. The proposed action will overlap in time and space with this species, and WDPS Steller sea lions will be exposed to stressors as a result of the action, primarily acoustic stressors exceeding the NMFS acoustic thresholds of concern.

5.3.1 Exposure to Acoustic Disturbance/Noise from Pile Driving and Removal

Pile driving and removal during the proposed action will generate sound levels exceeding the NMFS acoustic thresholds of concern for pinnipeds. The zone of influence where we expect WDPS Steller sea lions to be exposed to sound levels above the NMFS thresholds and background levels is 225 meters from the action for impulse noises (e.g., impact driver use), and 1150 m from the action for continuous noises (e.g., vibratory hammer use for pile driving and removal). These zones were calculated using the expected sound levels from the operations, expected sound transmission loss (as described in section 5.2.1 above) and mitigation measure considerations, such as the use of Micarta pile caps (discussed in more detail in the *Proposed Mitigation Measures* section 2.2.1 above).

As detailed in the *Status of Listed Species* section above, an estimated 40 Steller sea lions will enter the project area each day during pile driving and removing operations. Based on this, and the number of days that pile driving and removal is scheduled to occur, FHWA/DOT estimates that 3,200 exposures of WDPS Steller sea lions to noise levels exceeding the NMFS Level B acoustic thresholds of concern will occur during vibratory and impact pile driving and removal operations (Table 4).

Table 4. Estimated number of exposures of Steller sea lions to noise from the pile driving and removal during the proposed action exceeding the NMFS acoustic thresholds of concern.

	Vibratory and Impact Level B (potential disturbance)	**Down-hole Drill Level B (potential disturbance)**	**Impact Hammer Level A (potential injury)**
Number of Days	80	60	22
Number of Steller Sea Lion Exposures	3,200	60	30

Source: HDR 2015 (FHWA and DOT 2015)

The expected take from exposure to noise from down-hole drilling is expected to be very low because of the low noise levels produced by this type of pile installation, and the 3-meter (10-foot) distance to the Level B isopleth. Potential exposure at the Level B harassment threshold for down-hole drilling is estimated at 60 Steller sea lions, one for every day of the activity (Table 4).

The attraction of sea lions to the nearby seafood processing plant increases the possibility of individual sea lions occasionally entering the Level A harassment zone (190 dB or greater for Steller sea lions) before they are observed and before impact pile driving can be shut down. Although a protected species observer will be present at all times during pile installation, it is possible that sea lions could approach quickly and enter the Level A harassment zone before the pile-driving activity is shut down. This likelihood is increased by the high level of sea lion activity in the area, with sea lions following vessels and swimming around vessels at the neighboring dock. It is assumed that a single sea lion could be taken each day that impact pile driving occurs. Therefore, in the incidental harassment authorizations application for the Pier 1

Project, DOT requested 22 Level A takes plus an approximate 30 percent contingency of 8 additional takes, for a total of 30 takes for Level A harassment (Table 4). The potential for Level A harassment is predicted only for impact pile driving operations.

5.3.2 Exposure to Other Potential Stressors

Take of WDPS Steller sea lions is not expected to occur from other potential stressors related to the proposed action. Turbidity and sedimentation from the proposed action will likely be small and temporary in nature, and will not likely directly or indirectly impact sea lions, their prey, or their habitat. In addition, risk of spills and pollutants will be mitigated by implementing plans and processes established to provide best management practices and policies to prevent accidental spills. No discharges into marine waters are authorized for the proposed action.

WDPS Steller sea lions will be exposed to the presence of some additional marine vessel traffic as a part of the proposed action. However, sea lions in the action area are fairly habituated to ship traffic, and the vessels operating as part of the proposed action will be moving at slow speeds. Take of WDPS Steller sea lions by vessel operations is not expected and authorization for such takes has not been requested by the FHWA.

An interrelated or interdependent action associated with the proposed action is a temporary Petro Marine fuel header will be constructed on land (described in more detail in the *Potential Effects* section above). This project would entail upland construction, which is not expected to affect Steller sea lions or their habitat. The project could increase the risk of oil spills and pollutants, but this risk would be mitigated by following best management practices and other processes described in planning documents. This project is not expected to result in any exposures to WDPS Steller sea lions.

