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

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion for Furie's Offshore Oil and Gas Exploration Drilling in the Kitchen Lights Unit of Cook Inlet, Alaska, 2017-2021

NMFS Consultation Number: AKR-2016-9600

Action Agency: U.S. Army Corps of Engineers (Corps), Alaska District

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species	Is the Action Likely to Adversely Affect Critical Habitat	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered	Yes	No	No	No
Fin Whale (*Balaenoptera physalus*)	Endangered	Yes	N/A	No	N/A
Humpback Whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	No	N/A	No	N/A
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	Yes	N/A	No	N/A
Steller Sea Lion, Western DPS (*Eumatopias jubatus)*	Endangered	Yes	No	No	No

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

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

Date: May 31, 2017

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TERMS AND ABBREVIATIONS

ºC	degrees Celsius
%DPH	(DPH*100)/AEH
ADEC	Alaska Department of Environmental Conservation ADF&G
AEH	acoustic effort hours
AFSC	Alaska Fisheries Science Center
AOGCC	Alaska Oil and Gas Conservation Commission Apache
APDES	Alaska Pollutant Discharge Elimination System ASRC
BA	biological assessment
BE	biological evaluation
BCP	blowout contingency plan BlueCrest
BMP	best management practices
CFR	U.S. Code of Federal Regulations
CISPRI	Cook Inlet Spill Prevention & Response, Inc.
DA	Department of the Army
dB	decibel
DPH	detection positive hour
DPS	distinct population segment
ESA	Endangered Species Act Escopeta
Furie	Furie Operating Alaska LLC
GIS	geographic information systems
GOA	Gulf of Alaska
HFC	high-frequency cetaceans
Hz	hertz
IHA	incidental harassment authorization Jacobs
KABATA	Knik Arm Bridge and Toll Authority kHz
KLU	Kitchen Lights Unit
km	kilometer
km2	square kilometer
lbs-ft	pound-feet
LFC	low-frequency cetaceans
logR	logarithm of the radius
MASP	maximum anticipated surface pressure MFC
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act m/s
MTTS	masked temporary threshold shift NAD
NMFS	National Marine Fisheries Service NMML
ODPCP	Oil Discharge Prevention and Contingency Plan OMSI
OPW	otariid pinnipeds in water
OSK	Offshore Systems Kenai

OSV	offshore supply vessel
PBF	principal biological features
PK	peak sound pressure
POA	Port of Anchorage
PPW	phocid pinnipeds in water
psi	pounds per square inch
re 1 μPa	referenced to 1 micropascal rms
rms	root mean square
PSO	protected species observer
PTS	permanent threshold shift
RCRA	Resource Conservation and Recovery Act SEL
SELcum	cumulative sound exposure level
SPCC	Spill Prevention, Control, and Countermeasure SPL
SPLrms 90%	root mean square sound pressure level averaged over pulse duration containing 90 percent of energy
SSV	sound source verification
TL	transmission loss
TTS	temporary threshold shift
T&E	threatened and endangered
TVD	true vertical depth
USACE	U.S. Army Corps of Engineers USCG
USFWS	U.S. Fish and Wildlife Service WNP
WP	working pressure
Yost	Randolph Yost Jack-up Drilling Rig

1. INTRODUCTION

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

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

In this document, the action agency is the U.S. Army Corps of Engineers (Corps), Alaska District, which proposes to authorize Furie Operating Alaska, LLC to drill up to 9 exploratory wells in the Kitchen Lights Unit of Cook Inlet, Alaska from 2017 through 2021. The consulting agency for this proposal is NMFS's Alaska Region (AKR). This document represents NMFS's biological opinion (opinion) on the effects of this proposal on endangered and threatened species and designated critical habitat.

The opinion and incidental take statement were prepared by NMFS in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR 402.

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

1.1 Background

This opinion considers the effects of offshore oil and gas exploratory drilling in the Kitchen Lights Unit of Cook Inlet, along with associated ancillary activities. These actions have the potential to affect the endangered Cook Inlet beluga whale (*Delphinapterus leucas*), the endangered western North Pacific distinct population segment (DPS) humpback whale (*Megaptera novaeangliae*), the threatened Mexico DPS humpback whale (*Megaptera novaeangliae*), the endangered western DPS Steller sea lion (*Eumatopias jubatus*), the endangered fin whale (Balaenoptera physalus), and designated critical habitat for Cook Inlet beluga whales and Steller sea lions.

This opinion is based on information provided by Jacobs Engineering Group, Inc. (Jacobs) in the March, 2017, Biological Evaluation for Offshore Oil and Gas Exploratory Drilling in the Kitchen Lights Unit, Cook Inlet, Alaska (Jacobs 2017), updated project descriptions and marine mammal take estimates, revised mitigation measures, and e-mail exchanges between the applicant, their designated non-Federal representative (Jacobs), and NMFS. A complete record of this consultation is on file at NMFS's Anchorage, Alaska office.

1.2 Consultation History

On May 5 and October 27, 2016, The Corps, their designated non-federal representative (Jacobs), representatives from Furie, and NMFS held pre-consultation meetings discussing the proposed project, take calculation approaches, and appropriate pathways towards completing consultation. Furie submitted its C-Plan on November 9, 2016; these were discussed at a meeting on November 16, 2016. On December 21, 2016, NMFS sent comments to Furie regarding the C-Plan. On January 12, 2017, Furie sent a Tech Memo to NMFS addressing acoustic thresholds of the proposed activity; NMFS and Furie met to discuss the tech memo on January 13, 2107. Based on our review of the draft analysis, NMFS recommended the Corps proceed with formal consultation under section 7 of the ESA on January 30, 2017. On March 22, 2017, NMFS received Furie's Biological Evaluation and request to initiate informal consultation. On April 26, 2017, NMFS provided comments on the Biological Evaluation to Furie, and again recommended proceeding under formal consultation due to the potential for take of listed species. NMFS met with Furie on April 28, 2017, to discuss NMFS comments and preliminary responses from Furie. On May 1, 2, 5, and 8, 2017, Furie sent additional information to NMFS in response to follow-up questions regarding details of the project description and modifications to mitigation measures. On May 9, NMFS received a revised set of species effects determinations from the Corps and a request that formal consultation begin. NMFS initiated formal consultation on May 9, 2017.

2. DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

This opinion considers the effects of the Corps' authorization of oil and gas exploratory drilling operations in the Kitchen Lights Unit within Cook Inlet, Alaska between June 2017 and December 2021. The following description of the proposed action derives primarily from the BE prepared by Jacobs (2017).

Furie is proposing to drill one exploratory well (the Kitchen Lights Unit [KLU] #6, also known as the Deep Jurassic 1 well) in the KLU in 2017. In the years 2018 through 2021, Furie has tentative plans to drill up to an additional eight wells (one to two wells per year) resulting in nine total drilling locations within the KLU. The KLU is an offshore lease area of 83,394 acres, north of the East Foreland and south of the village of Tyonek in Cook Inlet, Alaska (see Figure 1).

Actions associated with this proposed activity include transport of a jack-up rig, the Randolph Yost (Yost), by up to three tugs to the drilling sites, geophysical surveys, pile driving at each drilling location, drilling operations, vessel and air traffic associated with rig operations, fuel storage, well completion activities.

Because the jack-up rig acts as a temporary structure that may pose a hazard to navigation in waters of the United States, the activity requires authorization from the Corps under the Rivers and Harbors Act of 1899.

2.1.1 Proposed Activities

General Project Description

Expanding upon past activities in the area, Furie's continuation of exploratory drilling in the KLU is expected to start in June 2017, at the Deep Jurassic location. This is currently the only well to be drilled in 2017. The well is expected to take approximately 120 days to drill and test. In subsequent years, Furie is tentatively planning drill up to eight other wells (Table 1). Drilling activities are planned only during ice-free months in Cook Inlet (generally April to October). In the years 2018 through 2021 up to two exploratory wells may be drilled each year, with total operation duration of up to 210 days per season. The jack-up rig is expected to operate at each well for 45 to 120 days depending on the target depth.

Table 1. Furie's Kitchen Lights Unit proposed well locations and schedule (Jacobs 2017).

Well Name	Latitude/ Longitude[1]	Target Formations	Arrive month	Depart month	Year
KLU #6, Deep Jurassic[2]	60.92135 N, 151.16890 W	Gas/Oil in Sterling, Beluga, Tyonek, Hemlock, and Upper Jurassic Naknek	July	October	2017
KLU #4 (re-entry)	60.97191 N, 151.07608 W	Gas/Oil in Tyonek, Hemlock, and Jurassic	May	July	2018
KLU #9	61.01361 N, 150.98000 W	Oil in Hemlock	July	October	2018
KLU #12	60.96715 N, 151.10787 W	Oil in Hemlock	May	July	2019
KLU #10	60.90374 N, 151.18310 W	Gas/Oil in Sterling, Beluga, Tyonek, Hemlock, and Upper Jurassic	July	October	2019
KLU #11	60.88679 N, 151.16702 W	Oil in Hemlock	May	July	2020
KLU #13 (formerly KLU #6)	60.87005 N, 151.26767 W	Gas/Oil in Beluga and Tyonek	July	October	2020

KLU #8	60.86667 N, 151.30780 W	Gas/Oil in Beluga and Tyonek	May	July	2021
KLU #7	60.82499 N, 151.37530 W	Gas/Oil in Tyonek and Hemlock	July	October	2021

[1] North American Datum 83

[2] This location is approximately one tenth of a mile southeast from the "Deep Jurassic" location proposed in the public notice for the Department of Army Authorization (60.92289 N, 151.17056 W). This well name will be "KLU #6" in future filings with AOGCC.

The Yost jack-up rig is the anticipated equipment for drilling exploratory wells within the KLU. The Yost is a Marathon LeTourneau designed Class 116-C, A1 self-elevating jack-up mobile drilling unit. Once in position, the three legs will "jack down" and secure the rig to the seafloor. The Yost will be pinned to the seafloor by pumping seawater into the preload tanks. The water within the preload tanks will not be mixed with any wastewater streams and will be discharged as "Uncontaminated Ballast Water" under the Alaska Pollutant Discharge Elimination System (APDES) general permit. The hull of the Yost is triangular and is approximately 243 feet long, 200 feet wide, and 26 feet deep. It has three square, truss-type legs that are 410 feet long allowing it to operate in water depths up to 300 feet. The spud cans at the base of each leg are 46 feet in diameter. It is equipped with three EMD 16-645-E8 diesel engines rated at 1,950 horsepower that drive three EMD A20-N6 2,100 kilowatt, 600 volt alternating current generators (Jacobs 2017).

The Yost will operate in water depths from 45 to 120 feet at the proposed well sites. The Yost can accommodate a crew of up to 118 persons with its onboard facilities, but the expected population is 45 to 75 people. The jack-up rig is equipped with a helideck; aircraft and vessel support is anticipated (details below). Potable water will be transported via support vessels and stored in tanks for use on the jack-up drilling rig. Freshwater for drilling will also be transported via support vessels and be used as the base for drilling muds.

The Yost will discharge wastewater into Cook Inlet while it is at each drilling site. The Alaska Department of Environmental Conservation (ADEC) wastewater discharges were approved under the APDES General Permit, AKG315100 by authorization AKG315102 on May 1, 2016. The Yost will most likely be stored over the winter in Nikiski, Alaska at the OSK dock (its current location), but it may also be stored in Homer or Port Graham, Alaska during future winter seasons (Jacobs 2017).

Geophysical Surveys

Prior to the arrival of the Yost on a drilling site, a high-resolution geophysical survey (e.g. side scan sonar or multi-beam survey) of the potential drilling location will be conducted to ensure the rig is not placed on underwater obstructions, shipwrecks, cables, or other structures. The geophysical survey equipment is anticipated to operate at a frequency above the hearing range of marine mammals (e.g. greater than 200 kilohertz [kHz]).

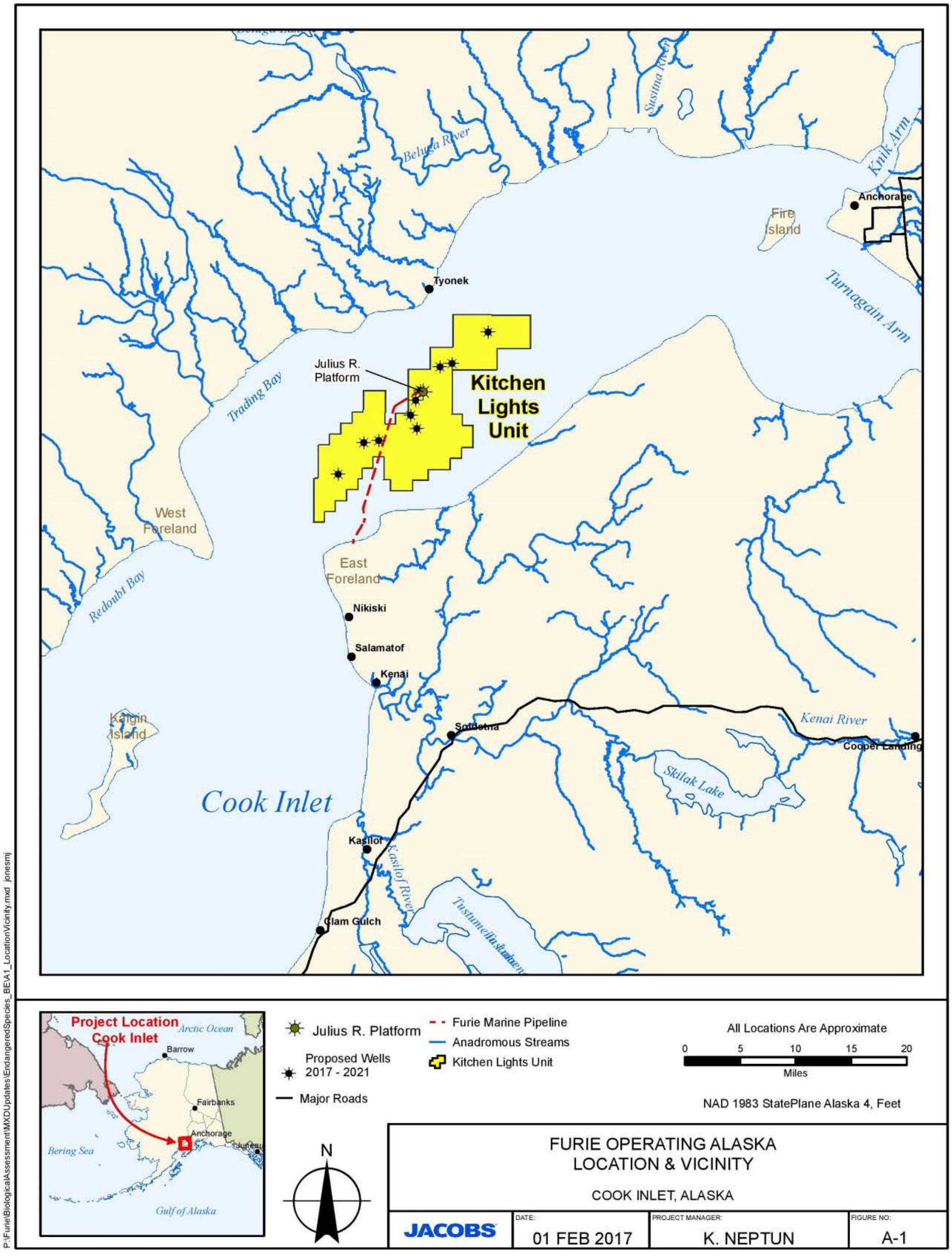

Figure 1. Proposed well location sites in Kitchen Lights Unit in Cook Inlet (Jacobs 2017).

Drill Rig Transport and Positioning by Tug(s)
At the start of the open water season (typically April), the Yost will be towed to an exploratory well site from the OSK dock using a minimum of three tugboats. Vessel speed during the rig tow is generally 5 knots or less. The rig is moved with three tugs to maintain control and precisely position it at the drilling site.

Tugs will remain in Cook Inlet during the mobilization of the jack-up rig and depart after it is in position and secure on the seafloor. Tug specifications are in Table 2. The expected duration of the tugs' engagement in each phase of their activities is summarized in Table 3. Furie expects to use some or all of the tugs during the 5 year operation.

Table 2. Tug specifications for Furie oil and gas exploration 2017-2021 (Pers. Comm. Lenz 2017).

Tug Name	Horse Power	Bollard Pull	SPL on tow
Anna T	4400	65 tons	Unknown
Bon Franco	5360 @ 1600 rpm	70.24 short tons astern	Unknown
Millennium Falcon	4400	57.72 short tons astern	Unknown
Millennium Star	4400 @ 1600 rpm	58.65 short tons astern	Unknown
Lauren Foss[1]	8200	101 short tons	167 dB re 1 μPa

[1]Sound source verification (SSV) indicates that the 90th percentile 120 dB isopleth for this vessel while towing the 400 ft Tuuq at 6.5 kts was 1500m (Austin et al. 2013).

Pile Driving
The drive pipe supports the initial sedimentary part of the well, preventing the surface layers from collapsing and obstructing the wellbore. The drive pipe is also used as a foundation for the wellhead, and facilitates the return of cuttings from the drill head. Drive pipes are expected to be installed using impact pile driving, driven downwards to about 150 feet below the seafloor. Pile driving is expected to take 8-10 hours per pile, spread over two to three days (Jacobs 2017).

Furie proposes to use one of two hammers for impact pile driving operations (Delmag D62-22 or IHC S-90). Buccaneer conducted sound source verification measurements using the Delmag D62-22 for 30-inch pile installation at their Southern Cross lease in 2013. Based on this previous study with the same equipment in a nearby area of Cook Inlet, the anticipated source level for the D62-22 hammer is 190 dB re 1 μPa at 55 m (Illingworth and Rodkin 2014).

Sound source verification measurements were performed at the Harmony platform in California using the IHC S-90 for installing 26-inch steel conductor pipes, resulting in a source level of 201 dB re 1 μPa at 1 m (MacGillivray and Schlesinger 2014).

Drilling
Well drilling will start with the placement of a 30-inch diameter drive pipe approximately 150 feet below the mudline. Sections of pipe will be assembled either by welding or will be equipped with drivable quick connections. Drilling will commence once the drive pipe is installed. For a typical well, a 26-inch well bore will first be drilled and a 20-inch conductor casing will be installed to approximately 1,600 feet. As the well is drilled deeper, the diameter of the well bores

and casing will decrease. Typically the final well bore will be approximately 8.5 inches in diameter with a 7-inch diameter liner. Wells targeting both oil and gas formations will be drilled from 7,200 feet true vertical depth (TVD) to 24,000 feet TVD.

<u>Associated Vessel Activity (non-tug)</u>
Major supplies will be staged onshore at the Nikiski OSK Dock. Required supplies and equipment will be moved from the staging area by contracted supply vessels and loaded aboard the rig when it is established on a drilling location. Major supplies will include fuel, potable water, drilling water, mud materials, cement, casing, and well service equipment (Jacobs 2017).

Offshore supply vessels (OSVs) that will supply the Yost are of steel construction with strengthened hulls to give the capability of working in extreme conditions. The supply vessels are typically 165 to 210 feet in length with engine ratings ranging from 2,500 to 6,000 total horsepower. In 2017, over the 120-day expected duration to drill the Deep Jurassic well, it is anticipated that the OSVs will make approximately 60 trips to the jack-up rig. In subsequent years when up to two wells are drilled, a maximum of 90 trips are expected over the season. Each trip constitutes about a half day of operation, resulting in approximately 30 days of use in 2017, and up to 45 days in subsequent years. Anticipated vessel use duration is presented in Table 3. These vessels are equipped with bow thrusters. However, as part of the proposed action, bow thrusters will not be used on the OSVs or other vessel operations except for in emergencies that threaten human life, property damage, or environmental damage. The timing of vessel deliveries will be coordinated such that the vessel captains will determine the conditions that allow for a safe delivery without the use of bow thrusters (Pers. Comm. Drew Lenz, May 5, 2017).

Table 3. Expected vessel use during Exploratory Drilling from 2017 through 2021.

Vessel	Use	2017 Vessel Operation Time	2017 Expected Month of operation	2017-2021 Vessel Operation Time	2017-2021 ExpectedMonths of operation
2 tugs towing rig (170 dB	Move Yost to the well	3-6 hours	July	6-12 hours	May/July
1 tug for braking and positioning, mostly not under a load (170 dB intervals when	Maneuver Yost at the well location	3-6 hours	July	6-12 hours	May/July
Standby tugs (3) (150 SPL)	Stand-by during rig jack-up	2-4 hours holding position, 1 day	July	4-8 hours holding position, 1 day on standby	May/July

Standby tugs (3) (150 SPL)	Stand-by during rig re-float	2-4 hours holding position	October	4-8 hours holding position	July/October
2 tugs under load towing rig (170 dB SPL)	Return Yost to Port	3-6 hours	October	6-12 hours	July/October
1 tug for braking and positioning, mostly not	Return Yost to Port	3-6 hours	October	6-12 hours	July/October
2 tugs, maneuvering (170 SPL)	Position Yost at port for	2-4 hours under load, 1 day on	October	4-8 hours under load, plus 1 day on standby at 150	July/October
Supply Vessel(s)	Support drilling operations	60 deliveries (30 days total)	October	90 deliveries per year (45 days per year total operation)	July/October

Associated Aircraft Activity

Aircraft support during exploratory drilling activities is expected to include an average of one trip per day with a four trips per day maximum using a Bell 407 helicopter or similar aircraft. A Bell 407 helicopter will be on call to provide emergency air support from Nikiski, Alaska during installation and construction activities. All fueling and maintenance activities of aircraft will be performed in Nikiski. Sound generation from aircraft is anticipated to fall within the range of 110 to 137 decibels (dB) sound pressure level (SPL), generally at frequencies less than 2 kHz (Blackwell and Greene 2002). All aircraft will transit at an altitude of 1,500 feet or higher, excluding takeoffs and landings. The maximum SPL of project aircraft (137dB at 1m)(Jacobs 2017) attenuates to 120 dB at 14 m, and transference of acoustic energy from air to water is less than 100% even within the 26^{o} cone beneath the aircraft (Richardson et al. 1995).

Well Completion

Depending on the test results of the targeted formations, well completion activities may be conducted. If a well does not have promising results it will be plugged and abandoned (P&A) using accepted P&A techniques (Jacobs 2017). Some wells may also be suspended for later re-entry and testing or deepening. If a well contains economically viable reserves, it will undergo completion activities. There are several different types of completions, but they generally include the installation of production casing, cementing, perforating, and gravel packing. The discharge of fluids used during the completion process is not approved by the APDES general permit; therefore, these fluids will be containerized and shipped to an appropriate disposal facility.

Fuel Storage

Bulk fuel will not be stored within the action area during exploratory drilling. Day use fuel storage will be located in containment enclosures with a containment capacity of 125 percent of the total volume of the fuel vessel. Fuel spills are considered a highly unlikely event. Moreover, all vessels and structures will be equipped with spill kits and absorbent material to immediately contain and remediate any spills. Any transfer or bunkering of fuel for offshore activities will be performed either dockside or will comply with USCG bunkering-at-sea regulations. Compliance with the 2013 Environmental Protection Agency Vessel General Permit is described in Jacobs (2017).

2.1.2 Mitigation Measures

Furie proposes to implement mitigation measures to minimize impacts on and reduce likelihiood of take of listed marine mammals. Briefly, protected species observers (PSOs) will be located on-site throughout drill rig transport, pile driving, during vessel delivery activity and aircraft landings and take-offs, and throughout all associated aerial or marine-based protected species surveys, where they will be located on-board the survey craft. PSOs will monitor the shut-down and monitoring zones indicated for each activity in Table 4, and will do so throughout the duration of that activity. Drilling cannot be interrupted at any given time, nor can tug operations discontinue controlling rig transport without causing risk to life, property, or the environment. PSOs will order the shutting down (e.g. pile driving) or delay (e.g. aircraft/watercraft arrival/departure) of those activities that can be discontinued or delayed whenever listed marine mammals enter, or appear likely to enter, associated exclusion zones (i.e., an area where harassment occurs) (see Table 4).

Table 4. Exclusion zones associated with each oil and gas exploration-related activity.

Activity	Exclusion zone radius	Basis for exclusion zone
Yost transport by three tugs	2,154 m, rounded to 2,200 m	170 dB SPL (BE table 4-1 with practical spreading loss)[1]
Tugs not under load	100 m	150 dB SPL
Pile driving Delmag D-62	5,500 m	190 @ 55m dB (BE table 2-11, Illingworth and Rodkin 2014, but with practical spreading loss applied)
Pile driving S-90 w/o cushion	550 m	201 dB re 1 μPa @ 1m
Drilling and pumping	330 m	158 dB SPL (BE Table 5-1)
Well completion or well plugging and abandonment	330 m	Conservative estimate based on comparison with drilling and pumping, where this activity produces less noise than drilling and pumping.[2]
OSV deliveries (primarily M/V Sovereign, with M/V Perseverance used on occasion)	100 m	150 dB SPL (BE Table 5-1)
Aircraft	230 m or 13^{o} each side of aircraft	230 m = 2x230 m cone radius at water surface for aircraft at 1000 ft.

[1]Based upon SSV of Lauren Foss, a tug that is nearly twice as powerful as the other tugs expected to be used, while on tow.
[2]Pers. Comm. Andrew Lentz, Jacobs Engineering, May 5, 2017)

Furie has indicated that for activities that result in an exclusion zone of less than 225 m radius (i.e., vessel resupply and tug transit), specially-trained dill rig or vessel crew members (CM) can take on PSO responsibilities.

PSO and PSO/CM Responsibilities

1. PSO and CMs serving as observers will be in good physical condition and be able to withstand harsh weather conditions for an extended period of time. They must have vision correctable to 20-20.
2. PSO and CMs serving as observers will complete training conducted by a qualified PSO instructor prior to deployment to the project site.
3. PSO and CMs will have the experience and ability sufficient to conduct field observations and data collection according to assigned protocols.
4. PSOs will have the experience or training in the field identification of marine mammals and marine mammal behavior. PSO and CMs serving as observers will be able to accurately identify marine mammals in Alaskan waters by species.
5. PSO and CMs serving as observers will have sufficient training, orientation or experience with the exploration operations sufficient to accurately report on activities occurring during marine mammal sightings.
6. PSOs and CMs serving as observers will have writing skills sufficient to prepare understandable reports of observations and technical skills to complete data entry forms accurately.
7. PSOs will be present before and during all rig transport and positioning, tug movement, pile driving, drilling, well completion and well abandonment activities.
8. PSO and CMs will be on site to monitor the exclusion zones for all aircraft and watercraft-based deliveries.
9. Two PSOs on alternating watch will be stationed on a separate vessel that will transit ahead of the tugs while the rig is towed to and from the drilling site. The PSOs on the observation vessel will ensure the harassment exclusion zone ahead of the tugs (2,200 m) is clear of marine mammals. To the extent practical, while maintaining control of the rig, the tugs will reduce the throttle/thrust if marine mammals are sighted in the expected path. The reduced throttle/thrust would be expected to reduce the size of the 120 dB radius. Once the drilling site is reached, the PSO vessel will maintain a position up-current from the tugs while the rig "jacks-down" to the sea floor to set/pin the legs. The PSO vessel will remain on site with the tugs and accompany them back to port, monitoring the tug exclusion zones along the way. Alternately, two PSOs may be transferred to two separate tugs and monitor from those platforms while the PSO support vessel returns to port.
10. Throughout impact pile driving operations, at least two PSOs will be stationed on the jack-up rig.
11. PSO and CMs serving as observers will ensure the area within the 330-meter exclusion zone around drilling rig is clear of marine mammals prior to commencing drilling activities.

12. PSO and CMs serving as observers will be positioned such that the entire exclusion zone for all activities (see Table 4) is visible (e.g., situated on the helideck or other elevated promontory on the jack-up rig, in aircraft or OSV) except as noted in item 13.
13. If a Delmag D-62 hammer is used to install the drive pipe, with the associated 5,500 meter exclusion zone, Furie agrees to place two PSOs on two support vessels positioned to maximize the portion of the up-current exclusion zone that is visible to the PSOs and which is not effectively monitored from the Yost. The PSOs will alternate watch and the vessels will maintain position on the up current side of the jack-up rig during the entire duration of pile driving. The up current position would provide the greatest degree of coverage for approaching animals, assuming approaching animals would be more likely to travel with, instead of against, the current. Two PSOs would also be stationed on the jack up rig on an alternating watch to monitor as much of the exclusion zone as is feasible.
14. PSO and CMs will have the ability to effectively communicate orally, by radio and in person, with project personnel to provide real-time information on marine mammals and will have the ability and authority to order appropriate mitigation responses to avoid take of all marine mammals.

15. Prior to commencing impact pile driving, PSOs will scan waters within the impact pile driving exclusion zone and ensure listed marine mammals remain absent from those waters for 30 minutes prior to initiation of impact pile driving.

    15.1. If one or more listed marine mammals are observed within the exclusion zone during this 30 minute observation period, impact pile driving will not begin until all marine mammals vacate the exclusion zone of their own accord; and the exclusion zone has remained clear of marine mammals for 30 minutes.

    15.2. The PSOs will continuously monitor the exclusion zone during pile driving operations for the presence of listed marine mammals, and will order the pile driving activities to immediately cease if one or more listed marine mammals appears likely to enter the exclusion zone. If a listed marine mammal occurs within the exclusion zone during pile driving, take has occurred. If unauthorized take occurs, the PSO must contact NMFS immediately to report the incident.

    15.3. Should activities that produce in water noise at or greater than 160 dB cease for more than 60 minutes, PSOs will scan the exclusion zone for 30 minutes before pile driving commences to ensure listed marine mammals are absent from the exclusion zone.
16. If no marine mammals are observed for 30 minutes, soft-start procedures will be applied to all impact pile driving activities to provide a chance for any unobserved marine mammals to leave the area prior to impact pile driving at operational power. For impact pile driving, a soft start is comprised of an initial set of three strikes from the hammer at about 40 percent energy, followed by a 30 second waiting period, then two subsequent three-strike sets with associated 30-second waiting periods at the reduced energy. Following this soft-start procedure, impact pile driving at operational power may commence provided marine mammals remain absent from the exclusion zone.

17. An aerial survey of the entire pile driving exclusion zone may be conducted at the beginning of the day prior to the soft start of pile driving, in lieu of the vessel based PSOs. Aerial surveys must continue until the PSO on-board the aircraft determines that marine mammals are absent from the entire impact pile driving exclusion zone. The pile driving exclusion zone will continue to be monitored from the Yost throughout pile driving operations.
18. PSOs will be trained on distance estimation using an inclinometer or binocular reticles.
19. The PSO will have the following equipment to address their duties:
    - 19.1. Range finder;
    - 19.2. Annotated chart (noting the rig location) and compass;
    - 19.3. Inclinometer;
    - 19.4. Two-way radio communication, or the equivalent, with on-site project manager,
    - 19.5. Appropriate Personal Protective Equipment;
    - 19.6. Daily tide tables for the project area;
    - 19.7. Watch or chronometer;
    - 19.8. Binoculars (quality 7 x 50 or better) with built-in rangefinder or reticles (rangefinder may be provided separately);
    - 19.9. Hand-held GPS;
    - 19.10. A copy of this biological opinion and associated Incidental Take Statement and all appendices, printed on waterproof paper and bound;
    - 19.11. Observation Record forms printed on waterproof paper, or weatherproof electronic device allowing for required PSO data entry.
20. PSO and CMs serving as observers will record observations on data forms or into electronic data sheets, electronic copies of which will be submitted to NMFS in a spreadsheet format on a monthly basis. During 2017 operations, reports of take of any marine mammal will be submitted to NMFS within 24 hours of occurrence (see contact information at item 29).
21. PSO and CMs serving as observers will have stop-work authority in the event a marine mammal is observed in, or is determined likely to enter an exclusion zone associated with a particular ongoing activity (see Table 3). Appropriate actions include, but are not limited to: reducing tug power while moving the rig, immediate discontinuation of pile driving, delay of aircraft or watercraft departure if doing so does not compromise human safety, altering the speed or course of OSVs, tugs and other support vessels.
22. If take of any marine mammal occurs, the PSO and CMs will report that take to NMFS at the contact specified in item 29. Alternately, crew members may report marine mammal takes to a PSO who has been designated as the point of contact between crew members and NMFS.
23. PSO and CMs serving as observers will have no other primary duties beyond watching for, acting on, and reporting on events related to marine mammals. For crew members, this mitigation measure only applies during the time the crew member must assume the duties of the PSO due to the absence of a qualified PSO.
24. PSO and CMs serving as observers will work in shifts lasting no longer than four hours with at least a one-hour break between shifts, and will not perform duties as a PSO for more than 12 hours in a 24-hour period (to manage PSO fatigue).

25. Furie will instruct OSV captains not to use bow thrusters during deliveries to the platform. However, PSOs will likely be present for most OSV deliveries, as they are expected to be present for the duration of drilling activity.
26. Since placement of buoys or other moored indicators is not practical in the extreme tidal currents at the project location, an inclinometer reading will be the primary means of determining exclusion zones.
27. If a marine mammal is observed within, or is determined likely to enter an exclusion zone (see Table 3), the PSO or CM will contact the jack-up rig crane operator, or OSV captain directly via radio with instructions to avoid take of the marine mammal. If take of a marine mammal occurs, the PSO will notify NMFS at the contact information below (item 29)
28. PSO or CMs serving as observers will use a NMFS-approved Observation Record (Appendix A). Observation Records will be used to record the following:
    - 28.1. Date and time that permitted activity begins and ends;
    - 28.2. Weather parameters (e.g. percent cloud cover, percent glare, visibility) and sea state where the Beaufort Wind Force Scale (https://www.weather.gov/mfl/beaufort) will be used to determine sea-state;
    - 28.3. Species, numbers, and, if possible, sex and age class of observed marine mammals, along with the date and time of the observation;
    - 28.4. The predominate sound-producing activities occurring during each marine mammal sighting;
    - 28.5. Marine mammal behavior patterns observed, including bearing and direction of travel;
    - 28.6. Behavioral reactions of marine mammals just prior to, or during sound-producing activities;
    - 28.7. Location of marine mammal, distance from observer to the marine mammal, and distance from the predominate sound-producing activity or activities to marine mammals;
    - 28.8. Whether the presence of marine mammals necessitated the implementation of mitigation measures, and the duration of time that normal exploration operations were affected by the presence of marine mammals;
    - 28.9. Other human activity in the area.
29. In addition to annual reporting, the Corps or its non-federal representative will require the applicant to provide NMFS, within 90 days of project completion at the end of the 5-year period, a report of all parameters listed above, noting also all operational shutdowns or delays necessitated due to the proximity of marine mammals, to:

    Greg Balogh, Anchorage PRD supervisor
    National Marine Fisheries Service
    Protected Resources Division, Anchorage office
    222 W. 7^{th} Ave. suite 552
    Anchorage, AK 99513

Mitigation Associated with OSV Deliveries

30. OSV captains will time their deliveries such that conditions will allow for a safe delivery without the use of bow thrusters except in the case of emergencies that threaten human life, property damage, or environmental damage.
31. Rig personnel will be made aware of project mitigation measures and will plan/request OSV deliveries accordingly.
32. OSV captains and crew will be educated about threatened and endangered species (Cook Inlet beluga, Steller sea lions, fin whales, and humpback whales) and trained to assist with the detection of these protected species. OSV crew will also be educated on avoidance measures to minimize the risk of OSV strikes of marine mammals as outlined below.
    - 32.1. The NMFS (2003) Alaska Marine Mammal Viewing Guidelines and Regulations will be implemented to minimize risk of potential impacts from OSV activities;
    - 32.2. OSVs will be operated at speeds of less than 10 knots relative to the current, using direct travel routes to the extent practical;
    - 32.3. OSVs will not approach within 100 m of marine mammals;
    - 32.4. OSV operators will ensure that marine mammals will not come between the OSV and other floating or stationary man-made structures or between the OSV and shore;
    - 32.5. If any marine mammals are observed on a heading and speed that will intersect an area within 100 m of the OSV, the OSV will slow to the extent practical while maintaining control and allow the marine mammal to pass. OSVs may also divert their heading away from the direction the marine mammal is travelling.

Mitigation measures for support aircraft

33. All aircraft will transit at an altitude of 1,500 feet or higher, excluding takeoffs and landing. Helicopters will not hover or circle above marine mammals.

Mitigation measure for all rig and vessel crew

34. All vessel and rig personnel will be responsible for cutting all unused packing straps, plastic rings, and other synthetic loops that have the potential to become entangled around fish or wildlife.

2.2 Action Area

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

The action area for this biological opinion will include: (1) the nine proposed drilling sites within the Kitchen Lights Unit in Cook Inlet; (2) the ensonified area associated with pile driving, drilling, and vessel and aircraft noise; and (3) transit areas for vessels and aircraft from Nikiski, Homer, or Port Graham to and from the drilling sites (see Figure 2).

Within this area, the loudest sound source with the greatest propagation distance is anticipated to be impact pile driving activities. Received levels from impact pile driving with a source level of 190 dB re 1 μPa rms at 55 m, may be expected on average to decline to 160 dB re 1 μPa (rms) within 5,500 m of the impact driving (Illingworth and Rodkin 2014). The 160 dB isopleth was chosen because beyond that point, no measurable effect from the project would occur).

The action area includes transit areas for mobilization, demobilization, and support activities as well as noise buffers around transit routes for vessels and aircraft. Mobilization and demobilization for the drilling rig is anticipated to occur out of Nikiski with Homer and Port Graham serving as alternative locations (Figure 2). Because we cannot predict all possible vessel and aircraft paths, we have adopted an action area that represents a minimum convex polygon connecting the outer-most perimeter of the largest exclusion zone centered around all proposed well locations and the servicing port of Nikiski, with the addition of a 2,200 m-wide swath centered on the expected route along which the Yost (or other drilling rig) will be transported by tugs to and from the OSK dock at Nikiski, Homer, or Port Graham.

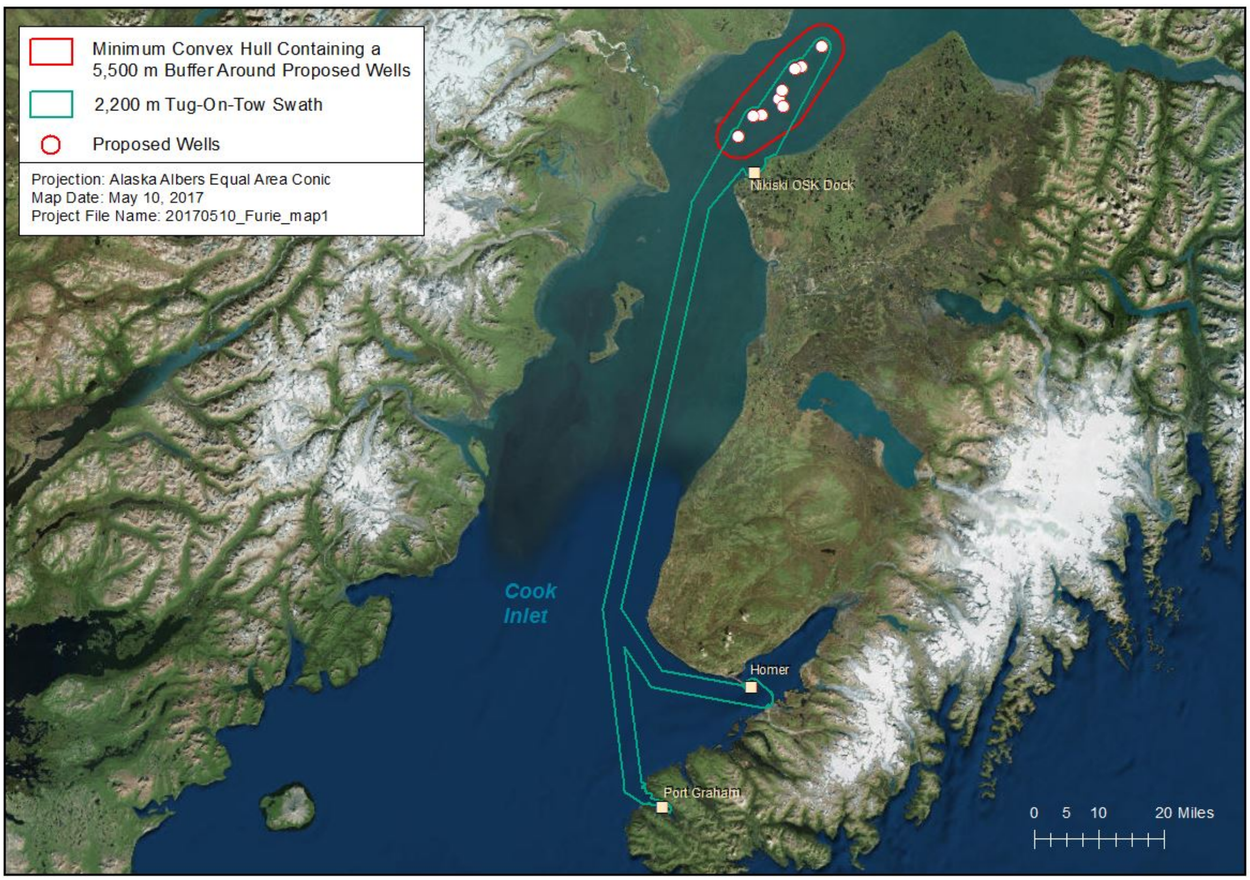

Figure 2. Action area for Furie oil and gas exploration operations in the Kitchen Lights Unit in Cook Inlet, Alaska, from 2017 through 2021. Defined by minimum convex hull connecting 5,500 m buffers around well sites and 2,200 m buffers around presumed potential on-tow tug paths.

3. APPROACH TO THE ASSESSMENT

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

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

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

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

- Identify those aspects (or stressors) of the proposed action that are likely to have direct or indirect effects on listed species or critical habitat. As part of this step, we identify the action area – the spatial and temporal extent of these direct and indirect effects.

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the rangewide status of critical habitat by examining the condition of its PBFs – which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this opinion.

- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.

- Analyze the effects of the proposed actions. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.

- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this opinion.

- Describe any cumulative effects. Cumulative effects, as defined in NMFS's implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this opinion.

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.

- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.

- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

4. RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

Five species of marine mammals listed under the ESA under NMFS's jurisdiction may occur in the action area. The action area also includes critical habitat the Cook Inlet beluga whale. This opinion considers the effects of the proposed action on these species and designated critical habitats (Table 5).

Table 5. Listing status and critical habitat designation for marine mammals considered in this opinion.

Species	Status	Listing	Critical Habitat
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered	73 FR 62919, October 22, 2008	76 FR 20180, April 11, 2011
Fin whale (*Balaenoptera physalus*)	Endangered	35 FR 18319, December 2, 1970	N/A
Western North Pacific DPS humpback whale (*Megaptera novaeangliae*)	Endangered	81 FR 62260, September 8, 2016	N/A
Mexico DPS humpback whale (*Megaptera novaeangliae*)	Threatened	81 FR 62260, September 8, 2016	N/A
Western DPS Steller sea lion (*Eumatopias jubatus*)	Endangered	62 FR 24345, May 5, 1997	58 FR 45269, August 27, 1993

4.1 Species and Critical Habitat Not Considered Further in this Opinion

As described in the Approach to the Assessment section of this opinion, NMFS uses two criteria to identify those endangered or threatened species or critical habitat that are likely to be adversely affected. The first criterion is exposure or some reasonable expectation of a co-occurrence between one or more potential stressors associated with Furie's activities and a listed species or designated critical habitat. The second criterion is the probability of a response given exposure. For endangered or threatened species, we consider the susceptibility of the species that may be exposed; for example, species that are exposed to sound fields produced by pile driving activities, but are not likely to exhibit physical, physiological, or behavioral responses given that exposure (at the combination of sound pressure levels and distances associated with an exposure), are not likely to be adversely affected by the pile driving activity.

For designated critical habitat, we consider the susceptibility of the constituent elements or the physical, chemical, or biotic resources whose quantity, quality, or availability make the designated critical habitat valuable for an endangered or threatened species. If we conclude that the quantity, quality, or availability of the constituent elements or other physical, chemical, or biotic resources is not likely to decline as a result of being exposed to a stressor and a stressor is not likely to exclude listed individuals from designated critical habitat, we would conclude that the stressor may affect, but is not likely to adversely affect the designated critical habitat.

The designations of critical habitat for species that occur in the project's action area use the term primary constituent element (PCE) or essential features. Recent revisions to our critical habitat regulations at 50 CFR §402 (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ‘‘destruction or adverse modification’’ analysis, which is the same regardless of whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We applied these criteria to the species and critical habitats listed above and determined that the following species and designated critical habitats are not likely to be adversely affected by the proposed action: designated critical habitat for Cook Inlet beluga and Steller sea lion.

4.1.1 Cook Inlet Beluga Whale Critical Habitat

NMFS designated critical habitat for the Cook Inlet beluga whale on April 11, 2011 (76 FR 20180). NMFS excluded all waters off the Port of Anchorage east of a line connecting Cairn Point (61^{o}15.4’N., 149^{o} 52.8’W.) and Point MacKenzie (61^{o}14.3’N., 149^{o} 59.2’W.) and north of a line connecting Point MacKenzie and the north bank of the mouth of Ship Creek (61^{o}13.6’N., 149^{o} 53.8’W.) (see Figure 3). The action area is located within designated Cook Inlet beluga critical habitat.

The Cook Inlet beluga whale critical habitat final rule (76 FR 20180) included designation of five Primary Constituent Elements (PCEs, referred to in this opinion as Physical and Biological Features (PBFs)). These 5 PBFs were deemed essential to the conservation of the CI beluga whale. The PBFs are:

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles of high and medium flow anadromous fish streams.
2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye,
    a. chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.
4. Unrestricted passage within or between the critical habitat areas.
5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Cook Inlet beluga whale critical habitat (Figure 3) includes two geographic areas in Cook Inlet comprising 7,809 km^2 (3,013 mi^2). The Kitchen Lights Unit occurs entirely within Area 2 of designated critical habitat.

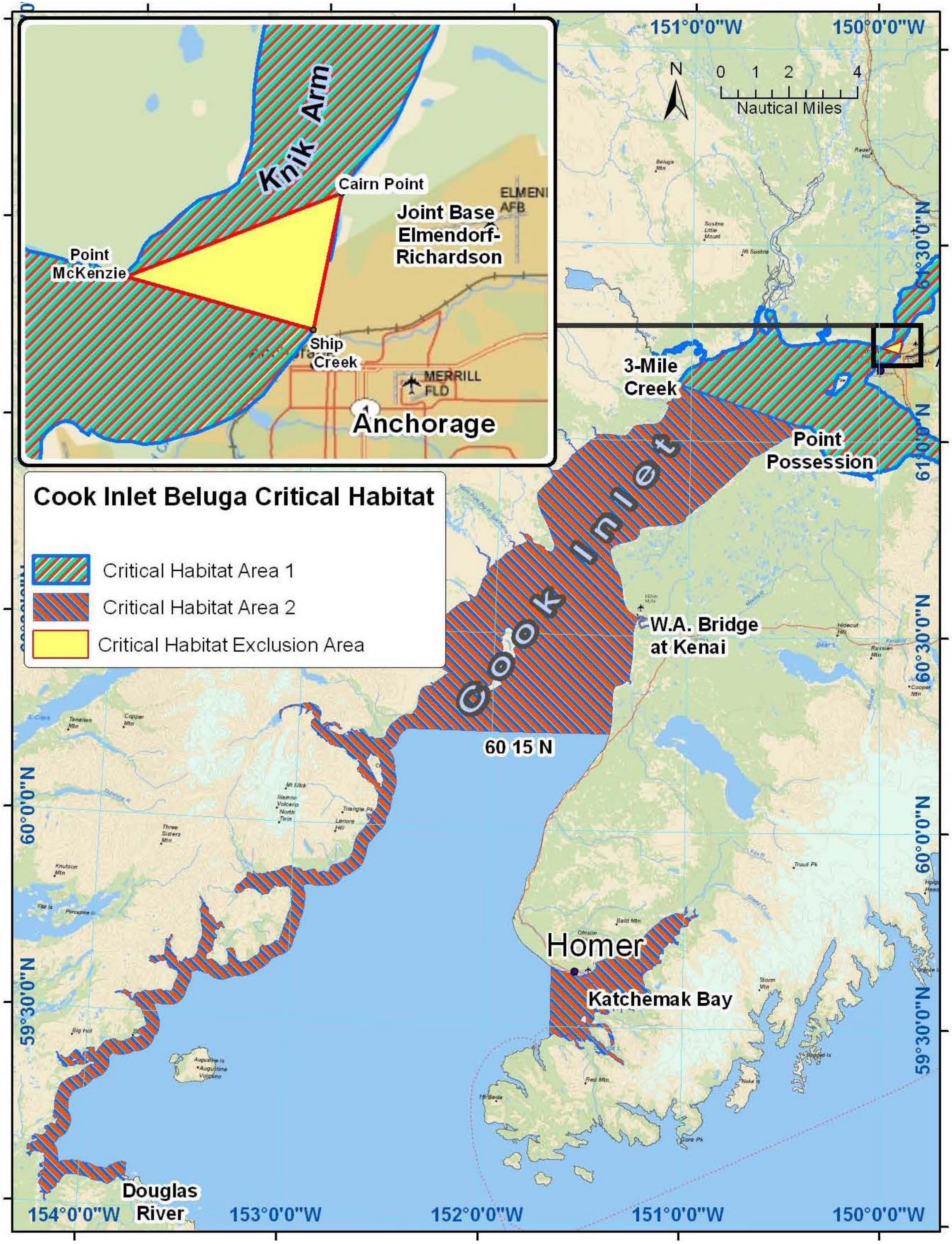

Figure 3. Critical Habitat for Cook Inlet beluga whales.

Area 1 habitat is located in the northernmost region of Cook Inlet and consists of shallow tidal flats, river mouths, and estuarine areas. Area 1 is important as foraging and calving habitats and beluga whales are concentrated in Area 1 during spring and summer months for these purposes.

Area 1 has the highest concentrations of beluga whales from spring through fall (approximately March through October) as well as the greatest potential for adverse impact from anthropogenic threats.

Area 2 habitat was designated for the area's importance to fall and winter feeding and transit. Area 2 includes the Cook Inlet waters south of Area 1 habitat as well as Kachemak Bay and foraging areas along the western shore of lower Cook Inlet (Figure 3). The proposed Furie exploratory drilling program will take place in Area 2 habitat that is primarily used by Cook Inlet belugas during the fall and winter months. Based on dive behavior and analysis of stomach contents from Cook Inlet belugas, it is assumed that Area 2 habitat is an active feeding area during fall and winter months when the spatial dispersal and diversity of winter prey likely influences the wider beluga winter range (NMFS 2008a). However, tagging data indicate use of Area 2 by belugas in all months except April and May, and the indicated absence of use of Area 2 in April and May is based upon tagging data from only 2 whales (MML unpublished data, April, 2017).

PBF1: Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles of high and medium flow anadromous fish streams.

The action area is located more than 5 miles from any intertidal/subtidal waters associated with any anadromous fish stream. In addition, the depth throughout the action area is greater than 30 feet MLLW. Because there is no overlap between the areal extent of this PBF and the action area, we anticipate that all effects of this action on PBF 1 will be undetectable. We therefore conclude that the effects of the action on this PBF will be insignificant.

PBF 2: Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.

The action area is not within Area 1 critical habitat, where feeding of the primary prey species typically occurs. Activities within the action area will have ceased prior to the time of year that belugas occur in this area at anything above the lowest density level predicted by spatial modelling of tagged beluga distribution (MML unpublished data, April, 2017). The action area is within an area most commonly used as winter habitat. Furie plans to be present in the area from April at the earliest through October at the latest. Furie's actions are expected to have no measurable effect on spring, summer and fall forage species such as eulachon and Pacific salmon. We expect that the only potential effect of this action on winter forage fish such as Pacific cod, walleye pollock, saffron cod, and yellowfin sole would be through acoustic disturbance. Acoustic effects on these species would be extremely localized in nature and temporary in duration, with no lingering effects lasting until belugas adopt wintering foraging strategies (December through March). Therefore, we conclude that the action's effects on PBF 2 are insignificant.

PBF 3: Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

Section 2.4 of the Biological Evaluation (Jacobs 2017) refers to several environmental and oil and gas exploration permits each having specific requirements and practices to minimize impact to the environment. It describes their treatment of several types of discharges (e.g. water-based drill muds and drill cuttings, treated sanitary and domestic gray water, stormwater drainage, uncontaminated ballast water, and non-contact cooling water). The Yost will have a 100 meter mixing zone associated with its APDES-authorized discharge permit, within which a suite of pollutants will disperse to non-harmful concentrations. Seafloor characteristics within KLU indicate tidal-induced bottom scouring such that discharges will not accumulate in the sediment, but be quickly dispersed and be flushed out of the Inlet with the tides (Jacobs 2017).

The Biological Evaluation outlines best management practices (BMPs) to ensure that harmful agents do not enter Cook Inlet. BMPs are in place to ensure deck drainage does not become contaminated with oil, grease, fuels, or other chemicals or hazardous materials. Deck drainage will pass through an oil-water separator before being discharged into Cook Inlet. Domestic wastewater (both black and gray water) will be treated with an OmniPure Model 5538 marine sanitation device. Treated effluent will be discharged into Cook Inlet. Monthly testing will ensure the APDES permit limitations are being met and that water quality standards are not exceeded outside of the 100-meter mixing zone allowed by the permit.

Furie will use freshwater-based drilling fluids for all planned drilling intervals. The fluids are less toxic than non-aqueous fluids. Furie will employ oilfield best practices to minimize the volume and toxicity of drilling fluids and cuttings. Drilling fluids will be cleaned of cuttings and recycled to use the minimum volume required to achieve the target depths. Toxicity of drilling fluid will be minimized by using the minimum amount/concentration of each additive necessary to achieve desired effect, and using the least toxic additive available if more than one achieves the desired effect. Furie will also ensure that products are stored correctly and protected from the weather, and that all hoses are properly secured when transferring fluids and/or cuttings from the rig to tanks. A static sheen test of a sample of drilling fluid will be conducted daily to ensure no free oil or diesel oil has contaminated the drilling fluids. Fluids with free oil cannot be discharged under the APDES permit. Furie will not discharge any fluids that are used while drilling through hydrocarbon zones. These fluids will be containerized and disposed of properly onshore. Measures will be implemented to ensure that water quality standards are not being exceeded outside of the 100-meter mixing zone for drilling fluids. Additional details can be found in Section 2.4 of the Biological Evaluation (Jacobs 2017).