5.4 Response to the Effects of the Proposed Action

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. Potential responses are described above in the *Potential Effects of the Proposed Action* section. 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.

5.4.1 Responses of WDPS Steller Sea Lions to Pile Driving and Removal

As described in the *Potential Effects of the Proposed Action* section above, WDPS Steller sea lions are susceptible to harm and harassment/disturbance from in-water noise associated with pile driving and removal during the proposed action.

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak and Schusterman 1999, Schlundt et al. 2000, Finneran et al. 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall et al. 2007). Marine mammals depend on acoustic cues for vital biological functions, (e.g., orientation, communication, finding prey, avoiding predators); thus, TTS may result in reduced fitness in survival and reproduction. However, this depends on the frequency and duration of TTS, as well as the biological context in which it occurs. TTS of limited duration, occurring in a frequency range that does not coincide with that used for recognition of important acoustic cues, would have little to no effect on an animal's fitness. Repeated sound exposure that leads to TTS could cause PTS. PTS constitutes injury, but TTS does not (Southall et al. 2007).

TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter et al. 1965). While experiencing TTS, the hearing threshold rises, and a sound must be stronger in order to be heard. In terrestrial mammals, TTS can last from minutes or hours to days (in cases of strong TTS). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the sound ends (Southall et al. 2007). Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, while in other cases the animal has an impaired ability to hear sounds in specific frequency ranges. This permanent change following intense noise exposure results from damage or death of inner or outer cochlear hair cells (Southall et al. 2007). It is often followed by retrograde neuronal losses and persistent chemical and metabolic cochlear abnormalities (Saunders et al. 1991, Ward 2007). There is no specific evidence that exposure to pulses of sound can cause PTS in any marine mammal. However, given the possibility that mammals close to a sound source can incur TTS, it is possible that some individuals might incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS. California sea lions experienced TTS-onset from underwater non-pulsed sound at 174 dB re 1 µpa (Kastak et al. 2005), but also did not show TTS-onset from pulsed sound at 183 dB re 1 µpa (Finneran et al. 2003). It is not clear exactly when Steller sea lions may experience TTS and PTS, but sound levels greater than 190 dB have been identified as the NMFS threshold of concern for harm/injury to the species.

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox et al. 2006, Southall et al. 2007). Studies examining such effects are limited. In general, little is known about the potential

for pile driving to cause auditory impairment or other physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would presumably be limited to short distances from the sound source and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall et al. 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways

Up to 30 unique WDPS Steller sea lions may be exposed to sound levels 190 decibels or greater during the proposed action. Ramp up procedures will be followed for impact pile driving operations, giving sea lions the opportunity to avoid approaching areas with sound levels exceeding 190 decibels. However, if sea lions do approach within 4 meters of impact pile driving activities, we expect some level of harm will occur to the animals' hearing organs, leading to reduced individual fitness. This level of harm is not expected to result in immediate mortality, but may affect the ability of individuals to forage and communicate effectively.

5.4.2 Responses of WDPS Steller Sea Lions to Other Potential Stressors

WDPS Steller sea lions in the action area are not expected to demonstrate any response to turbidity and sedimentation resulting from the proposed action. The likelihood of an oil or pollution spill from the proposed action or interrelated/interdependent actions is insignificant based on best management practices and spill avoidance procedures, therefore WDPS Steller sea lion response is not expected.

WDPS Steller sea lions may respond to marine vessels operating in the action area as a part of proposed action area by changing direction while swimming to avoid contact with the vessel, detected either audibly or visually. These responses are not expected to significantly affect individual fitness.

5.5 CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as: "those effects of future State or private activities not involving federal activities that are reasonably certain to occur within the action area of the federal action subject to consultation." Reasonably foreseeable future activities and their related effects to WDPS Steller sea lions in the action area would presumably involve activities within and immediately adjacent to Kodiak harbor/port. Any projects involving the placement of fill, dredging, or structures in the harbor would be subject to federal authorization from the USACE. Such authorizations would require consultation under the ESA on their effects to the listed species, and are therefore not addressed here as cumulative impacts.