The Yost jack-up rig is equipped with several types and ratings of blowout preventer equipment (BOPE) (Jacobs 2017, Section 2.4. Additional actions aimed at the prevention of oil spills are outlined in Furie's Spill Prevention, Control, and Countermeasure (SPCC) plan and as well as the Oil Discharge Prevention and Contingency Plan (ODPCP). The SPCC identifies measures to prevent spills of oil and other hazardous substances from operations (e.g. fuel and oil handling and storage) and the ODPCP, along with addressing prevention, provides the framework for a response to a large-scale spill resulting from a blowout or other major catastrophe. Furie recently updated its ODPCP which was approved by ADEC on 30 June 2016. After recent discussions with NMFS, Furie is revising its ODPCP to include early notification and coordination with NMFS.

NMFS expects that the measures described in Jacobs (2017) (and briefly summarized above) are sufficient to minimize both the probability and magnitude of effects on this PBF resulting from the introduction of toxins and other harmful agents to Cook Inlet beluga critical habitat. We therefore conclude that the action's effects upon PBF 3 are discountable and insignificant.

PBF 4: Unrestricted passage within or between the critical habitat areas.

Because this action occurs offshore and impacts a maximum radius of about 5500 m at any given time, there is ample room for beluga whales to bypass the action while avoiding harmful acoustic effects. We expect the probability of this action hindering passage of belugas to be extremely unlikely, so we conclude it will have discountable effects upon PBF 4

PBF 5: Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Temporary and intermittent noises associated with the proposed oil and gas exploration activities may generate sound at levels that could result in temporary displacement of beluga whales from their preferred habitat. However, none of the well sites are located in areas that overlap in space and time with known beluga concentrations (see PBF 2). The acoustic effects of this action are expected to be sufficiently temporary in nature and limited in geographic extent that habitat abandonment by belugas is extremely unlikely. In addition, the proposed action incorporates standard mitigation measures including exclusion zones and shutdown mechanisms to reduce the potential for exposure to belugas. We therefore conclude that the effects of this action on this PBF are discountable.

In summary, we conclude that this action will have insignificant and/or discountable effects on Cook Inlet beluga critical habitat PBFs. We therefore we will not consider effects to this critical habitat further in this opinion.

4.1.2 Steller Sea Lion Critical Habitat

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

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

The action area is located well outside designated Steller sea lion critical habitat, the most proximal portion of which is the buffer surrounding a major haulout at Nagahut Rocks (Figure

4). The northernmost extent of Steller sea lion critical habitat around Nagahut Rocks lies some 100 miles south of the Kitchen Lights Unit's southern extent. Steller sea lion critical habitat does not overlap with the Yost's alternative overwintering port of Homer, which is about 14 miles northeast of the critical habitat boundary. Given this lack of spatial overlap, we conclude the acoustic effects of this action on Steller sea lion critical habitat will be insignificant. Therefore, we will not consider designated critical habitat for Steller sea lion further in this opinion.

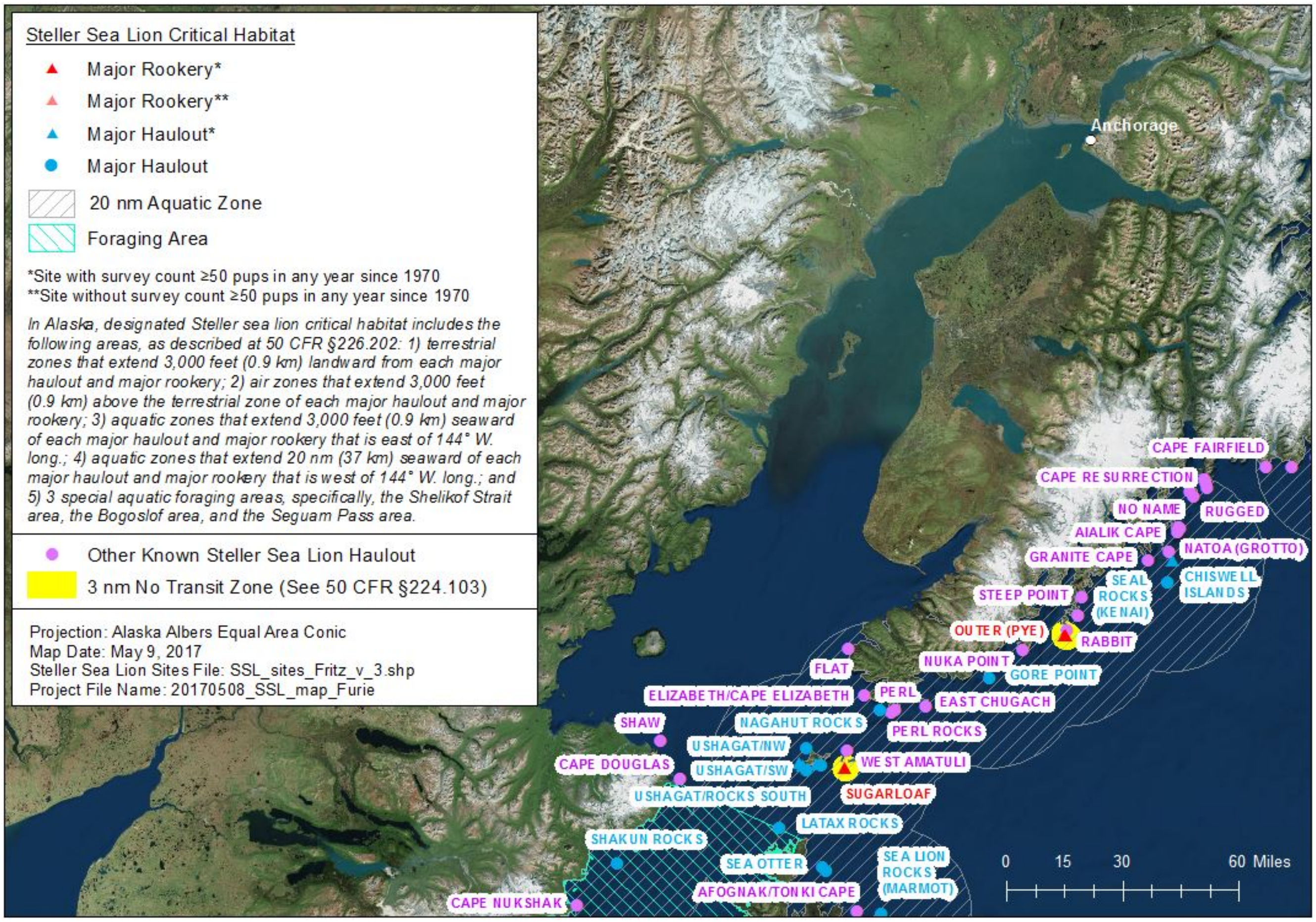

Figure 4. Steller sea lion critical habitat near Cook Inlet, Alaska.

4.2 Climate Change

One threat is or will be common to all of the species we discuss in this opinion: global climate change. Because of this commonality, we present this narrative here rather than in each of the species-specific narratives that follow.

The timeframe for the proposed action is June 2017 through October 2021 which is a relatively short duration. However, Alaska is experiencing rapid climate change with each new year and experiencing further decreases in ice cover and extensions of the open-water season.

The Fifth Assessment Synthesis Reports from the Working Groups on the Intergovernmental Panel on Climate Change (IPCC) conclude that climate change is unequivocal (IPCC 2013, 2014). The Report concludes oceans have warmed, with ocean warming the greatest near the surface (e.g., the upper 75 m have warmed by 0.11°C per decade over the period 1971 to 2010) (IPCC 2013, 2014). Global mean sea level rose by 0.19 m between 1901 and 2010, and the rate of sea level rise since the mid-nineteenth century has been greater than the mean rate during the previous 2 millennia (IPCC 2013). The IPCC projects a rise of the world's oceans from 0.26 to 0.98 meters by the end of the century, depending on the level of greenhouse gas emissions (Doney et al. 2012). Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (IPCC 2013, 2014). Further, ocean acidity has increased by 26% since the beginning of the industrial era (IPCC 2013) and this rise has been linked to climate change (Foreman and Yamanaka 2011, GAO 2014, Murray et al. 2014, Okey et al. 2014, Secretariat of the Convention on Biological Diversity 2014, Andersson et al. 2015). Climate change is also expected to increase the frequency of extreme weather and climate events including, but not limited to, cyclones, heat waves, and droughts (IPCC 2014). Climate change has the potential to impact species abundance, geographic distribution, migration patterns, timing of seasonal activities (IPCC 2014), and species viability into the future. Climate change is also expected to result in the expansion of low oxygen zones in the marine environment (Gilly et al. 2013). Though predicting the precise consequences of climate change on highly mobile marine species, such as many of those considered in this opinion, is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring.

Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012). Hazen et al. (2012) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. He predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses. MacLeod (2009) estimated, based upon expected shifts in water temperature, 88 percent of cetaceans would be affected by climate change, with 47 percent likely to be negatively affected.

For ESA-listed species that undergo long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperature regimes, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott. 2009). Low reproductive success and body condition in humpback whales may have resulted from the 1997/1998 El Niño (Cerchio et al. 2005).

Species that are shorter-lived, of larger body size, or generalist in nature are likely to be better able to adapt to climate change over the long term versus those that are longer-lived, smaller-sized, or rely upon specialized habitats (Purvis et al. 2000, Brashares 2003, Cardillo 2003, Cardillo et al. 2005, Issac 2009). Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Issac 2009). As such, we expect the risk of extinction to listed species to rise with the degree of climate shift associated with global warming. The limits to acclimatization or adaptation capacity are presently unknown. However, mass extinctions occurring during much slower rates of climate change in Earth history suggest that evolutionary rates in some organisms may not be fast enough to cope (IPCC 2014).

Foraging is not the only aspect that climate change could influence. Acevedo-Whitehouse and Duffus (2009) proposed that the rapidity of environmental changes, such as those resulting from global warming, can harm immunocompetence and reproductive parameters in wildlife to the detriment of population viability and persistence. Altered ranges can also result in the spread of novel diseases to new areas via shifts in host ranges (Simmonds and Eliott. 2009). It has also been suggested that increases in harmful algal blooms could be a result from increases in sea surface temperature (Simmonds and Eliott. 2009).

4.3 Status of Listed Species

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

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

4.4. Cook Inlet Beluga Whale

The endangered Cook Inlet beluga whale is the listed species most likely to be affected by this project, primarily from noise. In this opinion, we focus on aspects of beluga whale ecology that are relevant to the effects of this project.

4.4.1. Description and Status

The beluga whale is a small, toothed (Odontocete) whale in the family Monodontidae, a family shared with only the narwhal. Beluga whales are known as "white whales" because the adults are white. Beluga calves are born dark to brownish gray and lighten to white or yellow-white with age. Adult Cook Inlet beluga whales average between 3.6-4 m (12-14 ft.) in length, although Alaska Native hunters have reported some may grow to 6 m (20 ft.) (Huntington 2000).

A detailed description of the Cook Inlet beluga whales' biology, habitat and extinction risk factors may be found in the endangered listing rule for the species (73 FR 62919, October 22, 2008), the Conservation Plan for the Cook Inlet beluga whale (NMFS 2008) and the Recovery Plan (NMFS 2016). Additional information regarding Cook Inlet beluga whales can be found on the NMFS AKR web site at:
http://alaskafisheries.noaa.gov/protectedresources/whales/beluga.htm.

The Cook Inlet beluga whale population was estimated at 1,300 whales in 1979 (Calkins 1989), but experienced a dramatic decline in the 1990s. This decline was attributed to over-harvesting by subsistence hunting, which was then estimated to have removed 10 to 15 percent of the population per year. During 1994-1998 the population was documented to decline about 47 percent, from an estimated 653 to 347 whales (Hobbs et al. 2000). After measures were established in 1999 to regulate subsistence harvests, NMFS expected the population to grow at an annual rate of 2 to 6 percent. However, abundance estimates from the 1999-2008 aerial surveys showed the expected population growth did not occur. This led to the ESA listing of Cook Inlet beluga in 2008 (73 FR 62919), and designation of critical habitat in 2011 (76 FR 20180 April 11, 2011). Although only five Cook Inlet beluga whales have been harvested since 1999 and none since 2005, the population continues to decline. The 2014 population abundance estimate was 340 whales, indicating a 10 year decline of 0.4 percent per year (Shelden et al. 2015).

4.4.2. Range and Behavior

Cook Inlet beluga whales reside in Cook Inlet year-round, which makes them geographically and genetically isolated from other beluga whale stocks in Alaska (Allen and Angliss 2015). Within Cook Inlet, they generally occur in shallow, coastal waters, often in water barely deep enough to cover their bodies (Ridgway and Harrison 1981). Although beluga whales remain year-round in Cook Inlet, they demonstrate seasonal movements within the inlet. During the summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth *et al.* 2007). During the winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in the shallow waters along the west shore of Cook Inlet to Kamishak Bay. Some whales may also winter in and near Kachemak Bay.

Beluga whales are extremely social and often interact in close, dense groups. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1984; NMFS unpublished data). The only known observed occurrence of calving occurred in 2015 on the Susitna Delta (Dr. Tamara McGuire, LGL, Pers. Comm. March 27, 2017). Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Reeves *et al.* 2002).

Beginning in 1993, aerial surveys have been conducted annually or biennially in June and August by NMFS Marine Mammal Laboratory (NMFS 2008; Hobbs *et al*. 2011). Historic aerial surveys for beluga whales also were completed in the late 1970s and early 1980s (Harrison and Hall 1978; Murray and Fay 1979; Harza-Ebasco 1985). Results indicate that prior to the 1990s belugas used areas throughout the upper, mid, and lower Inlet during the spring, summer, and fall (Huntington 2000; Rugh *et al*. 2000; NMFS 2008; Rugh *et al*. 2010). The distribution has since contracted northeastward into upper Cook Inlet, which is especially evident in the summer range (see Figure 5) (Rugh *et al*. 2000; Speckman and Piatt 2000; Hobbs *et al*. 2008; NMFS 2008; Rugh *et al*. 2010 NMFS 2015a). The distributional shift coincided with the decline in abundance, and suggests the remaining belugas are congregating in preferred habitat (Moore *et al*. 2000; NMFS 2008; Goetz *et al*. 2012 NMFS 2015a). Groups of over 200 individuals, including adults, juveniles, and neonates, have been observed in the Susitna Delta area alone (Maguire *et al*. 2014). NMFS refers to this preferred summer-fall habitat as the Susitna Delta Exclusion zone and seeks to minimize human activity in this area of extreme importance to Cook Inlet beluga whale survival and recovery.

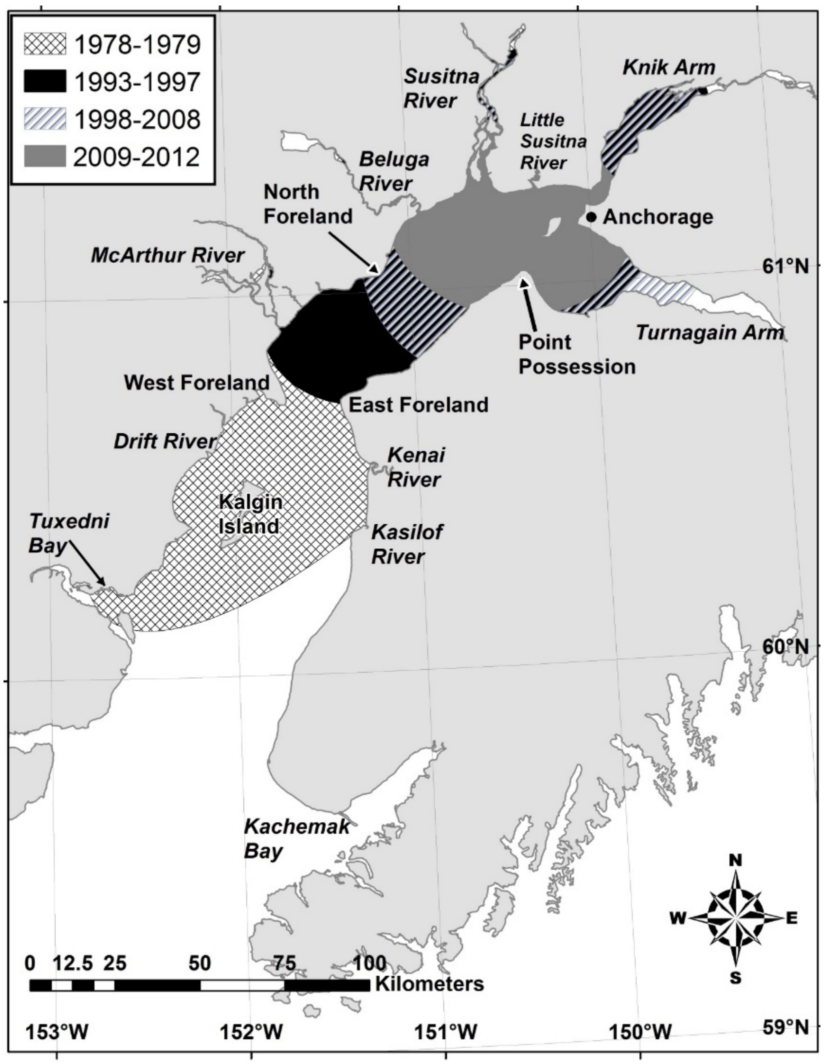

Figure 5. Summer range contraction over time as indicated by ADF&G and NMFS aerial surveys. Adapted from Shelden et al. 2015.

Goetz et al. (2012) modeled beluga use in Cook Inlet based on the NMFS aerial surveys conducted between 1994 and 2008. The combined model results indicate that lower densities of belugas are expected to occur in most of the pipeline survey area and the vicinity of the proposed marine terminal. However, beluga whales begin moving into Knik Arm around August 15, where they spend about a month feeding on Eagle River salmon. The area between Nikiski, Kenai, and Kalgin Island provides important wintering habitat for Cook Inlet beluga whales. Use of this area would be expected between fall and spring, with animals largely absent during the summer months when G&G surveys would occur (Goetz et al. 2012).

4.4.3. Hearing Ability

Like other odontocete cetaceans, beluga whales produce sounds for two overlapping functions: communication and echolocation. For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland et al. 2015), (well within the human hearing range), and the variety of audible whistles, squeals, clucks, mews, chirps, trills, and bell-like tones they produce have led to their nickname as sea canaries (ADFG 2015). At the other end of their hearing range, belugas use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au, 2000) to navigate and hunt in dark or turbid waters, where vision is limited. Belugas and other odontocetes make sounds across some of the widest frequency bands that have been measured in any animal group.

Even among odontocetes, beluga whales are known to be among the most adept users of sound. It is possible that the beluga whale's unfused vertebrae, and thus the highly movable head, have allowed adaptations for their sophisticated directional hearing. Awbrey *et al.* (1988) examined their hearing in octave steps between 125 Hz and 8 kHz, and found average hearing thresholds of 121 dB re1 µPa at 125 Hz and 65 dB re 1 µPa at 8 kHz. Johnson and McManus (1989), further examining beluga hearing at frequencies between 40 Hz and 125 kHz, found a hearing threshold of 140 dB re 1 µPa at 40 Hz. The lowest measured threshold (81 dB re 1 µPa) was at 4 kHz. Ridgway *et al*. (2001) measured hearing thresholds at various depths down to 984 ft (298 m) at frequencies between 500 Hz and 100 kHz and found that beluga whales showed unchanged hearing sensitivity at any measured depth. Finneran *et al.* (2005) described the auditory ranges of two belugas as 2 kHz to 130 kHz. Most of these studies measured beluga hearing in very quiet conditions. However, in Cook Inlet, tidal currents regularly produce ambient sound levels well above 100 dB (Lammers *et al.* 2013). Belugas' signal intensity can change with location and background noise levels (Au *et al.* 1985). In the first report of hearing ranges of belugas in the wild, results of Castellote *et al.* (2014) were similar to those reported for captive belugas, with most acute hearing at middle frequencies, about 10-75 kHz (Figure 2).

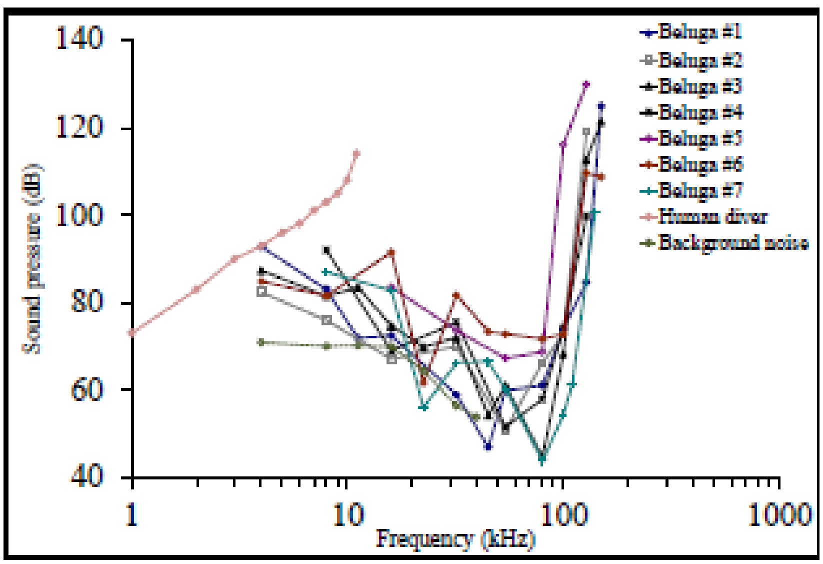

Figure 6. Audiograms of seven wild beluga whales; human diver audiogram and Bristol Bay background noise for comparison (from Castellote *et al.* 2014). Results indicate that beluga whales conduct echolocation at relatively high frequencies, where their hearing is most sensitive, and communicate at frequencies where their hearing sensitivity overlaps that of humans.

4.5 Fin Whale

4.5.1 Population Structure

Fin whales have two recognized subspecies: *B. p. physalus* occurs in the North Atlantic Ocean (Gambell 1985), while *B. p. quoyi* occurs in the Southern Ocean (Fischer 1829). Most experts consider the North Pacific fin whales a separate unnamed subspecies.

In the North Atlantic Ocean, the IWC recognizes seven management units or “stocks” of fin whales: (1) Nova Scotia, (2) Newfoundland-Labrador, (3) West Greenland, (4) East Greenland-Iceland, (5) North Norway, (6) West Norway-Faroe Islands, and (7) British Isles-Spain-Portugal. In addition, the population of fin whales that resides in the Ligurian Sea, in the northwestern Mediterranean Sea is believed to be genetically distinct from other fin whales populations (as used in this opinion, “populations” are isolated demographically, meaning, they are driven more by internal dynamics — birth and death processes — than by the geographic redistribution of individuals through immigration or emigration. Some usages of the term “stock” are synonymous with this definition of “population” while other usages of “stock” do not).

In U.S. Pacific waters, the IWC recognizes three “stocks”: (1) Alaska (Northeast Pacific), (2) California/Washington/Oregon, and (3) Hawaii (Allen and Angliss 2015). However, Mizroch et al. (2009) suggests that this structure should be reviewed and updated, if appropriate, to reflect current data which suggests there may be at least 6 populations of fin whales.

Regardless of how different authors structure the fin whale population, mark-recapture studies have demonstrate that individual fin whales migrate between management units (Mitchell 1974, Rice 1974), which suggests that these management units are not geographically isolated populations.

4.5.2 Distribution

Fin whales are distributed widely in every ocean except the Arctic Ocean (where they have only recently begun to appear). In the North Pacific Ocean, fin whales occur in summer foraging areas in the Chukchi Sea, the Sea of Okhotsk, around the Aleutian Islands, and the Gulf of Alaska; in the eastern Pacific, they occur south to California; in the western Pacific, they occur south to Japan. Fin whales in the eastern Pacific winter from California south; in the western Pacific, they winter from the Sea of Japan, the East China and Yellow Seas, and the Philippine Sea (Gambell 1985).

In the North Atlantic Ocean, fin whales occur in summer foraging areas from the coast of North America to the Arctic, around Greenland, Iceland, northern Norway, Jan Meyers, Spitzbergen, and the Barents Sea. In the western Atlantic, they winter from the edge of sea ice south to the Gulf of Mexico and the West Indies. In the eastern Atlantic, they winter from southern Norway, the Bay of Biscay, and Spain with some whales migrating into the Mediterranean Sea (Gambell 1985).

In the Southern Hemisphere, fin whales are distributed broadly south of 50° S in the summer and migrate into the Atlantic, Indian, and Pacific Oceans in the winter, along the coast of South America (as far north as Peru and Brazil), Africa, and the islands in Oceania north of Australia and New Zealand (Gambell 1985).

Mizroch et al. (2009) summarized information about the patterns of distribution and movements of fin whales in the North Pacific from whaling harvest records, scientific surveys, opportunistic sightings, acoustic data from offshore hydrophone arrays, and from recoveries of marked whales. Mizroch et al. (2009) notes that fin whales range from the Chukchi Sea south to 35° North on the Sanriku coast of Honshu., to the Subarctic boundary (ca. 42°) in the western and Central Pacific, and to 32° N off the coast of California. Berzin and Rovnin (1966) indicate historically “In the Chukchi Sea the finbacks periodically form aggregations in the region to the north of Cape Serdtse-Kamon’ along the Chukotka coast.”

Recent information on seasonal fin whale distribution has been gleaned from the reception of fin whale calls by bottom-mounted, offshore hydrophone arrays along the U.S. Pacific coast, in the central North Pacific, and in the western Aleutian Islands (Moore et al. 1998, Watkins et al. 2000, Moore et al. 2006, Stafford et al. 2007, Širović et al. 2013, Soule and Wilcock 2013). Moore et al. (1998, 2006), Watkins et al. (2000), and Stafford et al. (2007) all documented high levels of fin whale call rates along the U.S. Pacific coast beginning in August/September and lasting through February, suggesting that these may be important feeding areas during the winter. Fin whales have been acoustically detected in the Gulf of Alaska year-round, with highest call occurrence rates from August through December and lowest call occurrence rates from February through July (Moore et al. 2006, Stafford et al. 2007). However, fin whale sightings in Cook Inlet are rare. During the NMFS aerial surveys in 2001 through 2014, a total of nine groups (27 individuals) were reported, all of which were south of Kachemak Bay (Jacobs 2017).

4.5.3 Status

The fin whale was listed as an endangered species under the ESCA on December 2, 1970 (35 FR 18319), and continued to be listed as endangered following passage of the ESA (39 FR 41367). Fin whales are listed as endangered on the IUCN Red List of Threatened Animals (IUCN 2012). They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the MMPA. Critical habitat has not been designated for fin whales. A Final Recovery Plan for the Fin Whale (*Balaenoptera physalus*) was published on July 30, 2010 (NMFS 2010).

It is difficult to assess the current status of fin whales because (1) there is no general agreement on the size of the fin whale population prior to whaling and (2) estimates of the current size of the different fin whale populations vary widely. Prior to exploitation by commercial whalers, fin whales are thought to have numbered greater than 464,000 worldwide, and are now thought to number approximately 119,000 worldwide (Braham 1991).