DOT has identified several private projects that are reasonably certain to occur in the action area, including construction of a new Petro Marine facility (in uplands), along the adjacent waterfront. In addition, the Kodiak Waterfront Master Plan (29 July 2010) identifies the need for upgrades of various piers and harbors. To date, the chronic noise of the Kodiak port apparently has not

prevented Steller sea lions from using this area, as indicated by the frequent use of the St. Herman's Harbor float. Significant increases in the baseline activity and noise levels are not predicted within the action area in the foreseeable future.

Commercial fishing operations in the action area will continue to provide a food source for Steller sea lions for the foreseeable future. These operations will continue to contribute to apparent habituation of Steller sea lions to food sources aboard fishing vessels, and the associated underwater noise and marine vessel traffic of commercial fishing boats. Fisheries may also result in direct mortality or injury to Steller sea lions or competition for prey. Such effects would occur outside the action area but within the range of the WDPS, and have been evaluated in other section 7 consultations.

Climate change is another factor that may affect WDPS Steller sea lions near Kodiak. This is described in more detailed in the *Environmental Baseline* section above.

5.6 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step of NMFS's assessment of the risk posed to the species as a result of implementing the proposed action. In this section, we add the effects of the action to the environmental baseline and the cumulative effects 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 survival of the species in the wild by reducing its numbers, reproduction, or distribution; (2) result in appreciable reductions in the likelihood of recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (3) 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 current status of the species.

As discussed in the *Approach to the Assessment* section of this Biological Opinion, we begin our risk analyses by asking whether the probable physical, physiological, behavioral, or social responses of endangered or threatened species are likely to reduce the fitness of endangered or threatened individuals or the growth, annual survival or reproductive success, or lifetime reproductive success of those individuals. If we would not expect listed species exposed to an action's effects to experience reductions in the current or future survivability or reproductive success (e.g., fitness), we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise. Therefore, if we conclude that listed species are not likely to experience reductions in fitness, we would conclude our assessment because we would not expect the effects of the action to affect the performance of the populations those individuals represent or the species those populations comprise. If, however, we conclude that listed species are likely to experience reductions in their fitness as a result of their exposure to an action, we then determine whether those reductions would reduce the viability of the population or populations the individuals represent and the

species those populations comprise.

As part of our risk analyses, we consider the consequences of exposing endangered or threatened species to the stressors associated with the proposed actions, individually and cumulatively, given that the individuals in the action areas for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range. These stressors or the response of individual animals to those stressors can produce consequences — or "cumulative impacts"— that would not occur if animals were only exposed to a single stressor.

5.6.1 Steller Sea Lion Risk Analysis

The exposure and response analyses above lead us to conclude that endangered WDPS Steller sea lion individuals are likely to be exposed to noise levels exceeding the Level A and Level B NMFS acoustic thresholds of concern and will likely be harmed and harassed by the pile driving components of the proposed action. However, individuals are not likely to be killed or experience significant reduction in their current or expected future reproductive success as a result of that exposure.

We anticipate that up to 3,260 exposures of WDPS Steller sea lions to Level B sounds (e.g., 160-189 dB due to impact pile driving, and 125-189 dB due to vibratory pile driving) will occur as a part of the proposed action (Table 4). In addition, up to 30 WDPS Steller sea lions could be exposed to sound levels in exceedance of 190 dB (Table 4), which we conservatively assume will lead to injury (TTS or PTS). However, many of the Level B sound exposures are likely to be repeated exposures to the same individuals from the relatively small local population of about 40 habituated animals that use the Dog Bay Float in Herman Harbor.

Steller sea lions in the action are likely frequently exposed to Level B sounds from continuous noise sources, such as marine vessel traffic. They continue to return to the area to haul out and seek food from fishing vessels and processing facilities. Level B sounds from the proposed action are not expected to have a long term impact on individual WDPS Steller sea lions, or any population level effect.