Ohsumi and Wada (1974) estimated that the North Pacific fin whale population ranged from 42,000-45,000 before whaling began. Of this, the “American population” (i.e., the component centered in waters east of 180º W longitude), was estimated to be 25,000-27,000. Based on visual surveys, Moore *et al.* (2002) estimated 3,368 (CV=0.29) and 683 (CV=0.32) fin whales in the central eastern Bering Sea and southeastern Bering Sea, respectively, during summer surveys in 1999 and 2000. However, these estimates are considered provisional because they were never corrected for animals missed on the track line or that may have been submerged when the ship passed. Dedicated line transect cruises were conducted in coastal waters of western Alaska and the eastern and central Aleutian Islands in July-August 2001-2003 (Zerbini et al. 2009). Fin whale sightings (n = 276) were observed from east of Kodiak Island to Samalga Pass, with high aggregations recorded near the Semidi Islands. Zerbini et al. (2006) estimated that 1,652 (95% CI: 1,142-2,389) whales occurred in the area. An annual increase of 4.8% (95% CI: 4.1-5.4%) was estimated for the period of 1987-2003 (Allen and Angliss 2015).

The best estimate of the fin whale population west of the Kenai Peninsula is 1,368, the greater minimum estimates from the 2008 and 2010 surveys (Friday et al. 2013). This is a minimum estimate for the entire stock because it was estimated from surveys which covered only a small portion of the range of this stock.

The minimum estimate for the California/Oregon/Washington stock, as defined in the U.S. Pacific Marine Mammal Stock Assessments: 2008, is about 2,316 (Carretta et al. 2009). An increasing trend between1979/80 and 1993 was suggested by the available survey data, but it was not statistically significant (Barlow et al. 1997).

Similarly, estimates of the current size of the different fin whale populations and estimates of their global abundance also vary widely. The final recovery plan for fin whales accepts a minimum population estimate of 2,269 fin whales for the Western North Atlantic stock (NMFS 2010). However, based on data produced by surveys conducted between 1978-1982 and other data gathered between 1966 and 1989, Hain et al. (1992) estimated that the population of fin whales in the western North Atlantic Ocean (specifically, between Cape Hatteras, North Carolina, and Nova Scotia) numbered about 1,500 whales in the winter and 5,000 whales in the spring and summer. Because authors do not always reconcile “new” estimates with earlier estimates, it is not clear whether the current “best” estimate represents a refinement of the estimate that was based on older data or whether the fin whale population in the North Atlantic has declined by about 50% since the early 1980s.

The East Greenland-Iceland fin whale population was estimated at 10,000 animals (95 % confidence interval = 7,600- 14,200), based on surveys conducted in 1987 and 1989 (Buckland et al. 1992). The number of eastern Atlantic fin whales, which includes the British Isles-Spain-Portugal population, has been estimated at 17,000 animals (95% confidence interval = 10,400 - 28,900; (Buckland et al. 1992)). These estimates are both more than 15 years old and the data available do not allow us to determine if they remain valid.

Forcada et al. (1996) estimated the fin whale population in the western Mediterranean numbered 3,583 individuals (standard error = 967; 95% confidence interval = 2,130-6,027). This is similar to a more recent estimate published by Notarbartolo-di-Sciara et al. (2003). Within the Ligurian Sea, which includes the Pelagos Sanctuary for Marine Mammals and the Gulf of Lions, the fin whale population was estimated to number 901 (standard error = 196.1) whales (Forcada et al. 1995).

Regardless of which of these estimates, if any, have the closest correspondence to the actual size and trend of the fin whale population, all of these estimates suggest that the global population of fin whales consists of tens of thousands of individuals and that the North Pacific population consists of at least 5,000 individuals. Based on ecological theory and demographic patterns derived from several hundred imperiled species and populations, fin whales appear to exist at population sizes that are large enough to avoid demographic phenomena that are known to increase the extinction probability of species that exist as "small" populations (that is, "small" populations experience phenomena such as demographic stochasticity, inbreeding depression, Allee effects, among others, that cause their population size to become a threat in and of itself). As a result, we assume that fin whales are likely to be threatened more by exogenous threats such as anthropogenic activities (primarily whaling, entanglement, and ship strikes) or natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate) than endogenous threats caused by the small size of their population.

Nevertheless, based on the evidence available, the number of fin whales that are recorded to have been killed or injured in the past 20 years by human activities or natural phenomena, does not appear to be increasing the extinction probability of fin whales, although it may slow the rate at which they recover from population declines that were caused by commercial whaling.

4.5.4 Feeding and Prey Selection

In the North Pacific overall, fin whales prefer euphausiids (mainly *Euphausia pacifica*, *Thysanoessa longipes*, *T. spinifera*, and *T. inermis*) and large copepods (mainly *Calanus cristatus*), followed by schooling fish such as herring, walleye Pollock (*Theragra chalcogramma*), and capelin (Nemoto 1970, Kawamura 1982).

A migratory species, fin whales generally spend the spring and early summer feeding in cold, high latitude waters as far north as the Chukchi Sea, with regular feeding grounds in the Gulf of Alaska, Prince William Sound, along the Aleutian Islands, and around Kodiak Island, primarily on the western side. In the fall, fin whales tend to return to low latitudes for the winter breeding season, though some may remain in residence in their high latitude ranges if food resources remain plentiful. In the eastern Pacific, fin whales typically spend the winter off the central California coast and into the Gulf of Alaska. Panigada et al. (2006) found water depth to be the most significant variable in describing fin whale distribution, with more than 90% of sightings occurring in waters deeper than 2,000 m.

Feeding may occur in waters as shallow as 10 m when prey are at the surface, but most foraging is observed in high-productivity, upwelling, or thermal front marine waters (Gaskin 1972, Sergeant 1977, Nature Conservancy Council 1979 as cited in ONR 2001, Panigada et al. 2008).

4.5.5 Diving and Social Behavior

The percentage of time fin whales spend at the surface varies. Some authors have reported that fin whales make 5-20 shallow dives with each of these dive lasting 13-20 seconds followed by a deep dive lasting between 1.5 and 15 minutes (Gambell 1985, Stone et al. 1992, Lafortuna et al. 2003). Other authors have reported that the fin whale's most common dives last between 2 and 6 minutes, with 2 to 8 blows between dives (Watkins 1981, Hain et al. 1992). The most recent data support average dives of 98 m and 6.3 min for foraging fin whales, while non-foraging dives are 59 m and 4.2 min (Croll et al. 2001). However, Lafortuna *et al.* (1999) found that foraging fin whales have a higher blow rate than when traveling. Foraging dives in excess of 150 m are known (Panigada et al. 1999). In waters off the U.S. Atlantic Coast, individuals or duos represented about 75 percent of sightings during the Cetacean and Turtle Assessment Program (Hain et al. 1992). Barlow (2003) reported mean group sizes of 1.1–4.0 during surveys off California, Oregon, and Washington.

There is considerable variation in grouping frequency by region. In general, fin whales, like all baleen whales, are not very socially organized, and most fin whales are observed as singles. Fin whales are also sometimes seen in social groups that can number 2 to 7 individuals. However, up to 50, and occasionally as many as 300, can travel together on migrations (NMFS 2010).

In waters off the Atlantic Coast of the U.S. individual fin whales or pairs represented about 75% of the fin whales observed during the Cetacean and Turtle Assessment Program (Hain et al. 1992). Individual whales or groups of less than five individuals represented about 90% of the observations (out of 2,065 observations of fin whales, the mean group size was 2.9, the modal value was 1, and the range was 1 – 65 individuals; (Hain et al. 1992)). Fin whales in the Cook Inlet have only been observed as individuals or in small groups.

4.5.6 Vocalizations and Hearing

The sounds fin whales produce underwater are one of the most studied *Balaenoptera* sounds. Fin whales produce a variety of low-frequency sounds in the 10-200 Hz band (Watkins 1981, Watkins et al. 1987, Edds 1988, Thompson et al. 1992). The most typical signals are long, patterned sequences of short duration (0.5-2s) infrasonic pulses in the 18-35 Hz range (Patterson and Hamilton 1964). Estimated source levels for fin whales are 140-200 dB re 1 µPa m (Patterson and Hamilton 1964, Watkins et al. 1987, Thompson et al. 1992, McDonald et al. 1995, Clark and Gagnon 2004). In temperate waters intense bouts of long patterned sounds are very common from fall through spring, but also occur to a lesser extent during the summer in high latitude feeding areas (Clark and Charif 1998). Short sequences of rapid pulses in the 20-70 Hz band are associated with animals in social groups (McDonald et al. 1995), Clark personal communication, McDonald personal communication). Each pulse lasts on the order of one second and contains twenty cycles (Tyack 1999).

During the breeding season, fin whales produce a series of pulses in a regularly repeating pattern. These bouts of pulsing may last for longer than one day (Tyack 1999). The seasonality and stereotype of the bouts of patterned sounds suggest that these sounds are male reproductive displays (Watkins et al. 1987), while the individual counter calling data of McDonald et al. (1995) suggest that the more variable calls are contact calls. Some authors feel there are geographic differences in the frequency, duration and repetition of the pulses (Thompson et al. 1992).

As with other vocalizations produced by baleen whales, the function of fin whale vocalizations is unknown, although there are numerous hypotheses (which include: maintenance of inter-individual distance, species and individual recognition, contextual information transmission, maintenance of social organization, location of topographic features, and location of prey resources; see the review by (Thompson et al. 1992) for more information on these hypotheses). Responses to conspecific sounds have been demonstrated in a number of mysticetes, and there is no reason to believe that fin whales do not communicate similarly (Edds-Walton 1997). The low-frequency sounds produced by fin whales have the potential to travel over long distances, and it is possible that long-distance communication occurs in fin whales (Payne and Webb 1971, Edds-Walton 1997). Also, there is speculation that the sounds may function for long-range echolocation of large-scale geographic targets such as seamounts, which might be used for orientation and navigation (Tyack 1999).

While there is no direct data on hearing in low-frequency cetaceans, the applied frequency range is anticipated to be between 7 Hz to 35 kHz (NMFS 2016c).

Baleen whales have inner ears that appear to be specialized for low-frequency hearing. In a study of the morphology of the mysticete auditory apparatus, Ketten (1997) hypothesized that large mysticetes have acute infrasonic hearing. Synthetic audiograms produced by applying models to X-ray computed tomography scans of a fin whale calf skull indicate the range of best hearing for fin whale calves to range from approximately 0.02 to 10 kHz, with maximum sensitivities between 1 to 2 kHz (Cranford and Krysl 2015).

4.6 Western North Pacific DPS and Mexico DPS Humpback Whale

4.6.1 Population Structure and Status

NMFS currently recognizes four stocks of humpback whales in the North Pacific:

- Western North Pacific stock
- Central North Pacific stock
- California/Oregon/Washington stock
- American Samoa stock

Under the stock structure, humpback whales in the action area may belong to either the western or central North Pacific stocks.

The humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA) on December 2, 1970 (35 FR 18319). Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered. NMFS recently conducted a global status review and changed the status of humpback whales under the ESA. The Western North Pacific DPS (which includes a small proportion of humpback whales found in the action area) is listed as endangered; the Mexico DPS (which includes a small proportion of humpback whales found in the action area) is listed as threatened; and the Hawaii DPS (which includes most humpback whales found in the action area) is not listed (81 FR 62260; September 8, 2016). Critical habitat has not been designated for the Western North Pacific or Mexico DPSs.

The abundance estimate for humpback whales in the Gulf of Alaska is estimated to be 2,089 (CV=0.09) animals which includes whales from the Hawaii DPS (89%), Mexico DPS (10.5%), and Western North Pacific DPS (0.5%[1]) (NMFS 2016a, Wade et al. 2016) (see Table 6).

[1] For endangered Western North Pacific DPS we chose the upper limit of the 95% confidence interval from the Wade et al. (2016) estimate in order to be conservative due to their status.

Humpback whales occur throughout the central and western Gulf of Alaska from Prince William Sound to the Shumagin Islands. Seasonal concentrations are found in coastal waters of Prince William Sound, Barren Islands, Kodiak Archipelago, Shumagin Islands and south of the Alaska Peninsula. Large numbers of humpbacks have also been reported in waters over the continental shelf, extending up to 100 nm offshore in the western Gulf of Alaska (Wade et al. 2016).

The WNP DPS humpbacks is comprised of approximately 1,059 animals (CV=0.08) (Wade et al. 2016). The population trend for the WNP DPS is unknown. Humpback whales in the WNP remain rare in some parts of their former range, such as the coastal waters of Korea, and have shown little signs of recovery in those locations. The Mexico DPS is threatened, and is comprised of approximately 3,264 animals (CV=0.06) (Wade et al. 2016) with an unknown, but likely declining, population trend (81 FR 62260). The Hawaii DPS is not listed under the ESA, and is comprised of 11,398 animals (CV=0.04). The annual growth rate of the proposed Hawaii DPS was estimated to be between 5.5 and 6.0 percent.

Whales from these three DPSs overlap on feeding grounds off Alaska, and are visually indistinguishable. All waters off the coast of Alaska may contain ESA-listed humpbacks.

Table 6. Probability of encountering humpback whales from each DPS in the North Pacific Ocean (columns) in various feeding areas (on left). Adapted from Wade et al. (2016).

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

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

4.6.2 Distribution

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

In recent years, humpback whales have been regularly observed in lower and mid Cook Inlet, especially in the vicinity of Elizabeth Island, Iniskin and Kachemak Bays and north of Anchor Point (Shelden et al. 2013). Of a total 83 humpback whales observed by NMFS during Cook Inlet beluga aerial surveys conducted from 1993-2012, only 5 were observed as far north as the Anchor Point area (Shelden et al. 2013), which is about 90 miles south of the action area.

Marine mammal observers during the 2013 marine mammal monitoring program at Cosmopolitan State well site #A-1, about 80 miles south of the proposed action area, reported 29 sightings of 48 humpback whales, although most of these animals were observed at a distance well south of the well site and none was recorded inside an active harassment zone (Owl Ridge 2014). Similarly, Shelden et al. (2015) observed four humpbacks, all in lower Cook Inlet (well south of the project area) during 2014 beluga surveys (Figure 4). During the 2014 Apache seismic surveys in Cook Inlet, a total of five groups (six individuals) were spotted by the marine mammal observers (Lomac-MacNair et al. 2014). During marine mammal monitoring conducted during the installation of Furie's gas platform the Julius R. in May and June of 2015, qualified PSOs observed two humpback whales (Jacobs 2017). Although there were opportunistic sightings of a single humpback (or mother-calf pair) in the vicinity of Turnagain Arm in 2014 (NMFS 2016), this observation is considered an anomaly. Shortly after these observations were made, a dead humpback, likely the same animal, was found in the same area, suggesting that this anomalous animal may have entered the area in a compromised state.

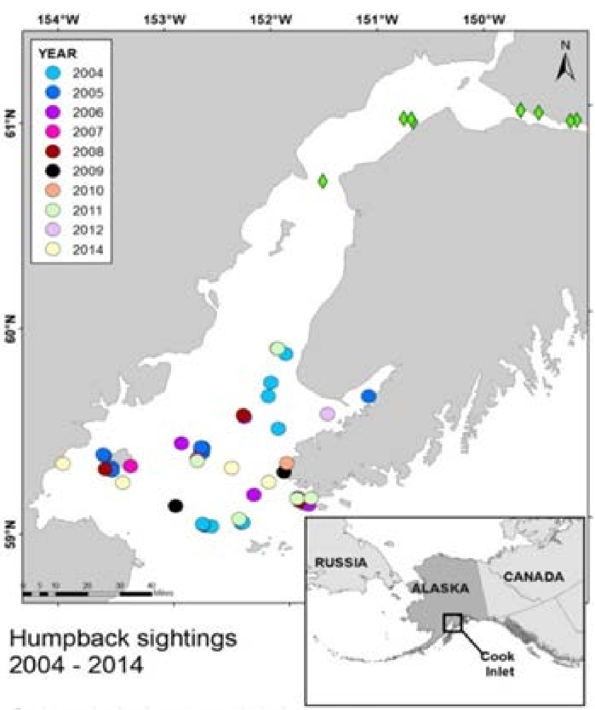

Figure 7. Humpback whale observations, as documented in Cook Inlet, 1994-2014. Green diamonds indicate opportunistic (and anomalous) sightings of a single whale, or possibly of an adult whale and calf, during April 25-May 1, 2014. Map created 3/12/2015 by Linda Vate Brattstrom, Marine Mammal Lab, NMFS, NOAA.

4.6.3 Vocalizations and Hearing

Humpback whales produce a variety of vocalizations ranging from 20 Hz to 10 kHz (Winn et al. 1970b, Tyack and Whitehead 1983a, Payne and Payne 1985, Silber 1986c, Thompson et al. 1986a, Richardson et al. 1995b, Au 2000, Frazer and Mercado III 2000, Erbe 2002, Au et al. 2006b, Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2016c).

During the breeding season males sing long, complex songs, with frequencies in the 20-5000 Hz range and intensities as high as 181 dB (Payne 1970, Winn et al. 1970a, Thompson et al. 1986b). Source levels average 155 dB and range from 144 to 174 dB (Thompson et al. 1979). The songs appear to have an effective range of approximately 10 to 20 km. Animals in mating groups produce a variety of sounds (Tyack 1981, Silber 1986b).

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

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

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

1. Complex songs with components ranging from at least 20 Hz–5 kHz with estimated source levels from 144– 174 dB; these are mostly sung by males on the breeding grounds (Winn et al. 1970a, Richardson et al. 1995a, Au et al. 2000, Frazer and Mercado 2000, Au et al. 2006a);

2. Social sounds in the breeding areas that extend from 50Hz – more than 10 kHz with most energy below 3kHz (Tyack and Whitehead 1983b, Richardson et al. 1995a); and

3. Feeding area vocalizations that are less frequent, but tend to be 20 Hz–2 kHz with estimated sources levels in excess of 175 dB re 1 Pa at 1m (Thompson et al. 1986b, Richardson et al. 1995a).

Additional information on humpback whale biology and natural history is available at:
http://www.nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html
http://alaskafisheries.noaa.gov/pr/humpback
http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/alaska/2015/ak2015_humpback-cnp.pdf

4.7 Western DPS Steller Sea Lions

Western DPS Steller sea lions occur in the project area, but in very low numbers (on the order of a few animals reported per year, and often no animals reported in a given year). As with Cook Inlet beluga whales, we focus in this opinion on aspects of western DPS Steller sea lion ecology that are relevant to the effects of this project.

4.7.1 Description and Status

Steller sea lions belong to the family Otariidae, which includes fur seals (*Callorhinus ursinus*). Steller sea lions are the largest otariid and show marked sexual dimorphism with males 2-3 times larger than females. On average, adult males weigh 566 kg (1,248 lbs.) and adult females are much smaller, weighing on average 263 kg (580 lbs.; Fiscus 1961; Calkins and Pitcher 1982; Winship *et al*. 2001).

The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345). At that time, the eastern DPS was listed as threatened, and the western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66139). Information on Steller sea lion biology, threats, and habitat (including critical habitat) is available online at: http://alaskafisheries.noaa.gov/protectedresources/stellers/default.htm and in the revised Steller Sea Lion Recovery Plan (NMFS 2008), which can be accessed at: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf .

Numbers of Steller sea lions declined dramatically throughout much of the species' range, beginning in the mid- to late 1970s (Braham *et al.* 1980, Merrick et al. 1987, NMFS 1992, NMFS 1995). For two decades prior to the decline, the estimated total population was 250,000 to 300,000 animals (Kenyon and Rice 1961, Loughlin et al. 1984). The population estimate declined by 50-60 percent to about 116,000 animals by 1989 (NMFS 1992), and by an additional 15 percent by 1994, with the entire decline occurring in the range of the western DPS.

The 2015 Stock Assessment Report for the western DPS of Steller sea lions indicates a minimum population estimate of 49,497 individuals (Allen and Angliss 2015). The population trend of non-pup western DPS Steller sea lions from 2000-2014 varies regionally, from -7.10 percent per year in the Western Aleutians to +5.22 percent per year in the eastern Gulf of Alaska. Despite incomplete surveys conducted in 2006 and 2007, the available data indicate that the western Steller sea lion DPS has at least been stable since 2004 (when the last complete assessment was done), although declines continue in the western Aleutian Islands. Overall, the western DPS Steller sea lion population (non-pups only) was estimated to be increasing at about 2.17 percent per year from 2000-2014 (Allen and Angliss 2014). In the region of this project (150^{o}-158^{o}), the population of non-pups is increasing at 2.61percent per year, while the number of pups counted are increasing at 2.14 percent per year.

4.7.2 Distribution

The range of the Steller sea lion extends across the rim of the North Pacific Ocean, from northern Japan, the Kuril Islands and the Okhotsk Sea, through the Aleutian Islands and Bering Sea, along Alaska's southern coast, and as far south as the California Channel Islands (NMFS 2008c). The eastern DPS includes sea lions born on rookeries from California north through Southeast Alaska; the western DPS includes those animals born on rookeries from Prince William Sound westward, with an eastern boundary set at 144^{o}W (Figure 4**).**

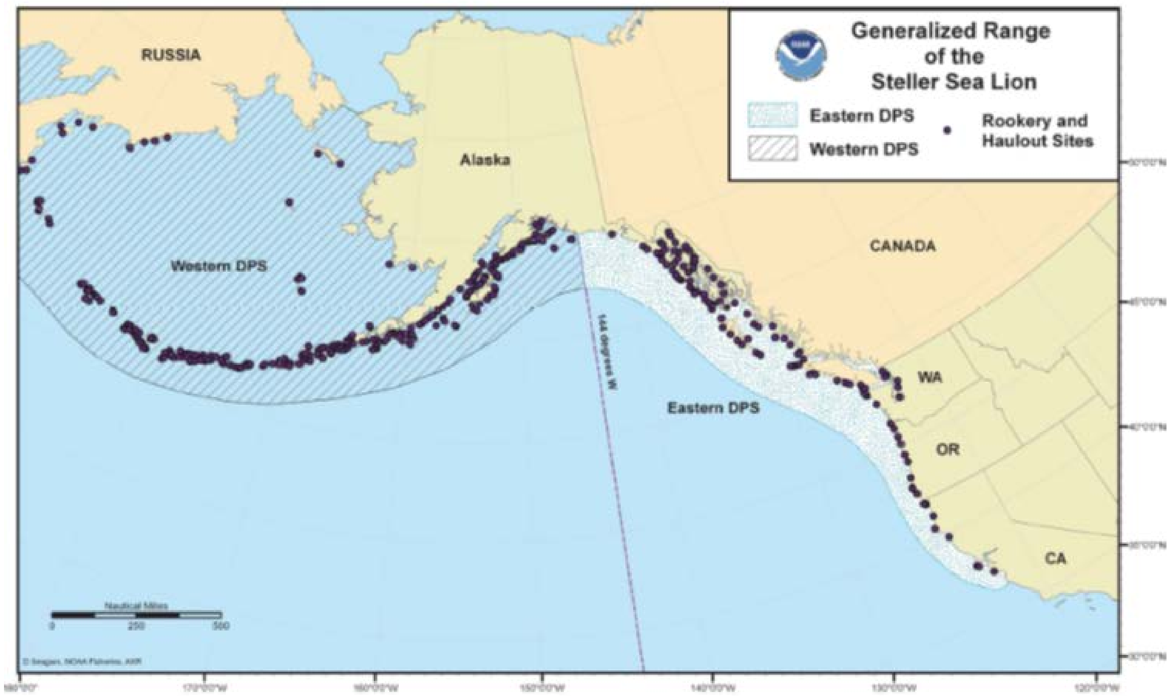

Figure 8. Range of the Steller sea lion.

The western DPS of Steller sea lion is the only population anticipated to be in the action area with the potential to be exposed to project related stressors.

Rugh et al. (2005) and Shelden et al. (2013) noted counts of Steller sea lions in lower Cook Inlet, with concentrations on Elizabeth Island, Shaw Island, Akumwarvik Bay and Iniskin to Chinitna Bays; all well south of the Kitchen Lights Unit, but closer to the southern portions of the action area potentially impacted by tug, rig, and vessel movement along routes that would take the Yost to overwintering ports in Homer or Port Graham. Although opportunistic sightings reported to NMFS have sporadically documented single Steller sea lions in Knik or Turnagain Arms, these are likely the occasional individual animal wandering into Cook Inlet river mouths during spring and summer periods to seek seasonal runs of eulachon or salmon.

4.7.3 Diving, Hauling out, Social Behavior

Steller sea lions tend to make shallow dives of less than 250 meters (820 feet) but are capable of deeper dives (NMFS 2008b). Female foraging trips during winter tend to be longer (130 kilometers) and dives are deeper (frequently greater than 250 meters). Summer foraging dives, on the other hand, tend to be closer to shore (about 16 kilometers) and shallower (100-250 meters) (Merrick and Loughlin 1997). Adult females stay with their pups for a few days after birth before beginning a regular routine of alternating foraging trips at sea with nursing their pups on land. Female Steller sea lions use smell and distinct vocalizations to recognize and create strong social bonds with their newborn pups.

Steller sea lions do not migrate, but they often disperse widely outside of the breeding season (Loughlin 1997). Because of their polygynous breeding behavior, in which individual, adult male sea lions will breed with a large number of adult females, Steller sea lions have clearly-defined social interactions. Steller sea lions are gregarious animals that often travel or haul out in large groups of up to 45 individuals (Keple 2002). At sea, groups usually consist of females and subadult males as adult males are usually solitary (Loughlin 2002). King (1983) reported rafts of several hundred Steller sea lions adjacent to haulouts.

4.7.4 Vocalizations and Hearing

Gentry (1970) and Sandegren (1970) described a suite of sounds that Steller sea lions form while on their rookeries and haulouts. These sounds include threat displays, vocal exchanges between mothers and pups, and a series of roars and hisses. Poulter and DelCarlo (1971) reported that Steller sea lions produce clicks, growls, and bleats underwater.

On land, territorial male Steller sea lions usually produce low frequency roars (Loughlin et al. 1987). The calls of females range from 30 Hz to 3 kHz, with peak frequencies from 150 Hz to 1 kHz for 1.0 to 1.5 seconds.

Kastelein et al. (2005) also described the underwater vocalizations of Steller sea lions, which include belches, barks, and clicks. The underwater audiogram of the male Steller sea lion in their study had a maximum hearing sensitivity at 77 dB RL at 1kHz. His range of best hearing, at 10dB from the maximum sensitivity, was between 1 and16 kHz. His average pre-stimulus responses occurred at low frequency signals. The female Steller sea lion's maximum hearing sensitivity, at 73 dB received level, occurred at 25 kHz. These authors concluded that low frequency sounds are audible to Steller sea lions. However, because of the small number of animals tested, the findings could not be attributed to individual differences in sensitivity or sexual dimorphism (Kastelein et al. 2005).

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2016c) (see Figure 9).

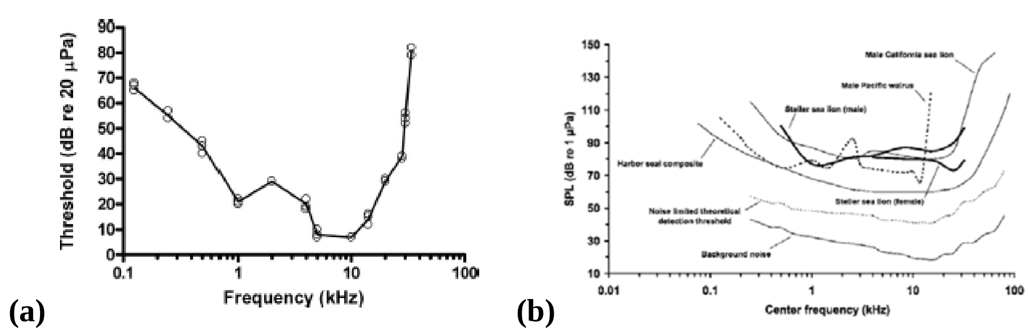

Figure 9. Underwater and aerial audiograms for Steller sea lions: (a) Muslow and Reichmuth (2010) for juvenile, aerial; (b) Kastelein *et al*. 2005 for adult male and female, underwater [audiograms of harbor seal, California sea lion and walrus for comparison].

5. ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

This section discusses the environmental baseline with respect to all species that may be adversely affected by the proposed action, with a particular focus on existing ongoing activities that may affect Cook Inlet beluga whales or their critical habitat, because that is the species most likely to be affected by the proposed action. Although some of the activities discussed below are outside the action area, they may still have an influence on the beluga whales or their habitat in the action area.

Cook Inlet beluga whales may be impacted by a number of anthropogenic activities present in upper and mid-Cook Inlet (between the Forelands to just north of Tyonek (Figure 11). Construction noise in Cook Inlet associated with coastal development includes dredging (e.g., at the Port of Anchorage), and pile driving (e.g., at the Port of Anchorage, Anchorage boat launch, Port MacKenzie, Homer harbor and several small projects in the Kachemak Bay area).

Table 7. Synopsis of environmental baseline threats to Cook Inlet beluga whales that are entirely or partially anthropogenic in nature. Over 61 percent of Alaska's human population (735,601) resides within southcentral Alaska or the Cook Inlet region. The Alaska Department of Labor and Workforce Development 2014 population estimate for the Municipality of Anchorage was 300,9549, for the Matanuska-Susitna Borough was 98,063 and for Kenai Peninsula Borough, 57,212 (ADOLWD 2015). The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with, including: coastal and marine development, ship strikes, noise pollution, water pollution, prey reduction, direct mortalities, and research, in addition to factors operating on a larger scale such as predation, disease, and environmental change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats (NMFS 1991; 2008b, 2015b). Anthropogenic risk factors are discussed individually below.

5.1. Coastal Development

Beluga whales and Steller sea lions use nearshore environments to rest, feed, and breed and thus could be affected by any coastal development that impacts these activities. Coastline development can lead to both direct loss habitat loss from construction of roads, housing or other shoreline developments, or indirect loss associated with bridges, boat traffic, in-water noise, and discharges that affect water quality. For the most part, the Cook Inlet shoreline is undeveloped, but there are a number of port facilities, airports, housing developments, wastewater treatment plants, roads, and railroads that occur along or close to the shoreline. Knik Arm supports the largest port and military base in the state, and there are numerous offshore oil and gas platforms between the Forelands to just north of Tyonek (Figure 11). Construction noise in Cook Inlet associated with coastal development includes dredging (e.g., at the Port of Anchorage), and pile driving (e.g., at the Port of Anchorage, Anchorage boat launch, Port MacKenzie, Homer harbor and several small projects in the Kachemak Bay area).

Table 7. Synopsis of environmental baseline threats to Cook Inlet beluga whales that are entirely or partially anthropogenic in nature.

Threat Type	Past Mortality?	Likely to adversely affect?	Significance of threat to population[1]
Coastal development	None known	Yes	Medium
Marine-based oil and gas development	None known	Yes	Low
Transmission lines	None known	Unknown	Low
Ambient noise	None known	No	Low
Oil and Gas industrial noise	None known	Unknown	Low
Vessel noise	None known	Unknown	Low
Seismic exploration noise	None known	Yes	High
Aircraft noise	None known	Unknown	Low
Coastal development noise	None known	Unknown	Medium
Water quality	None known	Unknown	Low
Contaminants	None known	Unknown	Low
Stormwater runoff	None known	Unknown	Unknown
Aircraft de-icing	None known	Unknown	Unknown
Ballast water	None known	Unknown	High
Point-source releases	None known	Yes	High
Fishery interactions	None known	Unknown	Medium/High
Incidental take in fisheries	None known	No	Low
Poaching or illegal harassment	None known	Unknown	Medium
Subsistence harvest	High	Yes	Low
Live strandings	Moderate	Yes	High
Predation	Low	Yes	High
Ship strikes	Suspected	Yes	Medium
Research	Low	Yes	Low
Environmental change	None known	Unknown	Unknown

[1]Represents level of relative concern from Cook Inlet Beluga Recovery Plan (NMFS 2016).

5.1.1 Road Construction

Alaska Department of Transportation undertook Seward Highway improvements from Mile 75 to 107 beginning in 2015. These activities include geophysical and geotechnical testing, on-shore blasting, pile removal and installation at stream crossings, and fill placed into Turnagain Arm to facilitate roadway straightening. It also included construction of a restricted-access boat ramp at Windy Point for emergency response, but which will also serve as an easy-access point for non-motorized water sports such as wind surfing and kite surfing.

During marine mammal monitoring efforts, Beluga whales were observed on 15 of the 16 days of monitoring at Twentymile Bridge; (6 April–23 April). Beluga whales were also observed twice on two separate days during both high tides at the Twentymile River. Even though no in-water activities occurred at night (at Twentymile Bridge), roadway flaggers present throughout the night mentioned they could hear beluga whales breathing during nighttime hours. Beluga whales were initially observed from the Twentymile River observation location a maximum of 2 hours and 9 minutes prior to the estimated high tide at Twentymile River. During the 2015 season, there were 18 observations of beluga whale groups, with each group size ranging from 3 to 30 animals. On thirteen occasions, in-water work was shut down due to the presence of beluga whales. On three additional occasions, work was already shutdown for other stop-work occurrences, including changes in drilling holes, shifts ending, equipment breakdown delays, weather conditions, or other reasons when beluga whales were initially sighted. Shutdowns typically occurred when beluga whales were at the mouth of Twentymile River to ensure the animals did not enter the harassment zone during in-water activities (HDR 2015). No takes of listed species were reported to have occurred during project activities.

5.1.2. Port Facilities

Cook Inlet has port facilities at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham; barge landings are present at Tyonek, Drift River, and Anchor Point. Anchorage has a small boat ramp near Ship Creek; the only hardened public access boat ramp in Upper Cook Inlet. Access to Cook Inlet can be obtained through numerous other boat launch sites, however (e.g. beach launch at Tyonek, Captain Sook State Recreation Area, City of Kenai boat launch, multiple boat launch locations near the mouth of the Kenai River, and Kasilof River State Recreation Site).

Port of Anchorage

The Port of Anchorage (POA) is Alaska's largest seaport and provides 90 percent of the consumer goods for about 85 percent of all of Alaska. It includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, and a small craft floating dock, plus 220 acres of land facility. About 450 ships or tug/barges call at the POA each year. Operations began at the POA in 1961 with a single berth. Since then, the POA has expanded to a terminal with five berths that moves more than four million tons of material across its docks each year (POA 2009). The Port of Anchorage is in the process of expanding. During the POA sheet pile driving activities between 2009 and 2011, 40 beluga whales were observed within the designated 160 dB disturbance zones, ranging from a high of 23 in 2009 to a low of 4 in 2011. A single Steller sea lion was sighted at the facility in 2009, and take of this animal was reportedly avoided by shutting down the pile driving activity. During 2016, the POA conducted a test-pile program to evaluate sound attenuation devices for potential use on the many piles they plan to drive during future port expansion efforts. During the course of this project, belugas entered the level B exclusion zone on 9 occasions, with 7 of those occurrences taking place on a single day (May 25, 2016). Only one 4-minute delay of start of operations was necessitated to avoid prohibited takes of belugas, and one authorized instance of level B harassment occurred, affecting a single whale (Cornick and Seagars 2016). Phase one of the expansion (upgrades to the petroleum and cement terminals) is expected to begin in 2018, as is shoreline stabilization in the northern port area.

Maintenance dredging at POA began in 1965, and is an ongoing activity from May through November in most years, affecting about 100 acres of substrate per year. Dredging at the POA does not seem to be a source of re-suspended contaminants (USACE 2005, 2008), and belugas often pass near the dredge, apparently undisturbed by its perennial presence.

Castellote et al. (2016) reports the following regarding potential acoustic impacts of anthropogenic activities near the Port of Anchorage.

> Weekly mean of daily beluga DPH from Cairn Point, Point MacKenzie, and Six Mile are surprisingly low compared to the DPH obtained in the upper part of Knik Arm. Saxon Kendall (2013) suggested that belugas might be displaced from the east side of the lower Knik arm due to construction activities at the Port of Anchorage, or that belugas might reduce their vocal activity when transiting through this area, or that beluga acoustic signals might be masked by anthropogenic noise. There is evidence of a decrease or even a cessation of acoustic activity of belugas in the presence of natural predators (i.e., killer whales) or engine noise disturbance. This acoustic response has been observed in both captive and free-ranging belugas and has been interpreted as a survival strategy to avoid detection by predators (Morgan 1979; Lésage et al., 1999; Castellote and Fossa 2006). Therefore, a reduction in acoustic detections could be plausible in areas of high anthropogenic noise, such as the lower Knik Arm.

Port MacKenzie

Port MacKenzie is along western lower Knik Arm and development began in 2000 with the construction of a barge dock. Additional construction has occurred since then and Port MacKenzie currently consists of a 152 m (500 ft.) bulkhead barge dock, a 366 m (1,200 ft.) deep draft dock with a conveyor system, a landing ramp, and more than 8,000 acres of adjacent uplands. Current operations at Port MacKenzie include dry bulk cargo movement and storage. The seawall to this port has failed twice (in the winter of 2015-2016 and 2016-2017), necessitating emergency pile driving and other repair measures to avoid additional loss of fill and damage to sheet piles. Emergency consultations occurred after much of the repair work had been completed. However, during April 2016, marine mammal monitoring occurred on site during pile driving operations. Observers recorded belugas in or near the pile driving exclusion zone on 12 occasions on 7 days from April 18-26. However, no pile driving was actively occurring during any of these close approaches, so no takes occurred and no shut-downs were ordered (Tutka LLC 2016).

Other Ports

The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shore-side tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. In 2009, a volcanic eruption of Mt. Redoubt forced the evacuation of the terminal and an eventual draw-down of oil stored on-site. Hilcorp Alaska bought the facility in 2012 and, after numerous improvements, partially reopened the facility to oil storage and tanker loading operations.

Nikiski is home to several privately owned docks. Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, sulfuric acid, petroleum products, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its dock in Nikiski, referred to as the Rig Tenders Dock, in anticipation of increased oil and gas activity in Cook Inlet and to serve activities in the Chukchi and Beaufort seas.

Ladd Landing beach, located on the Western Cook Inlet near Tyonek, serves as public access to the Three Mile Subdivision, and as a staging area for various commercial fishing sites in the area.

Western DPS Steller sea lions are affected by activities at ports throughout their range, especially where fish processing and noise overlap, such as in Kodiak harbor and in the Unalaska/ Dutch Harbor area.

5.2. Oil and Gas Development

Cook Inlet provides natural gas to the State's largest population centers. Platforms, pipelines, and tankers represent potential sources of spills. Lease sales for oil and gas development in Cook Inlet began in 1959 (ADNR 2014). Prior to the lease sales, there were attempts at oil exploration along the west side of Cook Inlet. By the late 1960s, 14 offshore oil production facilities were installed in upper Cook Inlet; therefore most Cook Inlet platforms and much of the associated infrastructure is more than 40 years old.

Today, there are 16 platforms in Cook Inlet (ADNR 2015), 12 of which are actively producing oil and gas; four are experiencing varying degrees of inactivity (Figure 11). ADNR (2015) reports 401 active oil and gas leases in Cook Inlet that total approximately 1,126,813 acres of State leased land, (419,454 acres onshore and 707,359 acres offshore). There are no platforms in lower Cook Inlet, although a lease sale currently being planned by BOEM (lease sale 244) could change that in the foreseeable future (Figure 10).

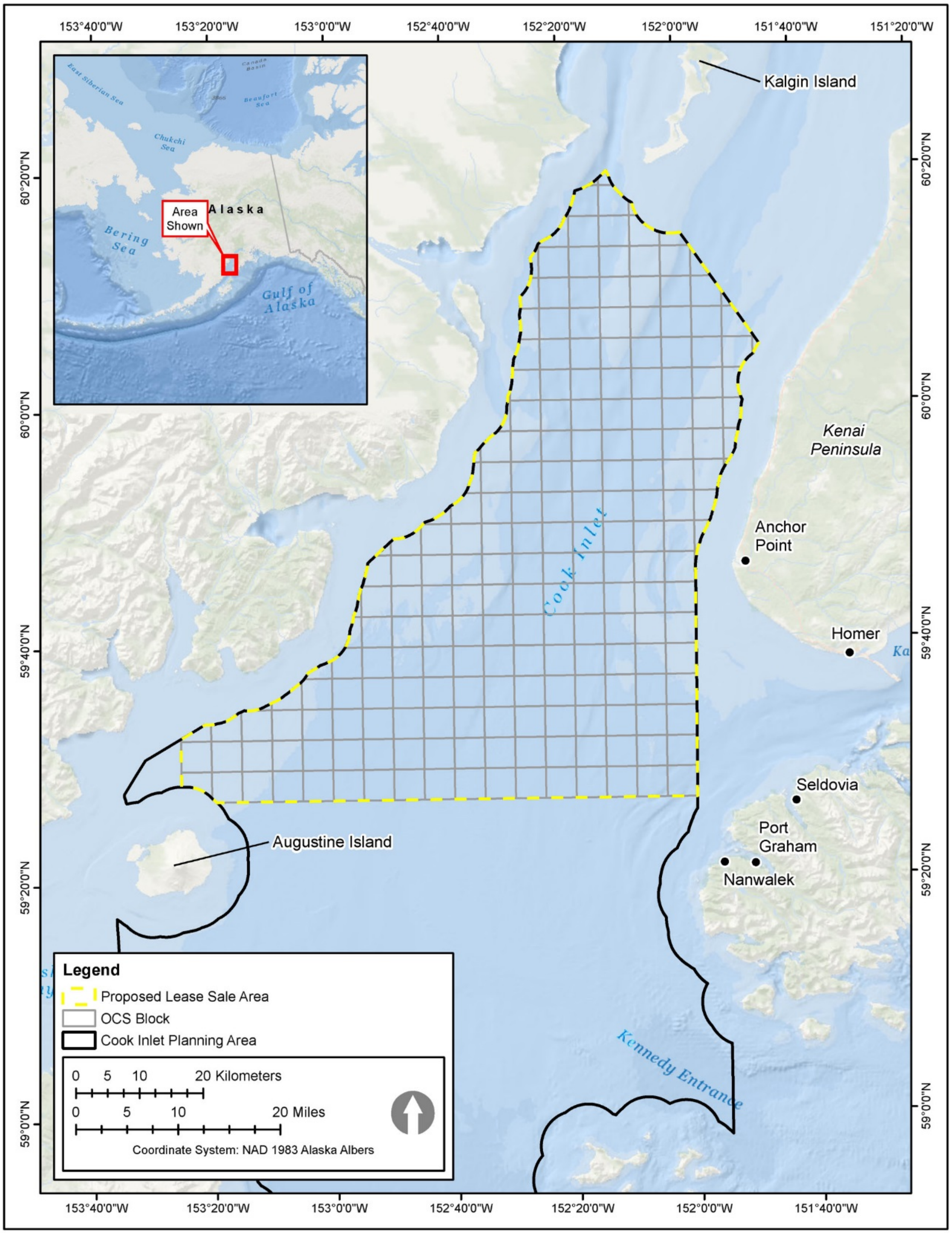

Figure 10. Proposed parcels for BOEM's Cook Inlet Lease Sale 244.

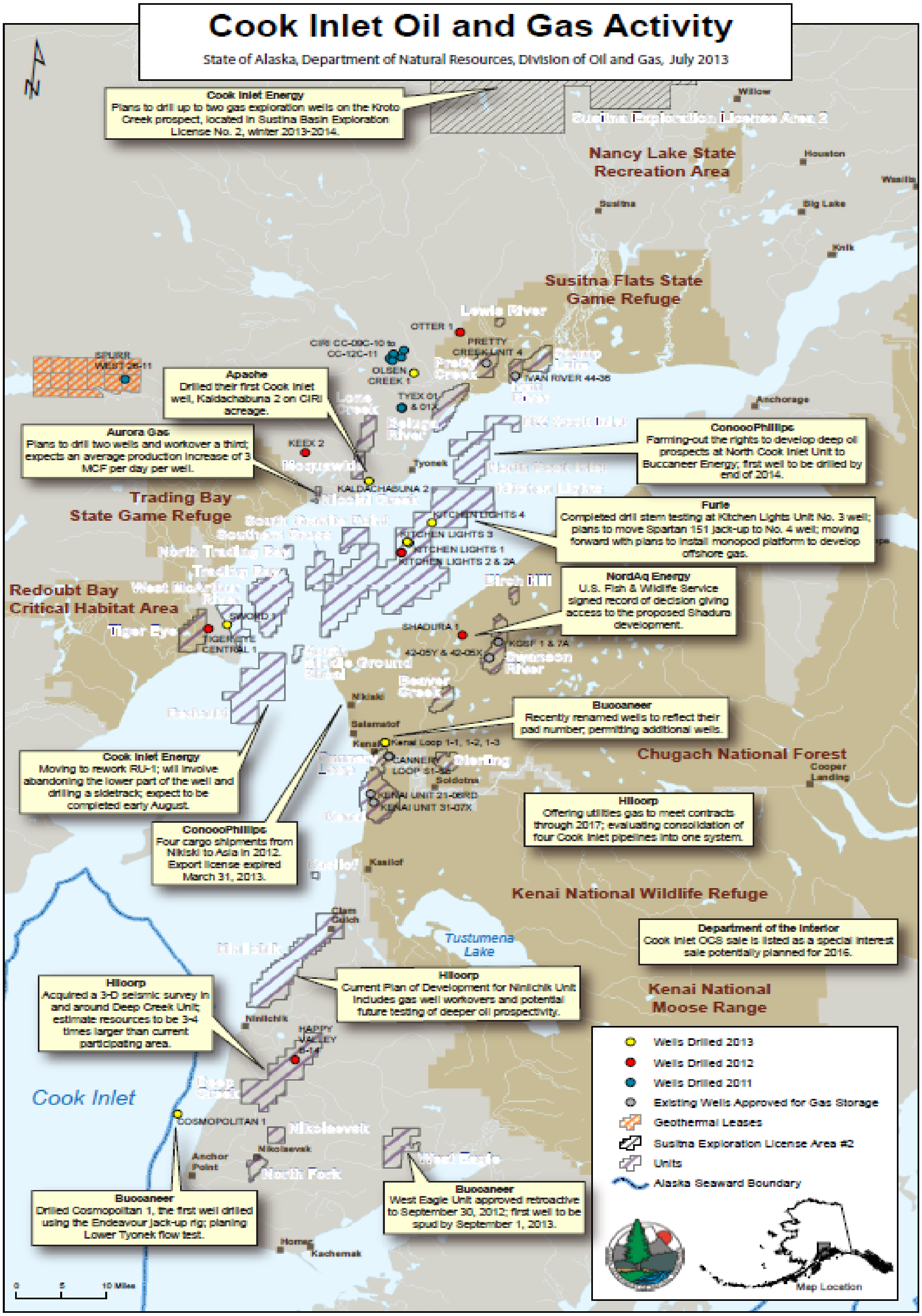

Figure 11. **Oil and gas operations in the Cook Inlet Source (ADNR 2015).**

5.3. Ambient Noise and Noise Pollution

Underwater sound levels in Cook Inlet arise from many sources, including physical noise, biological noise, and human-caused noise. Physical noise includes wind, waves at the surface, currents, earthquakes, ice movement, and atmospheric noise (Richardson et al. 1995). Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Human-caused noise consists of vessel motor sounds, oil and gas operations, maintenance dredging, aircraft overflights, and construction noise. Ambient sound varies within Cook Inlet. In general, ambient and background noise levels within the action area are assumed to be less than 120 dB whenever conditions are calm, and exceeding 120 dB during storm events (Blackwell and Greene 2003; Illingworth and Rodkin 2014).

5.3.1. Seismic Activity Noise in Cook Inlet

Seismic surveys use high energy, low frequency sound in short pulse durations to characterize subsurface geology (Richardson *et al*. 1995). Geophysical seismic activity has been described as one of the loudest human-made underwater noise sources, with the potential to harass or harm marine mammals, including beluga whales.

Cook Inlet has a long history of oil and gas activities including seismic exploration, G&G surveys, exploratory drilling, increased vessel and air traffic, and platform production operation. A seismic program occurred near Anchor Point in the fall of 2005. Geophysical seismic operations were conducted in Cook Inlet during 2007, near Tyonek, East and West Forelands, Anchor Point, and Clam Gulch. Additional small seismic surveys were again conducted in Cook Inlet during 2012. ADNR (2015) notes that since December 31, 2013 approximately 3,367 km^2 (1,300 mi^2) of 3D and 40,000 km (25,000 mi) of 2D seismic line surveys have been conducted in Cook Inlet.

Airguns have been previously and are presently being used in Cook Inlet for seismic exploration. In the past, large airgun arrays of greater than 3,000 in^3 have been used, which produce source noise levels exceeding 240 dB re 1 μPa rms. However, smaller arrays (440-2,400 in^3) are now being used in Cook Inlet both because of the generally shallow water environment and the increased use of ocean-bottom cable and ocean-bottom node technology.

Recent seismic surveys have used maximum airgun arrays of 1,760 and 2,400 in^3 with source levels of about 237 dB re 1 μPa rms. Shallow water surveys have involved 440, 620, and 880 in^3 arrays with source sound pressure levels less than 230 dB re 1 μPa rms. Measured radii to isopleths for MMPA Level A harm (190 dB for cetaceans and 180 dB for pinnipeds) from these guns have ranged from 50 m (164 ft) to nearly 2 km (1.2 mi), while Level B (160 dB) radii have ranged from 3 to 7 km (1.8-4.3 mi).

<u>AK LNG</u>

In 2016, ExxonMobil Alaska LNG LCC (EMALL) conducted geophysical and geotechnical surveys in Upper Cook Inlet, including within the Susitna Delta Exclusion Zone (SUDEX) under the terms of an IHA and biological opinion issued by NMFS. Operations involving G&G equipment did not occur within the SUDEX between 15 April and 15 October 2016. PSOs monitored for all marine mammals prior to and during all vessel movements when vessels were under power within the SUDEX. A total of 3 marine mammal sightings consisting of 5 estimated individuals were recorded within the SUDEX. These included 2 sightings of beluga whales (4 individuals), and 1 sighting of a single harbor seal. The two beluga whale sightings occurred, both at distances greater than700 m from the vessel, thus no beluga whales were observed within 100 m of vessels or likely to approach within 100 m of vessels. All marine mammal sightings in the SUDEX occurred during non-operational periods (i.e. when no vibracore operations were occurring) (Smultea 2016).

Apache Seismic Exploration 2012-2014

During over 1,800 hours of seismic activity in 2012, Apache Alaska Corporation (Apache) reported zero takes of either beluga whales or Steller sea lions; although some protected marine mammals were observed within zones ensonified to greater than 120 and 160 dB prior to powering down or shutting down of equipment. The company experienced five delays resulting from clearing the 160 dB disturbance zone, six shutdowns, one power-down, one power-down followed by a shutdown, and one speed and course alteration (Lomac-MacNair et al. 2013). In 2014 however, despite implementing a total of 13 shut-downs and 7 ramp up delays for marine mammals, observers recorded a total of 29 takes (12 beluga whales, 6 harbor porpoise, 9 harbor seals, and 2 humpback whales) from noise exposures (25 at ≥160 dB_{RMS} and 4 at ≥180 dB_{RMS} (Lomac-MacNair et al. 2013). Also during Apache's 2014 operations, about 4 groups of beluga whales occurred less than 500 m from the Apache source vessel during seismic operations (0.0014 groups per hour of effort x 3029.2 total hours of observation effort) (Lomac-MacNair et al. 2014). If these close approaches by belugas occurred during operation of the 1760 in^3 airgun array that was being used, that would represent 4 groups of belugas (of unstated group size) subjected to Level A take (Level A take isopleth for 1760 in^3 array for cetaceans = 1840 m). This report mistakenly indicates there were no Level A takes of Cook Inlet beluga whales in that year because mitigation actions were taken immediately upon observation of whales in this zone. However, by the time the whales were observed, unauthorized take had already occurred.

NMFS is aware of at least one humpback whale having been observed and possibly taken in upper Cook Inlet (by harassment and/or injury) by Apache's seismic operations on April 25, 2014 by the *M/V Peregrine Falcon* operating a 1,760 cui airgun array at full volume. The humpback whale was first observed 1.5 km (0.9 mi) from the sound source at a time when all whales within 1.84 km (1.1 mi) of the sound source would have been exposed to MMPA Level A take (sound impulses in excess of 180 dB). Although seismic operations were shut down immediately after observing this animal, the whale apparently was exposed to full volume seismic impulses during the time it transited from 1.84 km to 1.5 km (1.1 mi to 0.9 mi) from the sound source. Assuming seismic shots were fired at 15 second intervals, and the whale traveled directly towards the source at the average cruising speed of a humpback whale (4.0 km/hour [2.5 mi/hour]) (Noad and Cato 2007), then this whale would have been exposed to sound levels from at least 19 shots from the airgun while it was within the exclusion zone prior to shut-down; 19 shots exceeding the 180 dB threshold for Level A take.

SAE 3-D Seismic Exploration (2015)

Seismic operations took place in upper Cook Inlet, began on 15 May 2015 and continued until 27 September 2015. Eight vessels operated during the surveys including two seismic source vessels, the M/V Arctic Wolf (AW) and M/V Peregrine Falcon (PF) and one mitigation vessel, the M/V Westward Wind (WW). Seven PSOs were stationed on the source and mitigation vessels including two on each source vessel (AW and PF), and three on the mitigation vessel (WW). PSOs monitored from the vessels during all daylight seismic operations and most daylight non-seismic operations.

One trained passive acoustic monitoring (PAM) operator was stationed on a vessel to conduct monitoring during nighttime hours using a dipping or over-the-side (OTS) hydrophone. A total of 932 sightings (i.e., groups) of approximately 1,878 individual marine mammals were visually observed from 15 May – 27 September 2015 (Kendall et al. 2015). Harbor seals were the most commonly observed species with 823 sightings (~ 1,680 individuals), followed by harbor porpoises with 52 sightings (~65 individuals), sea otters with 29 sightings (~79 individuals) and beluga whales with eight sightings (~33 individuals). Large whale sightings consist of three humpback whale sightings (~3 individuals), one minke whale (1 individual) and one unidentified large cetacean. Other observations include one killer whale sighting (~2 individuals), one Dall's porpoise, four Steller sea lions, two unidentified dolphins/porpoise, five unidentified pinnipeds and two unidentified marine mammals.

Passive acoustic monitoring occurred from 1 July – 27 September and yielded a total of 15 marine mammal acoustic detections including two beluga whale and 13 unidentified porpoise. Nine detections occurred during seismic activity and six occurred during non-seismic activity. No acoustic observations of baleen whales or pinnipeds occurred during the monitoring period. A total of 207 marine mammals were confirmed visually or acoustically detected within the Level A (190 and 180 dB) and B (160 dB) exposures zones, resulting in 194 Level B and 13 Level A exposures (Kendall et al. 2015).