Level A sounds may affect the individual fitness of up to 30 WDPS Steller sea lions as a result of the proposed action by causing short- or long term hearing damage. It is possible that some of these individuals would recover their hearing over time. It is also possible that individual sea lions with hearing damage may stay in the Kodiak Harbor region in order to access easy sources of food if they are unable to successfully forage, communicate, or detect predators in more natural situations. While this may be a significant impact to 30 individuals, it is not significant on a population level. The most recent estimate of abundance of the WDPS Steller sea lion is 52,209 (Allen and Angliss 2014). Thirty individuals represents approximately 0.06% of the total estimated population of this endangered DPS. Therefore, these exposures are not likely to reduce the abundance, reproduction rates, and growth rates (or increase variance in one or more of these

rates) of the populations those individuals represent. As a result, this project is not likely to appreciably reduce Steller sea lions' likelihood of surviving or recovering in the wild.

6.0 CONCLUSION

This Biological Opinion has considered the direct, indirect, and cumulative effects of this action on WDPS Steller sea lions. The proposed action is expected to result in direct and indirect impacts. We estimate 3260 WDPS Steller sea lions takes will occur due to Level B sounds (harassment) and 30 will be taken due to Level A sounds (injury) during the term of the MMPA authorization (i.e., construction period). This injury and harassment is not likely to result in death of any Steller sea lions.

After reviewing the current status of the WDPS Steller sea lion, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the endangered western Steller sea lion DPS.

7.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without 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. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to the 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. ESA section 7(b)(4) regulations at 50 CFR 402.14 (i)(1) provide that where NMFS concludes that an action (or any offered reasonable and prudent alternative) and the resultant incidental take of listed species will not violate section 7(a)(2), NMFS will provide with the Biological Opinion a statement concerning incidental take.

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 statement is inoperative.

The terms and conditions described below are nondiscretionary. FHWA and NMFS OPR have a continuing duty to regulate the activities covered by this Incidental Take Statement. In order to monitor the impact of incidental take, FHWA and NMFS OPR must monitor the progress of the action and its impact on the species as specified in the Incidental Take Statement (50 CFR 402.14(i)(3)). If FHWA and NMFS OPR fail to require their grantees or permittees to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, and/or fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

7.1 AMOUNT OR EXTENT OF TAKE

The ESA section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions, or the extent of land or marine area that may be affected by an action, if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14 (i); see also 51 FR 19926, 19953-54 (June 3, 1986)).

We used the best scientific and commercial information available to determine whether and how listed individuals in the exposed populations might respond given their exposure to the proposed action. To estimate the number of animals that might be taken in this opinion, we classified the suite of responses as one or more forms of take and estimated the number of animals that might be taken by (1) reviewing the best scientific and commercial information available to determine

the likely suite of responses given exposure of listed marine mammals to the proposed action at various received levels; (2) classifying particular responses as one or more form of take (as that term is defined by the ESA and implementing regulations that further define "harass"); and (3) adding the number of exposure events that could produce responses that we would consider take.

NMFS anticipates that 3260 WDPS Steller sea lions will be taken by harassment level sounds (Level B) generated by the proposed action (3,200 during vibratory and impact pile driving, and 60 during down-hole drilling operations) (Table 5). In addition, NMFS anticipates that 30 WDPS Steller sea lions will be taken by injurious level sounds (Level A) generated by the proposed action (Table 5).

Table 5. Estimated number of takes of WDPS Steller sea lions incidental to activities described within the proposed action.

	Vibratory and Impact Level B (harassment)	**Down-hole Drill Level B (harassment)**	**Impact Hammer Level A (potential injury)**
Number of Steller Sea Lion Takes	3,200	60	30

If any of these expected take values are exceeded, reinitiation of a section 7 consultation of the Kodiak Ferry Terminal and Dock Improvements Project will be immediately triggered.

7.2 REASONABLE AND PRUDENT MEASURES

"Reasonable and prudent measures" (RPMs) are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

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 WDPS Steller sea lions resulting from the proposed action.

1. This ITS is valid only for the activities described in this biological opinion, and which have been authorized under section 101(a)(5) of the MMPA.

2. The taking of Steller sea lions shall be by incidental harassment only. The taking by death is prohibited and may result in the modification, suspension or revocation of the ITS.

3. FHWA and OPR shall implement a monitoring program that allows NMFS AKR to evaluate the exposure estimates contained in this biological opinion and that underlie this incidental take statement.