Marine mammals visually observed within the Level B exposure zone included harbor porpoises, a Steller sea lion, harbor seals and an unidentified large cetacean (Kendall et al. 2015). Two beluga whales and one unidentified porpoise were acoustically detected within the Level B exposure zone (Kendall et al. 2015). Marine mammals observed within the Level A exposure zone included harbor porpoises, a Steller sea lion and harbor seals. Seventy sightings occurred during clearing the safety zone, 14 sightings occurred during ramp-up and 18 shut downs were implemented because of sightings (Kendall et al. 2015). No power downs or speed/course alterations were performed due to marine mammal sightings (Kendall et al. 2015).

5.3.2. Oil and Gas Exploration and Production Noise

Blackwell and Greene (2003) recorded underwater noise produced at Phillips A oil platform at distances ranging from 0.3-19 km (0.2-12 mi) from the source. The highest recorded sound level was 119 dB at a distance of 1.2 km (0.75 mi). These were operating noises from the oil platform, not drilling noise, with frequencies generally below 10 kHz. While much sound energy in this noise fell below the hearing thresholds for beluga whales, some noises between 2-10 kHz were measured as high as 85 dB as far away as 19 km (12 mi) from the source. These frequencies are audible to beluga whales, but do not fall within the whale's most sensitive hearing range. Jack-up drilling rigs with the drilling platform and generators located above the sea surface and with lattice legs with very little surface contact with the water are relatively quiet compared to drill ships or semi-submersible drill rigs (Richardson et al. 1995).

Hilcorp Natural Gas Leak Repair

On February 7, 2017, a Hilcorp helicopter flying between Nikiski and Platform A identified bubbles resulting from a natural gas leak in one of their pipelines. The gas leak was reported to the National Response Center and Alaska Department of Environmental Conservation (ADEC) and work began on determining how to address the gas release. However, subsequent Hilcorp data revealed that the leak had been occurring since late December.

The initial estimated leak rate was between 225,000 to 325,000 cubic feet per day from an eight-inch pipeline 80 feet below Cook Inlet waters. The leaking gas line was providing dry natural gas (98.7% Methane) as fuel gas for the four platforms (Platform A, Platform C, Dillon Platform, and Bakers Platform) (Hilcorp 2017). NMFS submitted extensive comments concerning potential impacts to trust resources. NMFS worked with the Pipeline and Hazardous Materials Safety Administration (PHMSA), ADEC, and other stakeholders and formed a task force to develop mitigation and monitoring plans during the gas release repair activities.

The cause of the release was a large rock which caused a breach in the line. Due to weather and ice conditions, it took until May for repairs to be conducted. Initially, Hilcorp significantly reduced gas flow through the line, but did not shut down the line completely for fear of residual oil leaking into the marine environment. Divers were able to successfully install a temporary clamp on April 13, 2017. Divers successfully completed a permanent repair on May 19, 2017. Limited aerial survey efforts focused on wildlife in the vicinity of the leak did not indicate the presence of any marine mammals near the leak (Hilcorp Alaska LLC 2017). Repair activities will undergo emergency section 7 consultation.

PHMSA is requiring inspection and monitoring of the adjacent crude oil pipeline, and the task force is working on reviewing and prioritizing all pipelines in Cook Inlet to accelerate inspection and maintenance based on perceived risk to try and prevent future gas leaks and spills from occurring.

Anna Platform Oil Spill

On April 1, 2017, an oil spill was detected off the Anna Platform in Cook Inlet. Hilcorp reported the incident to ADEC on the same day. Initially, the likely source was thought to be an 8-inch crude oil flowline linking the Anna and Bruce platforms. Subsequently, documentation submitted by Hilcorp indicates the reported release resulted from an upset condition on the Anna Platform production facility flare system. It was anticipated a maximum of three gallons of oil was discharged into the marine environment. On April 28, ADEC issued an approval letter for restart of the Anna Platform and the Anna Platform to Bruce Platform crude oil flowline. The approval was conditioned based upon the following requirements: monitoring of well bore and casing pressures for the production wells during startup; timing startup to coincide with low slack tide to assure the best opportunity for any leaks to be observed; coordinated observations looking for sheens or evidence of system leaks; and the gradual startup of the platform systems. On May 1, PHMSA issued a Notice of Withdrawal of its Corrective Action Order regarding the Anna to Bruce flowline after a thorough review and analysis of documentation submitted by Hilcorp.

5.3.3. Vessel Traffic Noise

Vessel traffic includes large shipping, commercial and support vessels, commercial fishing vessels, and personal water craft. Vessel and air traffic are required for support during oil and gas development. Oil produced on the western side of Cook Inlet is transported by tankers to the refineries on the east side. Refined petroleum products are then shipped elsewhere. Liquid natural gas is also transported via tankers once it is processed (ADNR 2015). Blackwell and Greene (2003) recorded underwater noise produced by both large and small vessels near the POA. The tugboat *Leo* produced the highest broadband levels of 149 dB re: 1 μPa at a distance of approximately 100 m (328 ft), while the docked *Northern Lights* (cargo freight ship) produced the lowest broadband levels of 126 dB re: 1 μPa at 100 to 400 m (328-1,312 ft). Non-impulsive noise from ships generally exceeds 120 dB re 1 μPa $_{RMS}$ to distances between 500 and 2,000 m (1,640 and 6,562 ft), although noise effects are short term as the vessels are continuously moving.

Blackwell and Greene (2003) observed that beluga whales "did not seem bothered" when travelling slowly within a few meters of the hull and stern of the moored cargo-freight ship *Northern Lights* in the Anchorage harbor area. They speculated that in areas where belugas are subjected to a lot of (perennial) boat traffic, they may habituate and become tolerant of the vessels. However, in section 5.1.2, we present results from Castellote et al. (2016) indicating noises from ships and other activities in the Port of Anchorage area may cause a decrease or cessation of beluga vocalizations, or that such activities mask these vocalizations.

5.3.4. Aircraft Noise

Cook Inlet experiences significant levels of aircraft traffic, including private planes, commercial passenger and cargo aircraft, charter aircraft, and government aircraft, including military aircraft. Oil and gas exploration and development projects in Cook Inlet often involve helicopters and fixed-winged aircraft. Aircraft are used for surveys of natural resources, including Cook Inlet beluga whales. Airborne sounds do not transfer well to water because much of the sound is attenuated at the surface or is reflected where angles of incidence are greater than 13°; however, loud aircraft noise can be heard underwater when aircraft are directly overhead and surface conditions are calm (Richardson *et al*. 1995).

Richardson (1995) observed that beluga whales in the Beaufort Sea will dive or swim away when low-flying (500 m (1640 ft)) aircraft passed directly above them. Observers aboard Cook Inlet beluga whale survey aircraft flying at approximately 244 m (800 ft.) observed little or no change in swimming direction of the whales (Rugh *et al.* 2000). However, ground-based biologists have reported that belugas in this area often sound and remain submersed for longer than is typical when aircraft fly past at low altitudes or circle them overhead (NMFS unpublished data).

Anchorage Airport

The Anchorage International Airport is directly adjacent to lower Knik Arm and has high volumes of commercial passenger and cargo air traffic. It is among the busiest cargo hubs in the United States. Approaches to the airstrips usually have planes taking off and landing over the waters of Cook Inlet or Knik Arm.

Joint Base Elmendorf Richardson

Joint Base Elmendorf Richardson (JBER) has a runway near, and airspace directly over, Knik Arm. Air traffic there includes large surveillance and transport aircraft and fighter jets. Marine mammal monitors have anecdotally reported behavioral responses of Cook Inlet belugas to low-flying military aircraft in Knik Arm (NMFS, unpublished data).

Lake Hood

Lake Hood and Spenard Lake in Anchorage comprise the busiest seaplane base in the United States. Charter and private aircraft originating from this base often head across Knik Arm and fly along the coast towards the Susitna Delta. Biologists on site at the Susitna Delta report that some of these aircraft will circle concentrations of beluga whales located within the Susitna Delta, often causing behavioral reactions among the whales (NMFS unpublished data). NMFS is currently undertaking a public education campaign targeting private and charter aircraft pilots to reduce or eliminate these aircraft maneuvers.

Other airstrips

Other small private and public runways are found in Anchorage, Birchwood, Goose Bay, Merrill Field, Girdwood, near the Susitna Flats area, the Kenai Municipal Airport, Ninilchik, Homer, and Seldovia.

5.4. Underwater Installations

There are approximately 365 km (227 mi) of undersea pipelines in Cook Inlet, including 125 km (78 mi) of oil pipelines and 240 km (149 mi) of gas pipelines (ADNR 2015). One additional project has been approved and one is currently undergoing section 7 consultation.

Trans-Foreland Pipeline

In 2014, the Trans-Foreland Pipeline Co. LLC (owned by Tesoro Alaska) received approval from State, Federal, and regional agencies to build the Trans-Foreland Pipeline, a 46.7-km (29-mi) long, 20.3-cm (8-in) diameter oil pipeline from the west side of Cook Inlet to the Tesoro refinery at Nikiski and the Nikiski-Kenai Pipeline company tank farm on the east side of Cook Inlet. The pipeline will be used by multiple oil producers in western Cook Inlet, to replace oil transport by tanker from the Drift River Tank farm. Horizontal directional drilling (HDD) will be used at nearshore locations at the East and West Forelands to install the pipeline.

Hilcorp CIPL Extension

Hilcorp plans to extend their existing undersea pipeline network to connect their Tyonek platform to the land-based Tyonek/beluga pipeline at a point about 4 miles (6.4 km) north of the village of Tyonek. Hilcorp has applied for the following levels of MMPA level B take for their CIPL extension pipeline project: 23 Cook Inlet belugas, 117 harbor seals, 2 harbor porpoises, 3 Steller sea lions, 1 humpback whale and 1 killer whale.

5.5. Water Quality and Water Pollution

The Recovery Plan for the Beluga Whale (NMFS 2016) states that exposure to industrial chemicals as well as to natural substances released into the marine environment is a potential health threat for CI belugas and their prey. An in-depth review of available information on pollution and contaminants in Cook Inlet is presented in the plan.

Main sources of pollutants found in Cook Inlet likely include the 10 wastewater treatment facilities, stormwater runoff, airport de-icing, and discharge from oil and gas development (Moore *et al*. 2000). Ballast water discharge from ships is another source of potential pollution as well as potential release of non-indigenous organisms into Cook Inlet. Information and statistics ballast water management in Cook Inlet can be found at:
http://reports.nukaresearch.com/Reports/Cook-Inlet-ballast-water/Draft%201/regulations/
Given the amount of oil and gas production and vessel traffic, spills of petroleum products are a source of concern for marine mammals inhabiting Cook Inlet. Research indicates cetaceans are capable of detecting oil, but they do not seem to avoid it (Geraci 1990). Oil has been implicated in the deaths of pinnipeds (St. Aubin 1990).

According to the ADEC oil spills database, oil spills to marine waters consist mostly of harbor and vessel spills, and spills from platform and processing facilities. A reported 477,942 L (126,259 gal) (from 79 spills) of oil was discharged in the Cook Inlet area since July 1, 2013, primarily from vessels and harbor activities and from exploration and production facilities. Three of the ten largest spills in Alaska during state fiscal year 2014 occurred in Cook Inlet; these included 84,000 gallons of produced water by Hillcorp, Kenai gas field, 9100 gallons of process water released by the Tesoro API Tank Bypass Spill, and a Flint Hills, Anchorage spill of 4,273 gallons of gasoline (ADEC 2014).

Related effects to the marine mammals associated with these events could include death or injury from swimming through oil (skin contact, ingestion of oil, respiratory distress from hydrocarbon vapors), contamination of food sources, or displacement from foraging areas.

<u>Mixing Zones</u>
In 2010, EPA consulted with NMFS on the approval of the State of Alaska Department of Environmental Conservation's (ADEC) Mixing Zone Regulation section [18 AAC 70.240], including most recent revisions, of the Alaska Water Quality Standards [18 AAC 70; WQS] relative to the endangered Cook Inlet beluga whale (NMFS 2010). This biological opinion concluded that there was insufficient information to conclude whether belugas could be harmed by the elevated concentrations of substances present in mixing zones, but that the action was not likely to jeopardize the continued existence of the species. In 2017, EPA initiated formal consultation for this same action and its effects on designated Cook Inlet beluga critical habitat.

5.6. Fisheries

Fishing is a major industry in Alaska. Several fisheries occur in Cook Inlet waters that have the potential to compete with beluga whales and other marine mammals. The potential for interaction is a function of place and time of occurrence, target species, gear and equipment used, and fishing intensity. Commercial, recreational, personal use, and subsistence fisheries all occur within Cook Inlet. The operation of watercraft near the mouths and deltas of rivers entering Cook Inlet, Turnagain Arm, and Knik Arm can affect beluga whales, hindering them from using these waters in pursuit of prey such as eulachon and salmon. Vessel strikes and gear interactions are also possible throughout the regions fished. In the spring of 2012, a young beluga whale was found dead in an educational subsistence fishing net. While histopathology analysis determined the animal likely drowned, other health issues were documented that may have been a contributing factor (NMFS unpublished data). Other than this isolated interaction, NMFS is unaware of any beluga whale mortalities in Cook Inlet due to personal use, commercial, recreational, or subsistence fisheries.

Potential impacts from commercial fishing on Cook Inlet beluga whales include harassment, gear entanglement, ship strikes, reduction in prey, and displacement from important habitat. The likelihood of a lethal incidental take of a beluga whale from commercial fishing is low; however, the likelihood of reduced prey availability due to fishing activity remains unknown. While NMFS has numerous reports of beluga whales in the Kenai River prior to, and after the summer salmon fishing season (see section 7.1), they have not been observed in the river in recent times when salmon runs are strong and fishing activity (commercial, recreational, and personal use) are high (Shelden et al 2015a, Shelden et al. 2015b, Castellote et al. 2016). There is strong indication that these whales are dependent on access to relatively dense concentrations of high value prey species throughout the summer months. A significant reduction in the amount of available prey may impact the energetics for Cook Inlet beluga whales and delay recovery.

The potential impact of competition with groundfish fisheries in the Bering Sea / Aleutian Islands management area, through a reduction in the amount and quality of Steller sea lion prey species, has caused considerable debate among the scientific community. The primary issue of contention is whether fisheries reduce Steller sea lion prey biomass and quality at local and/or regional spatial scales that may lead to a reduction in Steller sea lion survival and reproduction, and if sustained, their carrying capacity. The effect of fisheries on the distribution, abundance, and age structure of the Steller sea lion prey field, at the spatial scale of foraging sea lions and over short and long temporal scales, is largely unknown (NMFS 2008c). The most recent minimum total annual mortality of western DPS Steller sea lions associated with commercial fisheries is 31.5 individuals (NMFS 2014).

5.7. Direct Mortality

Within the proposed action area there are several potential sources of direct mortality, including shooting, strandings, fishery/gear/debris interactions, vessel collisions, predation, and research activities.

5.7.1. Subsistence Harvest

The effect from past subsistence harvests on the Cook Inlet beluga whale population was significant (Figure 12. Population of Cook Inlet belugas when hunting was uncontrolled, controlled at very low harvest levels, and when hunting was not authorized. Blue bars and numbers along the x axis note known harvests of belugas during each year. Harvest methods used during the 1990s resulted in many struck and lost belugas. While a harvest occurred at unknown levels for decades or longer, the subsistence harvest levels increased substantially in the 1980s and 1990s. Reported subsistence harvests during 1994-1998 probably account for the stock's decline during that interval. In 1999, beluga whale subsistence harvest discontinued as a result of both a voluntary moratorium by the hunters and Public Law 106-553, which required hunting of Cook Inlet beluga whale for subsistence uses by Alaska Natives be conducted pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. During 2000-2005, only five Cook Inlet beluga whales were harvested for subsistence purposes.

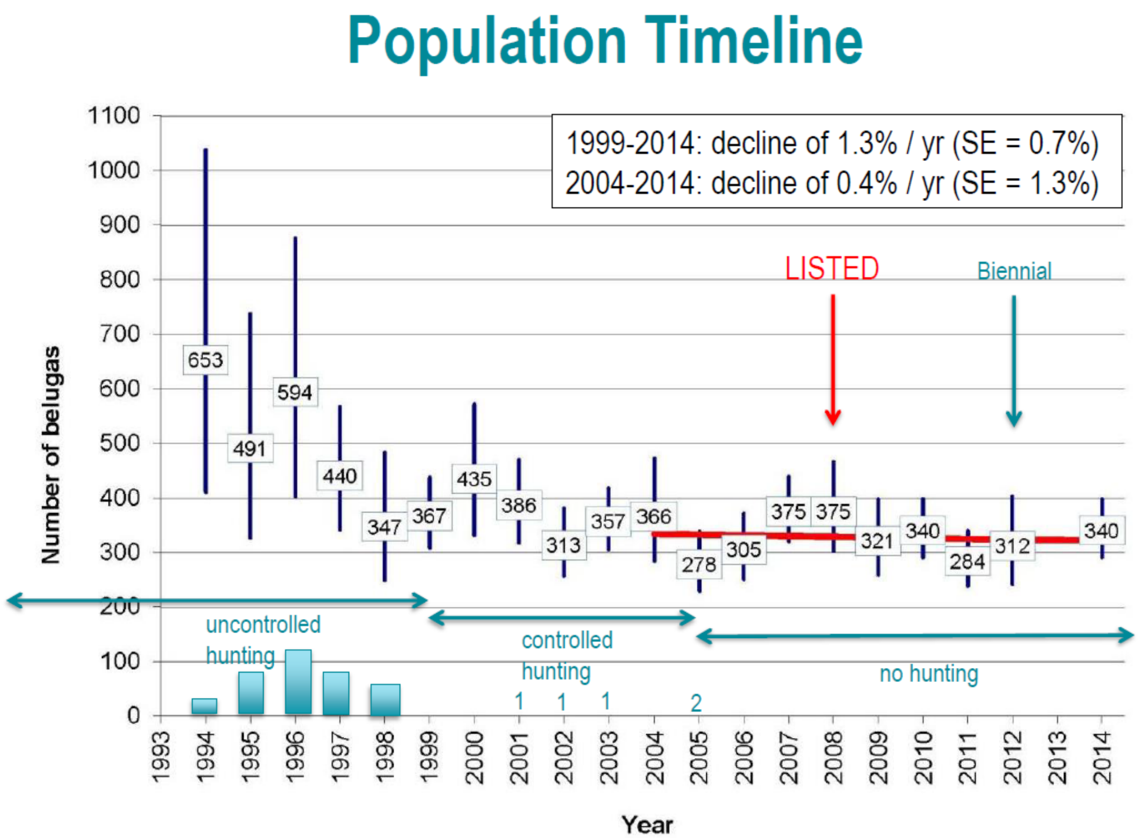

Figure 12. **Population of Cook Inlet belugas when hunting was uncontrolled, controlled at very low harvest levels, and when hunting was not authorized. Blue bars and numbers along the x axis note known harvests of belugas during each year. Harvest methods used during the 1990s resulted in many struck and lost belugas.**

Steller sea lions are hunted for subsistence purposes. As of 2009, data on community subsistence harvest are no longer being collected; therefore, the most recent estimate of annual statewide (excluding St. Paul Island) harvest[2] is 173 individuals from the 5-year period from 2004 to 2008. More recent data from St. Paul are available; the annual harvest is 27 sea lions from the 5-year period from 2007 to 2011.

5.7.2. Poaching and Illegal Harassment

Due to their distribution within the most densely populated region in Alaska and their approachable nature, the potential for poaching beluga whales in Cook Inlet exists. Although NMFS maintains an enforcement presence in upper Cook Inlet, effective enforcement across such a large area is difficult. No poaching incidents have been confirmed to date, although NMFS Enforcement has investigated several reported incidences of Cook Inlet beluga whale harassment.

Poaching and illegal harvest of Steller sea lions has historically occurred throughout their range. Western DPS Steller sea lions with suspected gunshot wounds have been found stranded on shore along the outer Copper River Delta as recently as 2016 (NMFS unpublished data).

[2] These numbers included both harvested and struck and lost sea lions.

5.7.3. Stranding

Live stranding occurs when a marine mammal is caught in waters too shallow to swim in. Strandings can be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then trapped by receding tide), or a result of illness or injury (NMFS 2016). Cook Inlet beluga whales have presumably adapted at least somewhat to survive live strandings because they breed, feed, and molt in the shallow waters of upper Cook Inlet, Knik Arm and Turnagain Arm, where extreme tidal fluctuations occur. More than 800 whales stranded (alive and dead) in Cook Inlet since 1988 (NMFS unpublished data). From 1999 to 2016, 417-470 beluga whales were reported to have stranded alive in upper Cook Inlet during 24 live-stranding events. During that same 17 year period, there were 159 dead stranded belugas reported, with an average of 9.4 dead standings per year in from 2007-2017. Beluga whale stranding events may represent a significant threat to the conservation and recovery of this stock. Stranding events that last more than a few hours may result in significant mortalities.

5.7.4. Predation

Killer whales are the only natural predators for beluga whales and Steller sea lions in Cook Inlet (Allen and Angliss 2014). Beluga whale stranding events have also been correlated with killer whale presence, and Native hunters report that beluga whales intentionally strand themselves in order to escape killer whale predation (Huntington 2000). Prior to 2000, an average of one Cook Inlet beluga whale was killed annually by killer whales, with 18 reported killer whale sightings in upper Cook Inlet during 1985-2002 (Shelden *et al*. 2003). During 2001-2012 only three Cook Inlet beluga whales were reported as preyed upon by killer whales (NMFS unpublished data). This is likely an underestimate, however, as preyed-upon belugas may well sink and go undetected. Killer whale predation has been reported to have a potentially significant impact on the Cook Inlet beluga whale population (Shelden *et al*. 2003).

The risk to western DPS Steller sea lions from killer whale predation is considered potentially high (Muto et al 2015), and may be one of the causes for past steep declines in population.

5.7.5. Ship Strikes

Cook Inlet beluga whales may be susceptible to ship strike mortality. To date, however, only one whale death, in October 2007, has been attributed to a potential ship strike based on bruising consistent with blunt force injuries (NMFS unpublished data). Beluga whales may also be more susceptible to strikes from commercial and recreational fishing vessels since both belugas and fishing activities occur where salmon and eulachon congregate. A number of beluga whales have been photographed with propeller scars (Maguire and Stephens 2014), suggesting that small vessel ship strike is not rare, but such strikes are often survivable. Small boats, which are becoming more abundant in Cook Inlet, are able to quickly approach and disturb these whales in their preferred shallow coastal habitat.

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).

5.7.6. Research

Research is a necessary endeavor to assist in the recovery of the Cook Inlet beluga population; however, research activities can also disturb these whales, especially when these activities include animal capture, drawing blood and tissue samples, or attaching tracking devices such as satellite tags. In the worst case, research can result in deaths of the animals. Shortly after a tagging event in 2002, a beluga whale was found dead; its tag had transmitted for only 32 hours. Another two beluga whales transmitted data for less than 48 hours, with similar dive patterns; it was assumed they too had died (NMFS, unpublished data). In 2015, an additional animal previously tagged by researchers washed up dead, with infection at the site of instrument attachment implicated as the cause of death.

Beluga surveys and research sometimes require boats, adding to the vessel traffic, noise, and pollution near the action area. Aerial surveys could also potentially disturb Cook Inlet beluga whales, especially where circling low-altitude flights are conducted to obtain accurate group counts. Boat based surveys, such as the photo-identification study, often require the boat to closely approach whales or whale groups, likely increasing noise in the immediate area. Deployment and retrieval of passive acoustic monitoring devices requires a boat, which temporarily increases noise in the immediate area. However, once the instruments are deployed, this type of monitoring is noninvasive.

Although research may affect beluga whales, it is anticipated that research will continue to increase because there are many remaining data gaps on Cook Inlet beluga whale biology and ecology (NMFS 2008a). However, managers are increasingly cautious in permitting only minimally invasive techniques.

5.8. Climate and Environmental Change

Overwhelming data indicate the planet is warming (IPCC 2014), which poses a threat to most Arctic and Subarctic marine mammals. Cook Inlet is a very dynamic environment which experiences continual change in its physical and structural composition; there are extreme tides, strong currents, and a tremendous volume of silt input from glacial scouring.

Beluga whales seasonally breed and feed in nearshore waters during the summer, but are ice-associated during the remaining part of the year. Ice floes can offer protection from predators and, in some regions, support prey, such as ice-associated cod. Moore and Huntington (2008) suggested that belugas and other ice-associated marine mammals might benefit from warmer climates as areas formerly covered ice would be available to forage. However, given the limited winter prey available in upper Cook Inlet (where ice predominates during winter), less winter ice might not benefit Cook Inlet beluga whales.

The bigger threat of climate change to belugas may not be the direct change in climate, but rather the effect regional warming would have on increased human activity. Less ice would mean increased vessel activity with an associated increase in noise, pollution, and risk of ship strike. Other factors include changing prey composition, increased killer whale predation due to lack of ice refuge, increased susceptibility to ice entrapment due to less predictable ice conditions, and increased competition with co-predators. Specific to Cook Inlet beluga whales, the greatest climate change risks would be where it might change salmon and eulachon abundance, and any increase in winter susceptibility to killer whale predation. Also, more rapid melting of glaciers might significantly alter the silt deposition in the Susitna Delta, potentially altering habitat for prey (NMFS 2008b). However, the magnitude of these potential effects is unpredictable, and the isolation of beluga whales within Cook Inlet since the last ice age suggests a strong resilience to environmental changes.

Whether recent increases in the presence of humpback whales in Cook Inlet can be attributed to climate change, whale population growth, or other factors remains speculative. Climate-driven changes in glacial melt are presumed to have profound effects on seasonal streamflow within the Cook Inlet drainage basin, affecting both anadromous fish survival and reproduction in unpredictable ways. Changes in glacial outwash will also likely affect the chemical and physical characteristics of Cook Inlet's estuarine waters, possibly changing the levels of turbidity in the inlet. Whether such a change disproportionately benefits marine mammals, their prey, or their predators is unknown.

Notable climate-driven changes are not expected to be measurable over the 5 years of oil and gas exploration associated with this proposed project. However, we note that any developed wells that may result from this project will facilitate the release of many tons of geologically-sequestered carbon emissions into the atmosphere, exacerbating the on-going problem of climate change. Climate change is not, however, expected to increase or decrease the effects of this particular action on listed species in the forseeable future.

6. EFFECTS OF THE ACTION

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

This biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS gives the benefit of the doubt to the listed species by minimizing the likelihood of false negative conclusions (concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

We organize our effects analysis using a stressor identification – exposure – response – risk assessment framework for the proposed activities.

We conclude this section with an *Integration and Synthesis of Effects* that integrates information presented in the *Status of the Species* and *Environmental Baseline* sections of this opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species.

6.1 Project Stressors

Stressors are any physical, chemical or biological entity that can induce an adverse response. The effect section starts with identification of the stressors produced by the constituent parts of the proposed action. Based on our review of the data available, the proposed oil and gas exploration activities may cause these primary stressors to listed marine mammals:

1. Sound fields produced by impulsive noise sources such as pile driving and geophysical surveys;
2. Sound fields produced by continuous noise sources such as: drilling and pumping operations, well completion or well plugging and abandonment activities, tugs towing, OSVs, other support vessels, aircraft;
3. Risk of vessels striking marine mammals;
4. Seafloor disturbance from drilling activities and placement of equipment;
5. Introduction of trash and debris that may cause entanglement or harm through ingestion; and
6. Pollution from unauthorized spills.