4. FHWA and OPR shall submit a report to NMFS AKR that evaluates the mitigation measures and the results of the monitoring program.

7.2.1 Terms and Conditions

"Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). 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, FHWA and NMFS OPR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above, the mitigation measures described as part of this action, and reporting/monitoring requirements.

Partial compliance with these terms and conditions may result in more take than anticipated, and 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, FHWA, NMFS OPR, or their grant recipient / authorization holder must undertake the following:

1. FHWA and NMFS OPR 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, FHWA, NMFS OPR, or their grant recipient / authorization holder must undertake the following:

1. 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.

2. In the event that the proposed action causes a take of a marine mammal that results in a mortality (e.g. ship-strike or other stranding), 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, Sadie.Wright@noaa.gov, the Alaska Regional Stranding Coordinator at (907) 586-7248 (Aleria.Jensen@noaa.gov), and NMFS OPR (robert.pauline@noaa.gov).

To carry out RPM #3, FHWA, NMFS OPR, or their grant recipient / authorization holder must undertake the following:

1. The disturbance and shut down zones must be fully observed during daylight hours, in order to document observed incidental take.

To carry out RPM #4, FHWA, NMFS OPR, or their grant recipient / authorization holder must undertake the following:

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

B. Submit a project specific report that analyzes and summarizes marine mammal interactions during this project to the Protected Resources Division, NMFS by email to Sadie.Wright@noaa.gov. This report will be submitted by June 2016. This report must contain the following information:

- Dates, times, species, number, location, and behavior of any observed ESA-listed marine mammals;

- Number of power-downs and shut-downs throughout all monitoring activities;

- An estimate of the instances of exposure (by species) of Steller sea lions that (A) are known to have been exposed to noise from pile driving with a discussion of any specific behaviors those individuals exhibited, and (B) may have been exposed to noise from pile driving, with a discussion of the nature of the probable consequences of that exposure on the individuals that were or may have been exposed;

- The report should clearly compare the number of takes (i.e., instances of exposure) authorized in the ITS with those observed during project operations;

- A description of the implementation and effectiveness of each Term and Condition, as well as any conservation recommendations, for minimizing the adverse effects of the action on ESA-listed marine mammals.

8.0 CONSERVATION RECOMMENDATIONS

In addition to section 7(a)(2), which requires agencies to ensure that proposed projects will not jeopardize the continued existence of listed species, section 7(a)(1) of the ESA places a responsibility on all federal agencies to use their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of endangered species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat. The following conservation measures are recommended:

1. Sound source verification of various noise-producing components of the proposed action should be conducted to better inform similar future consultations. Accurately assessing the sound levels will better enable NMFS to understand the impacts to Steller sea lions when measurements are compared to observed behaviors.

2. NMFS OPR should coordinate a national effort to develop a handbook of known/measured sound levels from pile driving and related activities to enable consistent and succinct analyses of potential exposures from this category of activity.

NMFS AKR requests notification of the action agencies' decisions regarding implementation of these conservation recommendations.

9.0 REINITIATION NOTICE

This concludes formal consultation on the Kodiak Ferry Terminal and Dock Improvements Project as described in the FHWA/DOT Biological Assessment. As provided in 50 CFR 402.16, reinitiation of formal 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 anticipated incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or designated critical habitat in a manner or to an extent not considered in this Biological Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or designated 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 or extent of incidental take is exceeded, the action agency must immediately reinitiate consultation.

10.0 REFERENCES

Allen, B. M., and R. P. Angliss. 2014. Alaska marine mammal stock assessments, 2013. U.S. Department of Commerce, NOAA Technical Memo. NMFS-AFSC-277:294.

Anderson, J. J. 2000. A vitality-based model relating stressors and environmental properties to organism survival. Ecological monographs 70:445-470.

Baker, C. S., and L. M. Herman. 1989. Behavioral responses of summering humpback whales to vessel traffic: experiments and opportunistic observations, U.S. National Park Service, Alaska Regional Office, Anchorage, AK. 50pp.

Blackwell, S. B., and C. R. Greene. 2002. Acoustic measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Sciences, Inc.

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

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

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

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

Cox, T. M., T. J. Ragen, A. J. Read, E. Vos, R. W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. W. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernandez, J. J. FInneran, R. Gentry, W. Gerth, F. Gulland, J. A. Hildebrand, D. S. Houser, T. Hullar, P. D. Jepson, D. Ketten, C. D. MacLeod, P. Miller, S. Moore, D. C. Mountain, D. Palka, P. J. Ponganis, S. A. Rommel, T. Rowles, B. L. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. G. Mead, and L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. Journal of Cetacean Research and Management 7:177-187.

Dazey, E., B. McIntosh, S. Brown, and K. M. Dudzinski. 2012. Assessment of underwater anthropogenic noise associated with construction activities in Bechers Bay, Santa Rosa Island, California. Journal of Environmental Protection 3:1286-1294.

DeMaster, D. P. 2011. Results of Steller sea lion surveys in Alaska, June - July 2011. Memorandum to J. Balsiger, K. Brix, L. Rotterman, and D. Seagars, December 5, 2011. Available AFSC, National Marine Mammal Laboratory, NOAA, NMFS 7600 Sand Point Way NE, Seattle WA 98115.

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

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

FHWA, and DOT. 2015. Revised Endangered Species Act Section 7 Biological Assessment for listed species and critical habitats under the jurisdiction of the National Marine Fisheries Service: Kodiak Ferry Terminal and Dock Improvements Project. State Project #68938. Federal Highways Administration Alaska Division, 709 West 9th Street, Room 851, Juneau, AK 99802. 89 pp.

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

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

Gaichas, S. K., K. Y. Aydin, and R. C. Francis. 2011. What drives dynamics in the Gulf of Alaska? Integrating hypotheses of species, fishing, and climate relationships using ecosystem modeling. Canadian Journal of Fisheries and Aquatic Sciences 68:1553-1578.

Gisiner, R. C. 1985. Male territorial and reproductive behavior in the Steller sea lion, *Eumetopias jubatus*. Ph. D. thesis, University of California, Santa Cruz.

Goldstein, T., S. Johnson, A. Phillips, K. Hanni, D. Fauquier, and F. Gulland. 1999. Human-related injuries observed in live stranded pinnipeds along the central California coast 1986-1998. Aquatic Mammals 25:43-51.

Hollowed, A. B., M. Barange, R. J. Beamish, K. Brander, K. Cochrane, K. Drinkwater, M. G. G. Foreman, J. A. Hare, J. Holt, S.-i. Ito, S. Kim, J. R. King, H. Loeng, B. R. MacKenzie, F. J. Mueter, T. A. Okey, M. A. Peck, V. I. Radchenko, J. C. Rice, M. J. Schirripa, A. Yatsu, and Y. Yamanaka. 2013. Projected impacts of climate change on marine fish and fisheries. ICES Journal of Marine Science: Journal du Conseil 70:1023-1037.

Horowitz, C., and M. Jasny. 2007. Precautionary management of noise: lessons from the US Marine Mammal Protection Act. Journal of International Wildlife law and Policy 10:225-232.

ICF, Jones & Stokes. 2012. Update to Appendix I-compendium of pile driving sound data, in 2009 final technical guidance for assessement and mitigation of the hydroacoustic effects of pile driving on fish. Prepared for California Department of Transportation, Sacramento, CA.

Illingworth & Rodkin, Inc. 2013. Naval base Kitsap at Bangor Trident support facilities explosive handling wharf (EHW-2) project: Acoustic monitoring report. Prepared for the Navy Strategic Systems Programs. Bangor, WA. 165 pp.

IPCC. 2013. Summary for policymakers. In: Climate change 2013: The physical science basis. Cambridge University Press.

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

Jensen, A. S., and G. K. Silber. 2003. Large whale ship strike database. NOAA Technical Memorandum NMFS-OPR:39.

Kastak, D., B. L. Southall, R. J. Schusterman, and C. R. Kastak. 2005. Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration. Journal of the Acoustical Society of America 118:3154-3163.