6.1.1 Acoustic Stressors

As discussed in Section 2, *Description of the Proposed Action*, the Corps intends to authorize activities that will introduce a variety of acoustic impacts within the action area (see Table 4).

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871). NMFS recently developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS; Level A harassment) (81 FR 51693). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels[3], expressed in root mean square[4] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA):

- impulsive sound: 160 dB re 1 μPa rms
- continuous sound: 120 dB re 1μPa rms

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

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

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (NMFS 2016c). These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (L_E) and peak sound level (PK) for impulsive sounds and L_E for non-impulsive sounds:

Table 8. PTS Onset Acoustic Thresholds for Level A Harassment (NMFS 2016c).

	PTS Onset Acoustic Thresholds* **(Received Level)**	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

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

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

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

While the ESA does not define "harass," NMFS recently issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016).

As described below, we anticipate that exposures to listed marine mammals from noise associated with the proposed action may result in disturbance and potential injury. However, no mortalities or permanent impairment to hearing are anticipated.

6.2 Exposure Analysis

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

6.2.1 Exposure to Impact Pile driving

Furie proposes to use one of two hammers for impact pile driving operations (Delmag D62-22 or IHC S-90). These impact hammer types have operated in Cook Inlet and California as part of BlueCrest's drilling program in 2013 and Harmony drilling program in 2015 respectively. These projects operated under IHAs that required acoustic measurements of underwater noise sources, and the results are cataloged in reports submitted to NMFS (MacGillivray and Schlesinger 2014, Illingworth and Rodkin 2014). The reports are publicly available on NMFS' ITA website: http://www.nmfs.noaa.gov/pr/permits/incidental/oilgas.htm.

Mitigation Measures to Minimize the Likelihood of Exposure to Impact Pile Driving

As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to impact pile driving:

1. Two PSOs are required on the Yost drilling rig, and one PSO on each observation vessel, and will ensure the area is clear of marine mammals within 5,500 m of the pile driving hammer for 30 minutes prior to starting pile installation.

2. Pile driving operations will shut-down if any marine mammal approaches within 5,550 m radius of pile driving site.

3. Use of soft-start procedures for impact pile driving.

4. An aerial survey of the entire pile driving exclusion zone may be conducted at the beginning of the day prior to the soft start of pile driving.

Approach to Estimating Exposure to Impact Pile Driving

The instances of exposure for pile driving for each species to received levels of pulsed sound ≥160 dB rms were estimated by multiplying:

- the expected beluga whale, humpback whale, fin whale, and Steller sea lion densities; by
- the anticipated area to be ensonified based on propagation modeling or similar pile driving projects; by
- the number of pile driving days

Anticipated Densities of Listed Species

Cook Inlet Beluga
Empirical estimates of beluga density in Cook Inlet are difficult to produce. One of the most robust is the Goetz et al. (2012) model based on beluga sighting data from the NMFS aerial surveys from 1994 to 2008 (Figure A-4). The model incorporated several habitat quality covariates (e.g. water depth, substrate, proximity to salmon streams, proximity to anthropogenic activity, etc.) and related the probability of a beluga sighting (presence/absence) and the group size to these covariates. After establishing the covariates with the highest correlations, the model was applied to the entire Inlet, providing an output of predicted summer beluga density for each km^2. For this project, the staff at the MML provided the processed geographic information systems (GIS) data layer containing the predicted summer density values for each km^2 cell within the entire Inlet.

To evaluate whether the Goetz et al. (2012) density estimates are sufficiently conservative, the values were compared to other sighting data in the area. To determine the number of animals expected within the KLU at any given time during the summer, the density of each of the 337 km^2 cells within the project area was summed. The result is a predicted average of 1.93 belugas within the KLU area at any given time during the summer. From 1994 and 2014 (excluding 2013) NMFS conducted annual aerial beluga surveys of the upper Inlet and flew over 90 transects that included some portion of KLU area (Rugh, Shelden, and Mahoney 2000; Rugh, Shelden, Mahoney et al. 2000; Rugh, Mahoney et al. 2004; Rugh, Shelden, et al. 2004; Rugh, Shelden, et al. 2005; Rugh, Goetz, et al. 2005; Rugh et al. 2006; Shelden et al. 2013, 2015). Most of the flights were conducted in June, but they ranged from May through November. In August of 2001, a single tagged beluga was sighted within the KLU area traveling south (Rugh, Mahoney et al. 2004). No other sightings of belugas were recorded within or near the project area during these surveys. Because more than 90 transects of the area over 20 years resulted in a sighting of one animal, the predicted 1.93 animals in the area at any given time by the Goetz et al. (2012) model is likely overestimated.

Other sources of sighting data reviewed for the area included the NMFS Cook Inlet beluga Opportunistic Sighting Database. This database did not list any sightings of belugas in the KLU from 2000 through 2015 (Shelden et al. 2016).

Additionally, from 9 May to 25 June 2015, Furie employed qualified PSOs during the construction of the Julius R. platform and the pipeline to the onshore facility in Nikiski. Over the 48 days, excellent viewing conditions (e.g. visibility greater than 10 km and Beaufort sea state 2 or less) occurred for approximately 729 hours. The average density for an area within 5 km of the PSO location along the pipeline was extracted from the Goetz et al. (2012) GIS layer and resulted in 0.00554 belugas/km^2. However, no belugas were sighted over the 48-day effort

(Jacobs 2017). PSOs were onboard the heavy lift ship used to install the platform, monitoring pile driving activities during all daylight hours for 23 days. A review of the environmental data during the effort found that viewing conditions were considered excellent for 278 hours of the 408 hours of daylight observation. The average density for an area within 5 km of the PSO location at the platform construction site was extracted from the Goetz et al. (2012) GIS layer and resulted in 0.00125 belugas/km^2. No belugas were sighted during this monitoring event either.

Of the nine potential well locations, the lowest density predicted by the Goetz et al. (2012) model of a 3,600 meter radius is at the 2017 Deep Jurassic location, which is 0.00106 belugas/km^2. The Corps proposed this as the best available density estimate for beluga, and it is assumed to be conservative (see Table 10).

Table 9. Cook Inlet Beluga Whale Density Estimate (Jacobs 2017).

Species/DPS	Estimated Density (animals/km^2)
Cook Inlet Beluga Whale	0.00106

Other Cetaceans

The raw densities calculated for fin and humpback whales sighted during the NMFS annual surveys are presented in Table 11.

The raw density estimate for fin whales is based on 27 animals sighted over 13 years of aerial surveys. This estimate may not be reliable but no other systematic survey data of fin whales in Cook Inlet is available. The infrequency of sightings of fin whales north of the forelands suggests that the true density is likely very low. However, the raw density of 0.000343 animals/km^2 is used to estimate potential exposures (Jacobs 2017).

Table 10. Cook Inlet Fin and Humpback Whale Raw Density Estimate (2001–2014[1,2]).

Species/DPS	Number of Animals	NMFS Survey Area (km^2)	Raw Density (animals/km^2)
Fin whale	27	78,746	0.000343
Humpback whale (all DPSs combined)	198	78,746	0.002510

[1] NMFS aerial survey not performed in 2013 and not included in the estimates.

[2] Data from Rugh et al. 2005, Shelden et al. 2013, 2015.

All of the humpback sightings during the NMFS aerial surveys were south of Ninilchik, approximately 55 miles south of the project area (see Figure 13). However, recent studies and monitoring events, including Furie's monitoring in the KLU in 2015, have documented humpback whales north of the forelands. Individual humpback whales in the GOA have a 10.5% and 0.5% probability of being from the threatened Mexico DPS and endangered Western North Pacific DPS respectively (NMFS 2016a, Wade et al. 2016). Therefore listed humpback whales are only anticipated to represent a fraction of the total humpback whale density in the area.

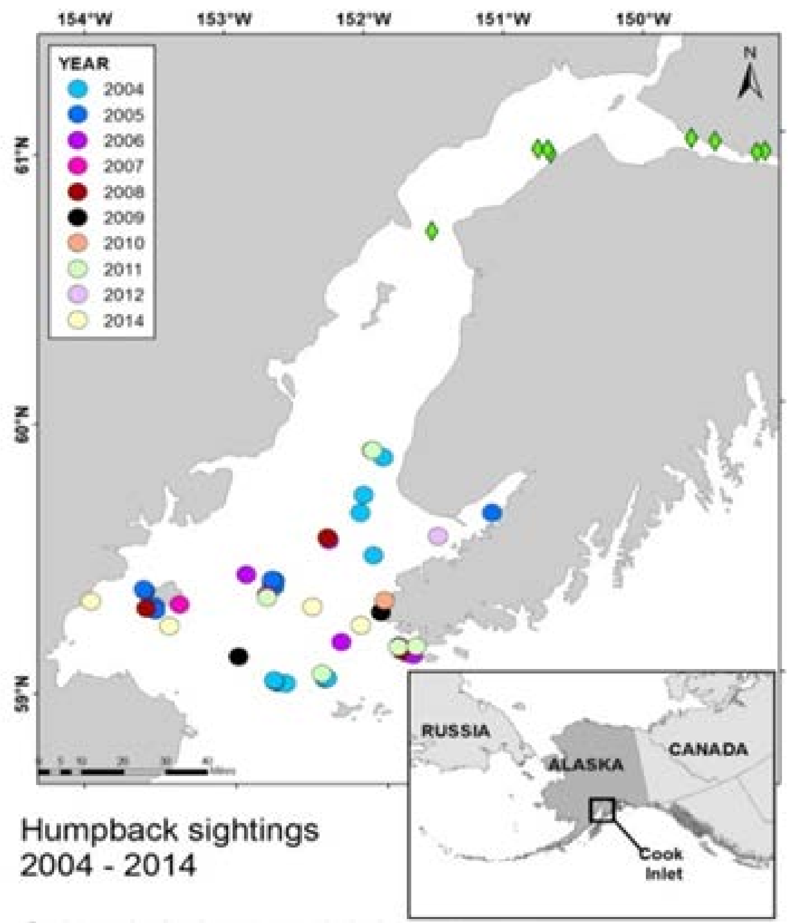

Figure 13. Humpback whale observations, as documented in Cook Inlet, 1994-2014. Green diamonds indicate opportunistic (and anomalous) sightings of a single whale, or possibly of an adult whale and calf, during April 25-May 1, 2014. Map created 3/12/2015 by Linda Vate Brattstrom, Marine Mammal Lab, NMFS, NOAA.

Steller Sea Lion

The nearest Steller sea lion haul-out from the project action area is approximately 100 miles to the south at the Flat Islands near Port Graham, Alaska (DeMaster 2014). Based on past studies and the NMFS aerial data in Cook Inlet, the majority of Steller sea lions are expected to be found south of the forelands. The Nemeth et al. (2007) study was the closest long-term survey of marine mammals near the action area. During the four months of observations of that study, no Steller sea lions were observed.

Although Steller sea lions are typically found in the lower Inlet there have been verified sightings in the upper inlet near the Port of Anchorage (POA). Steller sea lions were observed in 2009 during the POA Marine Terminal Redevelopment Project and in 2016 during the POA Test Pile project (Pers. com. Balogh 2016). During the 2015 monitoring of the platform installation (23 days) and pipeline construction (48 days) by Furie, four sightings of Steller sea lions were documented. Two other potential sightings were documented as a seal/sea lion unidentified, but are likely to have been Steller sea lions based on the PSO sighting notes (Jacobs 2017).

During the NMFS aerial beluga surveys from 2001 through 2012, and 2014, all Steller sea lion sightings were south of Chinitna Bay and Anchor Point, approximately 75 miles southwest of the project area. The raw density of 0.0085 Steller sea lions per km^2 from these surveys was calculated by taking the number of animals and dividing it by the survey area covered.

The monitoring conducted by PSOs during the installation of the platform and pipeline in the KLU documented six Steller sea lion sightings (four confirmed, two probable) over 1,275 hours during 71 days of combined observation.

While the actual surveyed area north of the forelands during the NMFS aerial surveys is not known precisely, none of the 670 sightings of Steller sea lions occurred north of the forelands. The low sighting rate during the other survey efforts indicate the use of the raw density figure would overestimate the true density north of the forelands. Based on this data, a density of one tenth the raw density or 0.00085 animals/km^2 is a sufficiently conservative figure to estimate potential Steller sea lion exposure to noise (see Table 12) (Jacobs 2017).

Table 11. Steller Sea Lion Raw Density Estimate for Cook Inlet (2001-2014[1,2]).

Species/DPS	Number of Animals	NMFS Survey Area (km^2)	1/10 Raw Density (animals/km^2)
Western DPS Steller Sea Lion	670	78,746	0.00085

[1] NMFS aerial survey not performed in 2013 and not included in the estimates.

[2] Data from Rugh, et al. 2005, Shelden et al. 2013, 2015.

Noise Propagation

Level A Isopleths

The applicant relied on the NMFS User Spreadsheet for Impact Pile Driving for calculating the Level A zones with the RMS SPL source level metric (NMFS 2016c). The results and input parameters are provided in Table 13.

Table 12. Level A isopleths (meters) calculated with NMFS User Spreadsheet Source Level (RMS SPL) (Jacobs 2017, Illingworth and Rodkin 2014)

Cook Inlet, AK (Illingworth and Rodkin 2014)			
Duration	**Humpback and Fin Whales (meters)**	**Beluga Whale (meters)**	**Steller Sea Lion (meters)**
1 Hour	1,753.8	62.4	68.3
5 Hours	5,128.0	182.4	199.8
Input parameters: SPL = 190 dB, Pulse Duration = 0.045 sec., Num. of Strikes/hr = 800, Propagation = 15 LogR, Source Distance = 55(m)			

The recent guidance presumes an animal remains within the Level A zone for 24 hours. The nature of pile driving is such that breaks in hammering occur as new sections of the drive pipe are welded on. To accumulate 10 total hours of potential exposure to pile driving noise an animal would likely have to be within the zone for 15 to 20 hours.

Tides are diurnal in Cook Inlet with two low and two high tides each day. Ebb and flood tidal currents between the forelands of Cook Inlet range between 2.3 knots (1.2 meters per second [m/s]) and 6.2 knots (3.2 m/s) (NOAA 2008). It is extremely unlikely a marine mammal would expend the additional energy required to maintain its position within the exclusion zone over several tidal cycles. Forage species density is low in the deeper waters of the project area when compared to river mouths of the upper inlet during the open water season. Studies in upper Cook Inlet have shown species of groundfish (flatfish, cod, etc.) are present, but occur in much smaller numbers than in the lower Inlet (Moulton 1997, Fechhelm et al. 1999, Robards et al. 1999). Additionally, it is unlikely an animal in the vicinity would remain undetected for an extended period of time by the PSOs stationed onboard the rig to monitor the exclusion zones. The mitigation measures for this project require that pile driving stop when any marine mammal approaches the Level B exclusion zone (see Table 14).

The proposed action only anticipates pile driving to be conducted intermittently for up to 10 hours over 2-3 days in 2017, and for up to 20 hours over 4-6 days for years 2018-2021 (Jacobs 2017). This would result in a maximum of 5 hours of intermittent operation per day. As previously mentioned, due to the lower food availability in the area during the operational period, the tidal cycle, and the species behavior, the 5-hour and 10-hour Level A isopleths are not realistic representations of potential exposure to marine mammal species. The 1-hour Level A isopleths (maximum distance 1,754 m) are sufficiently conservative to approximate the area affected by Level A noise (Jacobs 2017).

Level B Isopleths

Impact pile driving is an impulsive noise source with a level B harassment threshold of 160 dB re 1 µPa rms. In order to calculate the anticipated distance to the level B threshold, we used the best available sound source verification measurements conducted on the same impact hammer in a nearby area of Cook Inlet with a practical spreading model.

During Buccaneer’s 2013 exploration drilling program Illingworth and Rodkin (2014) measured sound levels produced by the impact hammer Delmag D62-22 for 30-inch pile installation at their Southern Cross lease in Cook Inlet. The measured level was 190 dB re 1 µPa at 55 m.

Using practical spreading (15 Log R), the extrapolated distance to the 120 dB re 1 µPa rms threshold was approximately 5,500 m (Table 14). Considering the Delmag D62-22 is the largest hammer being proposed for the action, we have conservatively based exposure estimates on its measured source level.

The area ensonified was then calculated (πr^2), for a total ensonified area of 94.985 km^2 (see Table 14).

Table 13. Distance (in meters) to level B threshold of concern 160 dB re 1 µPa rms SPL and ensonified area for impact pile driving activities (Illingworth and Rodkin 2014).

Sound Source	**160 dB Threshold/ Radius (meters)**	**Ensonified Area (km^2)**
Pile Driving (Delmag D62-22)	5,500	94.985

Number of Days of Operation

Only one well is planned for 2017, therefore pile driving of the drive pipe will only occur once (10 hours over 3 days). For the years 2018 through 2021, it is assumed pile driving will occur twice (once per well) for a total of 20 hours over 4-6 days (Jacobs 2017).

Results of Exposure Analysis (Pile Driving)

The estimated instances of exposure (see Table 15) are likely overestimates for the following reasons:

- The estimates assume that marine mammals would not avoid impact pile driving noise, yet some degree of avoidance is likely;
- The estimates assume pile driving will be occurring continuously for an hour duration and an animal will remain in place for the full duration. However, this is unlikely due to operational pauses, animal behavior, and tides;
- Noise propagation estimates assume practical spreading (15 log R) which is likely an underestimate for Cook Inlet where measured transmission loss typically varies from 18-21 log R. This results in a conservative propagation estimate.
- Mitigation measures will be employed if any marine mammals is sighted within or approaching the designated (160 dB) exclusion zone, and will result in a shutdown of pile driving operations.

Furie estimated exposures for Cook Inlet beluga whales, Mexico DPS humpback whale, Western North Pacific DPS humpback whale, fin whale, and western DPS Steller sea lion for pile driving operations for both level A and level B harassment (see Tables 15-16). The estimated instances of exposure to pile driving noise provided in Tables 15-16 assume mitigation measures are not in place. While we do not anticipate that these exposures will occur (animals exposed at lower received levels will most likely avoid these higher received levels, and mitigation measures will be instituted if animals approach exclusion zones), they have been included to account for faulty mitigation, or animals that may be missed by the PSOs.

Based on this analysis, we find that any Level A exposures associated with pile driving for the duration of the project are extremely unlikely to occur. We also find that Level B exposures during 2017 pile driving operations are extremely unlikely to occur. Only one Cook Inlet beluga and one Steller sea lion are anticipated to be exposed within the Level B harassment zone per year for the subsequent years of operation.

In the *Response Analysis* (Section 6.3) we apply the best scientific and commercial data available to describe the species' expected responses to these exposures.

Table 14. Potential Level A instances of exposure of listed marine mammals to received sound levels ≥SEL cumulative threshold to impact pile driving operations associated with Furie's exploratory drilling program.

Species	Activity	Radius (m)	Ensonified Area (km^2)	Activity Days		Density	DPS Probability of Occurrence (%)	Exposures	
				2017	2018-2012			2017	Per Year 2018-2021
Cook Inlet Beluga	Pile Driving	62.4	0.012	3	6	0.00106	n/a	0.00004	0.00008
Fin Whale		1,753.8	9.658			0.000343	n/a	0.00994	0.01990
Mexico DPS Humpback Whale		1,753.8	9.658			0.00251	10.5	0.00764	0.01502
Western North Pacific DPS Humpback Whale		1,753.8	9.658			0.00251	0.5	0.00036	0.00072
Steller sea lion		68.3	0.015			0.00085	n/a	0.00004	0.00006

Table 15. Potential Level B instances of exposure of listed marine mammals to received sound levels ≥160 dB 1 µPa (rms) to impact pile driving operations associated with Furie's exploratory drilling program.

Species	Activity	Radius (m)	Ensonified Area (km^2)	Activity Days 2017	Activity Days 2018-2012	Density	DPS Probability of Occurrence (%)	Exposures 2017	Exposures Per Year 2018-2021
Cook Inlet Beluga	Pile Driving	5,500	94.985	3	6	0.00106	n/a	0.3021	0.6041
Fin Whale						0.000343	n/a	0.0977	0.1955
Mexico DPS Humpback Whale						0.00251	10.5	0.0751	0.1502
Western North Pacific DPS Humpback Whale						0.00251	0.5	0.0036	0.0072
Steller sea lion						0.00085	n/a	0.2422	0.4844

6.2.2 Exposure to Drilling, mud pumping, well completion, and well plugging and abandonment

Well completion and well plugging and abandonment are substantially lower in acoustic impact than well drilling. Therefore, the exposure analysis is based on propagation estimates associated with well drilling noise. Sound source verification measurements were conducted on site from drilling and mud pumping activities on the Yost in 2016 (Denes and Austin 2016). These measurements indicated source levels for drilling were 158 dB re 1 µPa rms at 1m.

Mitigation Measures to Minimize the Likelihood of Exposure to Drilling Activities

As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to impact pile driving:

1. PSO/CMs will ensure the 330 meter exclusion zone is clear of marine mammals around drilling rig prior to commencing drilling activities.
2. PSO/CMs will be positioned such that the entire exclusion zone for all activities (330 m for drilling operations) is visible (e.g., situated on the helideck or other elevated promontory on the jack-up rig, in aircraft or OSV)

Approach to Estimating Exposures to Drilling Activities

The instances of exposure for drilling operations for each species to received levels of continuous sound ≥120 dB rms were estimated by multiplying:

- the expected beluga whale, humpback whale, fin whale and Steller sea lion densities; by
- the anticipated area to be ensonified based on propagation modeling or similar pile driving projects; by
- the number of drilling days

Anticipated Densities of Listed Species

The anticipated densities of listed species are the same as those listed in Tables 9-11 above (see Section 6.2.1).

Noise Propagation

Drilling operations in the KLU of Cook Inlet were measured from the Yost during 2016 operations. The Level B 120 dB re 1 µPa threshold distance was estimated at 330 meters for drilling and 172 meters for mud pumping (Denes and Austin 2016). A circle with a radius of 330 m results in an estimated area of 0.342 km^2 (0.132 mi^2) that may be exposed to continuous sounds ≥120 dB rms (Table 17). As indicated below, mud pumping activities have a much smaller ensonified area.

Drilling noise levels do not exceed the Level A peak SPLs, but do produce a small Level A zone based on cumulative SEL metric for the expected duration of use. Because of the small radius and proposed mitigation for the larger Level B harassment zone, Level A for drilling noise is not considered further in this opinion.

Table 16. Ensonified area estimates associated with 120 dB received sound levels for drilling and mud pumping during Furie's 2016 exploratory drilling activities (ensonified area provided in km^2) (Denes and Austin 2016).

Sound Source		120 dB
Drilling	Ensonified Area (km^2)	0.342
Mud Pumping	Ensonified Area (km^2)	0.093

Number of Days of Operation

The 2017 drilling season is anticipated to last 120 days in Cook Inlet. For subsequent years (2018-2021) this may be extended to 180 days to accommodate extra time for the additional wells. Active drilling will occur during a fraction of that time. Active drilling in 2017 is expected to take 30 days, and up to 45 days (over 2 wells) in the years 2018 through 2021. Drilling will occur intermittently over this time, as new sections of shaft will need to be attached, and drill bits will need to be replaced (Jacobs 2017).

For this analysis we consider the full 120 days for 2017 and 180 days for 2018-2021 considering that mud pumping, well plugging, well abandonment, and other activities may be occurring when drilling is not.

Results of Exposure Analysis (Drilling Operations)

We anticipate that noise associated with drilling operations would drop to 120 dB within 330 m (or less) of the Yost (Denes and Austin 2016). Even if we assume all of the activities associated with drilling (i.e., mud pumping, well plugging, engine noise) produce as much noise as active drilling (which is not anticipated), multiply by the full duration of the drilling season (120-180 days), which should provide an overestimate since the loudest noise of active drilling is only a fraction of that duration, and multiply by densities of listed animals, the estimated number of marine mammal exposures that could be ensonified by drilling operations was zero due to the small anticipated area ensonified to received levels ≥120 dB (rms), and low densities (see Table 18). We consider the likelihood of exposure to drilling operations to be extremely unlikely to occur and therefore discountable.

Table 17. Potential Level B instances of exposure of listed marine mammals to received sound levels ≥120 dB 1 μPa (rms) to drilling operations associated with Furie's exploratory drilling program.

Species	Activity	Radius (m)	Ensonified Area (km^2)	Activity Days 2017	Activity Days 2018-2012	Density	DPS Probability of Occurrence (%)	Exposures 2017	Exposures Per Year 2018-2021
Cook Inlet Beluga	Drilling Operations	330	0.342	120	180	0.00106	n/a	0.0435	0.0652
Fin Whale						0.000343	n/a	0.0141	0.0211
Mexico DPS Humpback Whale						0.00251	10.5	0.0108	0.0162
Western North Pacific DPS Humpback Whale						0.00251	0.5	0.0005	0.0008
Steller sea lion						0.00085	n/a	0.0349	0.0523

6.2.3 Exposure to Tugs Transporting the jack-up rig Yost to and from well sites

The jack-up rig Yost is currently housed at the OSK dock in Nikiski, which will be the staging area for the 2017 and 2018 drilling seasons. For subsequent years (i.e., 2019-2021), Furie may use additional docks at Homer or Port Graham (Jacobs 2017). For purposes of this analysis we have considered towing operations from these additional staging areas, even though it is more likely Furie will conduct staging from Nikiski.

During transport of the Yost or similar jack-up rig to the 9 well locations associated with this project, we expect tug activity to reflect what is noted in Table 3. We have assumed that all tugs will have a source level of 167 dB re 1 µPa rms at 1m, based upon an SSV conducted on the Lauren Foss, a tug that has over 50 percent more power than the tugs associated with the proposed action (Austin et al. 2013). In order to account for multiple tugs on tow at the same location, we added 3 dB to the source level of the Lauren Foss (i.e., 170 dB) (Pers. Comm. Austin, May 2017).

Mitigation Measures to Minimize the Likelihood of Exposure to Transport Noise
As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to impact pile driving:

1. Two PSOs are required on an observational vessel traveling in front of the tugs towing the Yost to clear the area within 2,200 m of the tugs on tow.

2. To the extent practical, tugs will reduce throttle/thrust if marine mammals are sighted in the expected path to reduce noise propagation.

3. PSOs from the observational vessel or onboard the tugs will ensure the area within 100 m of tugs is of clear of marine mammals when not on tow.