Kastak, D. A., and R. J. Schusterman. 1999. In-air and underwater hearing sensitivity of a northern elephant seal (*Mirounga angustirostris*). Canadian Journal of Zoology 77:1751-1758.

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

Keeling, R. F., A. Körtzinger, and N. Gruber. 2010. Ocean deoxygenation in a warming world. Annual Review of Marine Science 2:199-229.

Kenyon, K. W., and D. W. Rice. 1961. Abundance and distribution of the Steller sea lion. Journal of Mammalogy 42:223-234.

Kipple, B. M., and C. M. Gabriele. Underwater noise from skiffs to ships. Proceedings of Glacier Bay Science Symposium. pp 172-175. 2004.

Kryter, K. D., W. D. Ward, J. D. Miller, and D. H. Eldredge. 1965. Hazardous exposure to intermittent and steady-state noise. Journal of the Acoustical Society of America 39:451-464.

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

Laughlin, J. 2005. Underwater sound levels associated with pile driving at the Bainbridge Island ferry terminal preservation project. Washington State Department of Transportation Office of Air Quality and Noise, 15700 Dayton Avenue North, P.O. Box 330310, Seattle, WA 98133. 48 pp.

_____. 2006. Underwater sound levels associated with pile driving at the Cape Disappointment boat launch facility, wave barrier project. Washington State Department of Transportation:45.

_____. 2010a. Airborne noise measurements (A-weighted and un-weighted) during vibratory pile installation - Technical Memorandum to Sharon Rainsberry on June 21, 2010. Washington State Department of Transportation. 10 pp.

_____. 2010b. Revised Friday Harbor vibratory pile monitoring technical memorandum to John Callahan and Rick Huey on March 15, 2010. Washington State Department of Transportation. 3 pp.

_____. 2011. Port Townsend dolphin timber pile removal – vibratory pile monitoring technical memorandum to Rick Huey, January 3, 2011. Washington State Department of Transportation. 5 pp.

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

Loughlin, T. R., and A. E. York. 2000. An accounting of the sources of Steller sea lion, *Eumetopias jubatus*, mortality. Marine Fisheries Review 62:40-45.

Magnoni, L. J., M. L. M. Escude, J. Laughlin, and M. Walker. 2014. SR 20 Port Townsend ferry terminal, Slip 1 Transfer Span piles underwater sound levels. Washington State Department of Transportation, Office of Air Quality and Noise, 15700 Dayton Avenue North, P.O. Box 330310, Seattle, WA 98133-9710. 82 pp.

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

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

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

NMFS. 2008. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD:325.

_____. 2012. (Draft) Status review of the eastern distinct population segment of Steller sea lion (*Eumetopias jubatus*). NMFS Protected Resources Division, Alaska Region. 709 West 9th St., Juneau, AK 99802. 106 pp.

_____. 2013. Occurrence of western distinct population segment Steller sea lions East of 144° W. longitude. NOAA, National Marine Fisheries Service, Alaska Region, Juneau, AK. 3 pp.

NOAA. 2013. National Oceanic and Atmospheric Administration DRAFT guidance for assessing the effects of anthropogenic sound on marine mammals: acoustic threshold levels for onset of permanent and temporary threshold shifts. Silver Spring, Maryland. pp 83.

NRC. 2003. Ocean Noise and Marine Mammals. The National Acadamies Press, Washington, D.C.

_____. 2012. Climate change: evidence, impacts, and choices. Answers to common questions about the science of climate change. National Academy of Sciences. 40 p.

_____. 2013. An Ecosystem Services Approach to Assessing the Impacts of the *Deepwater Horizon* Oil Spill in the Gulf of Mexico. Committee on the effects of *Deepwater Horizon* Mississippi Canyon-252 oil spill on ecosystem services in the Gulf of Mexico, Ocean Studies Board, National Research Council of the National Academies Press, Washington, D.C. National Academies Press.

Overland, J. E., and M. Wang. 2007. Future climate of the North Pacific Ocean. Eos, Transactions American Geophysical Union 88:178-182.

Parks, S. E., C. Clark, and P. Tyack. 2007. Short-and long-term changes in right whale calling behavior: the potential effects of noise on acoustic communication. The Journal of the Acoustical Society of America 122:3725.

Pitcher, K. W. 1981. Prey of the Steller sea lion, *Eumetopias jubatus*, in the Gulf of Alaska. Fishery Bulletin 79:467-472.

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

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

Pitcher, K. W., P. F. Olesiuk, R. F. Brown, M. S. Lowry, S. J. Jeffries, J. L. Sease, W. L. Perryman, C. E. Stinchcomb, and L. F. Lowry. 2007. Abundance and distribution of the eastern North Pacific Steller sea lion (*Eumetopias jubatus*) population. Fishery Bulletin 105:102-115.

PND. 2015. Kodiak Pier 3 hydroacoustic monitoring report. Written by PND Engineers, Inc. for the Alaska Department of Fish and Game. 1506 W 36th Ave. Anchorage, Alaska 99503. 41 pp.

Raum-Suryan, K. L., K. W. Pitcher, D. G. Calkins, J. L. Sease, and T. R. Loughlin. 2002. Dispersal, rookery fidelity, and metapopulation structure of steller sea lions (*Eumetopias jubatus*) in an increasing and a decreasing population in Alaska. Marine Mammal Science 18:746-764.

Rehberg, M., R. Andrews, U. Swain, and D. Calkins. 2009. Foraging behavior of adult female Steller sea lions during the breeding season in Southeast Alaska. Marine Mammal Science 25:588-604.

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

Salinger, M. J., J. D. Bell, K. Evans, A. J. Hobday, V. Allain, K. Brander, P. Dexter, D. E. Harrison, A. B. Hollowed, B. Lee, and R. Stefanski. 2013. Climate and oceanic fisheries: recent observations and projections and future needs. Climatic Change 119:213-221.

Sandegren, F. E. 1970. Breeding and maternal behavior of the Steller sea lion (*Eumetopias jubata*) in Alaska. Unpublished MSc thesis. University of Alaska. 138 pp.

Saunders, J. C., Y. E. Cohen, and Y. M. Szymko. 1991. The structural and functional consequences of acoustic injury in the cochlea and peripheral auditory system: a five year update. The Journal of the Acoustical Society of America 90:136-146.

Schlundt, C. E., J. J. Finneran, D. A. Carder, and S. H. Ridgway. 2000. Temporary shift in masked hearing thresholds of bottlenose dolphins, *Tursiops truncatus*, and white whales, *Delphinapterus leucas*, after exposure to intense tones. Journal of the Acoustical Society of America 107:3496-3508.

Sheffield, G., and L. A. Jemison. 2010. Steller sea lions near Gambell, Alaska November-December 2010. Report to Sivuqaq Native Corporation and Gambell IRA. Alaska Department of Fish and Game, Nome, AK. 19 pp.

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

Spalding, D. J. 1964. Comparative feeding habits of the fur seal, sea lion, and harbour seal on the British Columbia coast. Fisheries Research Board of Canada.

Stearns, S. C. 1992. The evolution of life histories. Volume 248.Oxford University Press Oxford.

URS, Australia Pty Ltd. 2011. Ichthys gas field development project: potential effects of underwater blasting, pile driving and dredging on sensitive marine fauna in Darwin Harbor. INPEX Document No. C036-AH-REP-0115.

URS, Corp. 2007. Port of Anchorage marine terminal development project underwater noise survey test pile driving program. Prepared by Integrated Concepts & Research Corporation.

Ward, W. D. 2007. Effects of high-intensity sound. Pages 1497-1507 *in* Encyclopedia of Acoustics. John Wiley & Sons, Inc.

Wynne, K., D. Hicks, and N. Munro. 1992. 1991 marine mammal observer program for the salmon driftnet fishery of Prince William Sound Alaska. Final Annual Report. NMFS/NOAA contract 50ABNF000036. 53 pp. NMFS, Alaska Region, Juneau, AK.

Wynne, K. M., R. J. Foy, and L. Buck. 2011. Standardized comprehensive report: Gulf Apex Predator-prey Study (GAP): FY2004-06. NOAA Federal Program. 85pp. http://seagrant.uaf.edu/map/gap/reports/GAP-04-06_Final.pdf.