Approach to Estimating Exposures to Yost Transport Noise

Nikiski Staging Area
Furie anticipates that up to two tugs may be actively towing the drill rig Yost to the drill sites within KLU, while a third tug may assist with breaking. The anticipated roundtrip distance from Nikiski OSK dock where the drill rig is housed to the well location is approximately 44 km for the 2017 drilling season. For the proposed action, the estimated distance to the 120 dB isopleth associated with two rigs actively towing is anticipated to be 2,154 m (see Table 4).[5] By applying the 120 dB isopleth distance on either side of the transit line, the total ensonified area is anticipated to be approximately 190 km^2 for the active towing of the Yost during 2017 operations.[6] This is anticipated to increase slightly for subsequent years due to the additional transit between well sites (~13.8 km roundtrip).[7] Considering the additional transit time between

[5] Source level for multiple vessels on tow is considered 170 dB re 1 µPa rms at 1m. Using practical spreading (15 Log R), the anticipated distance to the 120 dB isopleth is 2,154 m.
[6] 44 km x 2(2.154) km = 190 km^2
[7] If the Yost is stored at Nikiski during all subsequent years, we calculate that, based on the centroid location for all wells (located at 60°54'47.21" N x 151°10'59.18" W), each trip will be 21 km long, and the average well to well

well sites, the total ensonified area is anticipated to be approximately 240.4 km^2 for the active towing of the Yost per year during 2018-2021 operations.[8]

Port Graham or Homer Staging Area (2019-2021)
Similarly, if Homer or Port Graham are used as staging areas, the roundtrip distance to KLU is anticipated to range from 340-392 km respectively for year 2019-2021. The average well to well transport roundtrip distance is 13.8 km (calculated using coordinates provided by Jacobs (2017)). By applying the 120 dB isopleth distance on either side of the transit line, the total ensonified area is anticipated to range from approximately 1,524-1,748 km^2 for towing of the Yost to and from Homer or Port Graham, respectively, during 2019-2021 operations.[9]

Towing noise levels do not exceed the Level A peak SPLs, but do produce a small Level A zone based on cumulative SEL metric for the expected duration of use. Because of the small radius and proposed mitigation for the larger Level B harassment zone, Level A for towing noise is not considered further in this opinion.

Anticipated Densities of Listed Species

The anticipated densities of listed species for towing operations staged out of Nikiski are the same as those listed in Tables 9-11 above (see Section 6.2.1).

For staging areas in Homer and Port Graham belugas are not anticipated south of Kalgin Island during project operations (MML unpublished data from tagged beluga). However, for transit areas north of Kalgin Island, we anticipate densities of belugas the same as those listed in Table 16 above (0.00106 animals/km^2) along the approximately 63 km route one-way. Considering Port Graham and Homer areas are far closer to several haulouts, we assume sea lion density is higher at 0.0085 animals/km^2 (Jacobs 2017) along the approximately196 km route one-way.

Results of Exposure Analysis (Drill rig Transport)

Nikiski Staging Area during 2017
We anticipate that noise associated with towing operations would drop to 120 dB within 2,154 m (or less) of the tugs (Austin et al. 2013). Even if we assume all of the tugs associated with the proposed action produce as much noise as the *Lauren Foss*, a tug that has over 50 percent more power (which is not anticipated), multiply by the full length of the roundtrip drill rig transit (44 km), which should provide a conservative estimate since the tugs will not be at full power the entire time, and multiply by densities of listed animals, the estimated number of marine mammal exposures that could be ensonified by towing operations was zero due to the small anticipated area ensonified to received levels ≥120 dB (rms), and low densities (see Table 19). In addition, PSOs will be in place monitoring out to 2,200 m radius of the towing tugs, and request that the towing tugs reduce power (and acoustic output) should marine mammals be detected approaching this exclusion zone. We consider the likelihood of exposure to towing operations to be extremely unlikely to occur and therefore discountable.

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transport distance is 6.9 km (calculated using coordinates provided by Jacobs (2017)).
[8] (42 km + 13.8km) x 2(2.154) km = 240.4 km^2
[9] (340 km + 13.8 km) x 2(2.154) km = 1,524.2 km^2 , and (392 km + 13.8 km) x 2(2.154) km = 1,748.2 km^2

Nikiski Staging Area during 2018-2021

Assuming the Yost is stored at Nikiski during all subsequent years (2018-2021), we calculate that, based on the centroid location for all wells (located at 60°54'47.21" N x 151°10'59.18" W), each trip will be 21 km long, and the average well to well transport distance is 6.9 km (calculated using coordinates provided by Jacobs (2017)). We still estimate zero listed marine mammals would be exposed due to the small ensonified area to received levels ≥120 dB (rms), and low densities (see Table 19). With the addition of PSOs and mitigation measures to reduce noise propagation, we consider the likelihood of exposure to towing operations from Nikiski to be extremely unlikely to occur and therefore discountable.

Port Graham/Homer Staging Area 2019-2021

Furie has indicated that the first two years of operations will be staged in Nikiski. However, subsequent years may stage in Nikiski, Homer, or Port Graham. We have included an analysis of potential exposures from transits from Homer or Port Graham even though shifting staging areas is unlikely. For Cook Inlet belugas, we assume that only 63 km of the tow will occur in waters occupied by belugas (i.e., transits north of Kalgin Island). Therefore, approximately one Cook Inlet beluga may be acoustically harassed per year (2018-2021) by rig movement to and from KLU to Port Graham or Homer (Table 20).[10]

Fin whale, Mexico DPS humpback whale, Western North Pacific humpback whale, and Western DPS Steller sea lion may be present along the full transit line (~196 km one-way), as well as between well sites (6.9 km one-way). Western DPS Steller sea lion may have a higher density in the lower portion of Cook Inlet (0.0085 animals/km^2). Therefore, approximately one fin whale, one Mexico DPS humpback whale, zero western North Pacific humpback whale, and 15 western DPS Steller sea lions may be acoustically harassed per year (2019-2021) by rig movement to and from KLU to Port Graham or Homer (Table 20).[11]

[10] (126 km + 13.8) x 2(2.154) km x 0.00106 belugas per km^2 = 0.6384 Cook Inlet beluga

[11] (392 km + 13.8) x 2(2.154) km x 0.000343 fin whale per km^2 = 0.5996 fin whale, (392 km + 13.8) x 2(2.154) km x (0.00251) x .105 Mexico DPS humpback whale per km^2 = 0.4607 Mexico humpback whale, (392 km + 13.8) x 2(2.154) km x (0.00251) x 0.005 WNP DPS humpback whale per km^2 = 0.0219 WNP humpback whale, (392 km + 13.8) x 2(2.154) km x 0.0085 Steller sea lion per km^2 = 14.8597 Western DPS Steller sea lion

Table 18. Potential Level B instances of exposure of listed marine mammals to received sound levels ≥120 dB 1 μPa (rms) to towing drill rig Yost from Nikiski associated with Furie's exploratory drilling program (2017-2021).

Nikiski Staging Area								
			Ensonified Area along Transit Line (km^2)					
Species	Activity	Radius (m)	2017	2018-2021	Density	DPS Probability of Occurrence (%)	2017	Per Year 2018-2021
Cook Inlet Beluga	Towing Rig	2,154	190.0	240.4	0.00106	n/a	0.2014	0.2548
Fin Whale					0.000343	n/a	0.0652	0.0825
Mexico DPS Humpback Whale					0.00251	10.5	0.0501	0.0634
Western North Pacific DPS Humpback Whale					0.00251	0.5	0.0024	0.0030
Steller sea lion					0.00085	n/a	0.1615	0.2043

Table 19. Potential Level B instances of exposure of listed marine mammals to received sound levels ≥120 dB 1 μPa (rms) to towing drill rig Yost from Port Graham or Homer associated with Furie's exploratory drilling program (2019-2021).

Port Graham or Homer Staging Areas							
			Ensonified Area along Transit Line (km^2)				
Species	Activity	Radius (m)	Beluga	Other Marine Mammals	Density	DPS Probability of Occurrence (%)	Per Year 2019-2021
Cook Inlet Beluga	Towing Rig	2,154	602.3	1,748.2	0.00106	n/a	0.6384
Fin Whale					0.000343	n/a	0.5996
Mexico DPS Humpback Whale					0.00251	10.5	0.4607
Western North Pacific DPS Humpback Whale					0.00251	0.5	0.0219
Steller sea lion					0.00850	n/a	14.8597

6.2.4 Exposure to OSV and support vessel activity

Our previous analysis (Section 6.2.3) focused on the loudest anticipated vessel sound source (towing the drill rig). This section will focus on the remaining noise component of vessel transit.

Mitigation Measures to Minimize the Likelihood of Exposure to Vessel Operations
As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to vessel noise:

1. Bow thrusters will not be used on supply vessels but for emergencies, timing of deliveries will be established to avoid unnecessary use;

2. PSO/CMs will have stop-work authority in the event a marine mammals is observed within or approaching a vessel exclusion zone (100 m for transit). Appropriate actions include, but are not limited to: delay of watercraft departure if doing so does not compromise human safety, altering the speed or course of OSVs, tugs and other support vessels; and

3. OSVs will not approach marine mammals within 100 m and will operate vessels at speeds of 10 knots or less relative to the current.

Approach to Estimating Exposures to Vessel Noise

General vessel transit includes OSV deliveries, tugs moving while not on-tow, and other support vessels, such as those carrying PSOs. These acoustic impacts will result from moving sources, and will be temporary in duration, on the order of minutes. Furie estimates 60 OSV deliveries in 2017 and 90 OSV deliveries per year in 2018 through 2021 (Jacobs 2017).

During 2001, underwater sound measurements from vessels in transit were recorded in Cook Inlet. The highest source level reported was 150 dB re 1 μPa rms at 1 m (Blackwell and Green 2002). The 120 dB isopleth was calculated using the practical spreading loss model (15 Log R), resulting in a radius of approximately 100 meters.

In addition to this, we considered trips by non-towing tugs. While Furie expects to deliver the Yost to Nikiski for overwintering, this has not been confirmed for year 2019-2021. Therefore, we assumed that the tugs may be returning the Yost to Port Graham or Homer in October of those years. We have also accounted for trips taken by two PSO vessels accompanying Yost movements, and their return to port. We assumed that tugs are based out of Nikiski. We also assumed that belugas would not be present south of Kalgin Island during the months that this project would be operating (based upon MML unpublished data from tagged animals). Finally, we assumed that mitigation measures would be completely effective in avoiding acoustic harassment of marine mammals while they were not underway (e.g. at idle or holding position in the tidal current while the Yost jacks up or refloats, or while deliveries are being made by OSVs.

Results of Vessel Noise Exposure
Listed cetaceans and pinnipeds have the potential to overlap with vessel noise associated with the proposed oil and gas exploration activities. We will discuss potential responses of listed species to vessel noise in Section 6.3.

Because the ensonified zone around these vessels is only 100 m, and these vessels will be able to change course, slow down, or stop in order to avoid marine mammals, we can assume substantial effectiveness of mitigation measures to avoid high received levels of noise.

6.2.5 Exposure to Aircraft activity

Mitigation Measures to Minimize the Likelihood of Exposure to Aircraft Activity
As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to aircraft activity:

1. PSO/CMs will be on site to monitor the exclusion zones for all aircraft and watercraft-based deliveries.
2. Aircraft shall not fly within 1,000 ft (305 m) of marine mammals or below 1,500 ft (457 m) altitude (except for take-off, landing, emergency situations, and inclement weather) while over land or sea.
3. Helicopters may not hover or circle above marine mammals.

Approach to the Assessment
Aircraft support during exploratory drilling activities is expected to include an average of one trip per day with a four trips per day maximum using a Bell 407 helicopter or similar aircraft (Jacobs 2017). Except on approach and take-off, aircraft will maintain an altitude (1,500 m) that is very unlikely to cause acoustic harassment of marine mammals. The maximum source level SPL of project aircraft is anticipated to be137dB at 1m (Blackwell and Greene 2002), this is anticipated to attenuate to 120 dB at 14 m, a distance that PSOs can ensure remains clear of marine mammals. The transference of airborne acoustic energy into water occurs within a 26^o cone beneath the aircraft. At 1000 feet (305 m) altitude, the exclusion zone radius described by the 13 degree angle of incidence of sound at the water surface is 224 m radius. At an altitude of 14 m (the distance at which proximity to the aircraft would result in underwater acoustic harassment, the radius of this exclusion zone where airborne air is transferred into the water column, is less than 4 meters. Coincidentally, the distance at which in-air acoustic harassment may occur (where a 137 dB SPL attenuates to 90dBA) is also 224 m. Therefore, ensuring that aircraft remain a lateral distance of 250 m away from marine mammals will ensure avoidance of acoustic harassment for those surfacing for air. With the application of mitigation measures, we conclude that the probability of a Furie aircraft harassing a listed species in the action area is extremely unlikely to occur and therefore considered discountable.

6.2.6 Exposure to Vessel Strike

Mitigation Measures to Minimize the Likelihood of Exposure to Vessel Strike

As discussed in Section 2.1.2, the following mitigation measures will be required through the Corps' permitting process to avoid or minimize exposure of marine mammals to vessel strike:

1. PSOs required on all tug boats and OSV vessels;

2. Vessels in transit shall be operated at speeds necessary to ensure no physical contact with whales occurs;
   a) Tugs towing the drill rig are anticipate to transit at slow speeds (~5 knots)
   b) Vessels will not approach within 100 meters of marine mammals

Approach to Estimating Exposures to Vessel Strike

As discussed in the *Proposed Action* section of this opinion, the activities Corps proposes to authorize for Furie's oil and gas exploration would increase the number of vessels transiting the area. Additional vessel traffic could increase the risk of exposure between vessels and marine mammals.

Assumptions of increased vessel traffic related to the proposed action are as follows:

- At the start of a program vessels will mobilize from either Nikiski, Homer, or Port Graham.

- The maximum number of vessels associated with the proposed action is anticipated to be six.

- Operations would commence on or after approximately April 1 and end by October 31 each year.

- At the end of a program, vessels will return to either Nikiski, Homer, or Port Graham. where they will demobilize.

Evidence suggests that a greater rate of mortality and serious injury to marine mammals correlates with greater vessel speed at the time of a ship strike (Laist et al. 2001, Vanderlaan and Taggart 2007), as cited in (Aerts and Richardson 2008). Vessels transiting at speeds >10 knots present the greatest potential hazard of collisions (Jensen and Silber 2004, Silber et al. 2009). Most lethal and severe injuries resulting from ship strikes have occurred from vessels travelling at 14 knots or greater (Laist et al. 2001).

While tug towing operations occur at relatively low speeds (5 knots), tugs not on tow, observer vessels, or OSVs may travel at greater speeds or during periods of limited visibility (Jacobs 2017). All of these factors increase the risk of collisions with marine mammals. However, standard mitigation measures discussed above are designed to help avoid potential vessel strikes to marine mammals.

Cetacean Exposure (beluga, humpback, and fin whale)
Available information indicates that vessel strikes of whales in the region are low and there is no indication that strikes will become a major source of injury or mortality in the action area.

Vessels will transit during open-water periods (April through October), and beluga, fin, and humpback whales are known to transit and feed in the action area during open-water periods.

NMFS researchers have witnessed avoidance and overt behavioral reactions by CI belugas when approached by small vessels (e.g., Lerczak et al. 2000). Although a beluga ship strike is rarely reported, a dead beluga whale washed ashore in Cook Inlet in 2007 with "wide blunt trauma along the right side of the thorax" (NMFS 2008b) suggesting a ship strike was the cause of the injury. In October 2012, a necropsy of another CI beluga carcass indicated the most likely cause of death was "blunt trauma such as would occur with a strike with the hull of the boat" (NMFS AKR, unpub. data). Scarring consistent with propeller injuries has also been documented among CI belugas (Burek 1999; LGL 2009; McGuire et al. 2011). Ship strikes with large vessels are not likely to occur or significantly affect listed species because large ships in the action area travel at slower speeds and in a direct route. Smaller boats that travel at high speed and change direction often present a greater threat than larger, slower vessels which move in straight lines (NMFS 2009).

Around the world, fin whales are killed and injured in collisions with vessels more frequently than any other whale (Laist et al. 2001, Jensen and Silber 2004, Douglas et al. 2008). Differences in frequency of injury types among species may be related to morphology. The long, sleek, fin whale tends to be caught on the bows of ships and carried into port where they are likely found and recorded in stranding databases (Laist et al. 2001). There have been 108 reports of whale-vessel collisions in Alaska waters between 1978 and 2011. Of these, 3 involved fin whale, but none were in Cook Inlet (Neilson et al. 2012). During 2015, one fin whale came into Port of Anchorage on the bulbous bow of a ship traveling from Seattle. However, it was unclear where the initial strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2017). Even if vessel-related deaths of fin whales in the waters outside of the action area where strike of fin whales has been known to occur were several times greater than observed levels, it would still be a small fraction of the total fin whale population (Laist et al. 2001).

Some of the unique feeding habits of fin whales may also put them at a higher risk of collision with vessels than other baleen whales. Fin whales lunge feed instead of skim feeding. These lunges are quick movements which may put them in the path of an oncoming vessel, and give the captain of a vessel little time to react. In addition, despite their large body size, fin whales appear to be limited to short dive durations (Goldbogen et al. 2007) which may make them more susceptible to ship strikes when they are near the surface. Based on ship-strike records, immature fin whales appear to be particularly susceptible to strike (Douglas et al. 2008).

The number of humpback whales killed worldwide by ship strikes is exceeded only by fin whales (Jensen and Silber 2004). On the Pacific coast, a humpback whale is killed about every other year by ship strikes (Barlow et al. 1997). There were 108 reports of whale-vessel collisions in Alaska waters between 1978 and 2011. Of these, 93 involved humpback whales (Neilson et al. 2012). During 2001, one humpback whale came into Port of Anchorage on the bulbous bow of a ship traveling from Seattle. However, it was unclear where the initial strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2017). Between 2008 and 2012 the mean minimum annual human-caused mortality and serious injury rate for humpback whales based on vessel collisions in Alaska was (0.45) reported in the NMFS Alaska Regional Office stranding database (Allen and Angliss 2015). However, even if vessel-related deaths of humpback whales in the waters outside of the action area where strike of humpback whales has been known to occur were several times greater than observed levels, it would still be a small fraction of the total humpback whale population (Laist et al. 2001). No vessel collisions or prop strikes involving humpback whales have been documented in the Cook Inlet.

In 2002 near Homer, a Steller sea lion was found with two separate head wounds looking like blunt trauma, with suspected vessel strike (NMFS Alaska Regional Office Stranding Database accessed May 2017).

Vessels would have a transitory presence in any specific location. NMFS is not able to quantify existing traffic conditions across the entire action area to provide context for the addition of six vessels. However, the rarity of collisions involving vessels and listed marine mammals in Cook Inlet despite decades of spatial and temporal overlap suggests that the probability of collision is low.

Based on the small number of vessels associated with the proposed activities, the limited number of sightings of fin and humpback whales in action area, the slow vessel speeds while towing the drill rig, mitigation measures to minimize exposure to vessel activities, and the decades of spatial and temporal overlap and the rarity of collisions with marine mammals, we conclude that the probability of a Furie vessel striking a cetacean in the action area is extremely unlikely to occur and therefore considered discountable.

6.2.7 Exposure to Pollution, Seafloor disturbance, Emissions

Authorized Discharge

Discharge associated with the jack-up rig is permitted by the ADEC under an APDES permit. Potential discharges that are authorized under APDES include water-based drill muds and drill cuttings, treated sanitary and domestic gray water, stormwater drainage, and non-contact cooling water. The APDES authorized discharges will adhere to state and national water quality standards (Jacobs 2017).

Unauthorized Discharge

Increased vessel activity in the action area will temporarily increase the risk of accidental fuel and lubricant spills from support vessels. Accidental spills may occur from a vessel leak or if the vessel runs aground. Potential impacts from such a spill on fin, humpback, and beluga whales or Steller sea lions in the action area will remain relatively small and will be minimized by implementing the appropriate spill response plan, and maintaining safe operational and navigational conditions (Jacobs 2017).

Accidental unauthorized spills may occur (i.e., from fuel or lubricant leaks). Associated vessels and structures will maintain and adhere to approved Spill, Prevention, Control, and Countermeasure (SPCC) plans as well as Oil Discharge Prevention and Contingency Plan (ODPCP). These plans include required adherence to NMFS's Pinniped and Cetacean Oil Spill Response Guidelines (NMFS-OPR-52).

Although it would be an extremely rare event, a well blowout is a potential risk. Though oil spills from offshore platforms up to 250 barrels have occurred, no oil well blowouts have been documented in Cook Inlet. Four gas blowouts have occurred in Cook Inlet since 1962, with the last occurring in 1987 (Moore et al. 2000). The risk of a blowout is considerably decreased given that Furie has conducted exploration drilling and testing in the KLU reservoir area and the reservoir pressures are generally known. In order to avoid or minimize the potential risk of a natural gas blowout, the jack-up drilling rig will be equipped with BOPE and a diverter system equipped to handle surface pressures up to and including 15,000 psi, approved by the AOGCC (see Jacobs 2017 for more details).

Some small spills could be in or close to areas used by listed marine mammals. However, small refined oil spills rapidly dissipate volatile toxic compounds within hours to a few days through evaporation, and residual components rapidly disperse in open waters. If individual beluga, humpback, or fin whales, or Steller sea lions were exposed to small spills, the spills would likely have minimal effects on their health due to small spills sizes, weathering, and rapid spill dispersal. Humpback and fin whales occur in very low densities in upper Cook Inlet during the summer months. Their low numbers further reduce the potential for exposure and response to oil spills.

A small fuel spill would be localized and would not permanently affect whale prey populations (e.g., forage fish and zooplankton). The amount of zooplankton and other prey lost in such a spill likely would be undetectable compared to what is available on the whales' summer feeding grounds. NMFS does not expect small spills to expose whales or their prey to a measureable level.

In the event of an oil spill in the marine environment, the permittees should immediately report the incident to the U.S. Coast Guard 17th District Command Center at 907-463-2000, and NMFS AKR, Protected Resources Division Oil Spill Response Coordinator at 907-586-7630 and/or email (sadie.wright@noaa.gov).

Seafloor Disturbance

Seafloor disturbance resulting from the jack-up rig associated with this action will likely have insignificant effects on both marine mammals and their habitat owing both to the small size of the footprint and the scouring effects of the tidal currents upon surface sediments.

The preventative measures and best practices to be implemented by Furie (as described in Jacobs 2017, section 2.4) addressing deck drainage, ballast water, cooling water, fire control water, domestic wastewater, mobilization, drilling, well-blowout prevention, oil spill prevention, support vessels, support aircraft and fuel storage should be sufficient to avoid adverse effects to marine mammals. It is extremely unlikely that pollution, seafloor disturbance, or emissions will have adverse impacts to marine mammals, and we expect any such effects will be insignificant.

6.2.8 Exposure to Geophysical Surveys

It is extremely unlikely that sidescan sonar or multibeam sonar with operating frequencies > 200 kHz will affect the ESA-listed species considered in this opinion because these frequencies are above the assumed hearing ranges of low-frequency whales (i.e., between 7 Hz and 35 kHz), mid-frequency whales (i.e., between 150 Hz and 160 kHz) and sea lions (i.e., between 60 Hz and 39 kHz). In the unlikely event that these acoustic devices operating >200 kHz are audible to ESA-listed whales and sea lions, it is unlikely that the pulsed sounds produced by these devices will reach these species because the sounds are produced in narrow beams and attenuate rapidly. To hear such sounds, ESA-listed species would need to remain within a few meters of the source and within the narrow beam of sound (i.e., directly under the vessel), a behavior that is extremely unlikely to occur. For these reasons, we conclude the effects from the obstacle avoidance sonars (operating at 200 kHz) are discountable.

6.2.9 Summary of Exposures

In Table 21, we summarize the calculated instances of acoustic harassment resulting proposed action, assuming no mitigation. We assume completely effective mitigation for aircraft activity due to the small zone to be monitored from a fixed and elevated platform (the Yost). Total instances of acoustic harassment cannot be derived by simply summing each column as some entries are mutually exclusive (e.g., the Yost cannot be overwintered at both Nikiski and at Port Graham / Homer, and different harassment calculations apply to these two winter ports). In these instances we assumed the scenario with the greatest potential for exposure (e.g., staging in Port Graham or Homer) for our total estimates.

In order to estimate likely exposure, mitigation measure effectiveness was taken into consideration. For impact pile driving activities, two PSOs are required on the Yost drilling rig, and one PSO on each observation vessel. These PSOs have shutdown authority if a marine mammal approaches within 5,500 meters of pile driving activities, and must be able to see the full zone for driving to initiate. During all pile driving activities, 50 percent mitigation effectiveness is assumed for all marine mammals (see Table 22).[12] During towing operations two PSOs are required on an observational vessel traveling in front of the tugs towing the Yost to clear the area within 2,200 m of the tugs on tow, and crew members on the tugs will also work to ensure the exclusion area is clear of marine mammals. To the extent practical, while maintaining control of the rig, the tugs will reduce the throttle/thrust if marine mammals are sighted in the expected path. The reduced throttle/thrust would be expected to reduce noise propagation distance. We assumed a 50 percent mitigation effectiveness of drill rig towing operations (see Table 22).[11]

[12] This may be an underestimate considering during Furie's 2015 operations on site, PSOs had visibility greater than 10 km during Beaufort sea state of 2 or less (Jacobs 2015).

Table 20. Summary of estimated instances of acoustic harassment per year across activities assuming no mitigation

Activity	Belugas 2017	Belugas 2018-2021	Fin Whale 2017	Fin Whale 2018-2021	Mexico Humpback Whale 2017	Mexico Humpback Whale 2018-2021	WNP Humpback Whale 2017	WNP Humpback Whale 2018-2021	Steller sea lions 2017	Steller sea lions 2018-2021
Impact Pile driving	0.302	0.604	0.098	0.196	0.075	0.150	0.004	0.007	0.242	0.484
Drilling/Mud Pumping	0.044	0.065	0.014	0.021	0.011	0.016	0.001	0.001	0.035	0.052
Towing Nikiski-Jurassic RT	0.201	0.255	0.065	0.083	0.050	0.063	0.002	0.003	0.162	0.204
Towing PG/H-centroid[1]	n/a	0.638	n/a	0.600	n/a	0.461	n/a	0.022	n/a	14.860
TOTAL	0.547	1.308	0.177	0.817	0.136	0.627	0.007	0.030	0.439	15.396

[1]PG/H = Port Graham or Homer, both locations being roughly equidistant from the well location centroid.

Table 21. Summary of estimated instances of acoustic harassment per year across activities assuming 50% mitigation effectiveness for pile driving and towing operations

Activity	Belugas 2017	Belugas 2018-2021	Fin Whale 2017	Fin Whale 2018-2021	Mexico Humpback Whale 2017	Mexico Humpback Whale 2018-2021	WNP Humpback Whale 2017	WNP Humpback Whale 2018-2021	Steller sea lions 2017	Steller sea lions 2018-2021
Impact Pile driving	0.151	0.302	0.049	0.098	0.038	0.075	0.002	0.004	0.121	0.242
Drilling/Mud Pumping	0.044	0.065	0.014	0.021	0.011	0.016	0.001	0.001	0.035	0.052
Towing Nikiski-Jurassic RT	0.101	0.128	0.033	0.042	0.025	0.032	0.001	0.002	0.081	0.102
Towing PG/H-centroid[1]	n/a	0.319	n/a	0.300	n/a	0.231	n/a	0.011	n/a	7.43
TOTAL[2]	0.296	0.686	0.096	0.419	0.074	0.322	0.004	0.016	0.237	7.724

[1]PG/H = Port Graham or Homer, both locations being roughly equidistant from the well location centroid.
[2] Total assumes 50% mitigation effectiveness for pile driving and towing operations.

6.3 Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

6.3.1 Responses to Impact Pile Driving

As described in the Sections 6.2.1, Cook Inlet beluga and western DPS Steller sea lion are anticipated to occur in the action area and are anticipated to overlap with noise associated with impact pile driving activities. We assume that some individuals are likely to be exposed and respond to this impulsive noise source. Potential annual exposures to Mexico DPS humpback whale, Western North Pacific humpback whale, and fin whale are extremely unlikely to occur.

During 2017, we estimate zero possible instances where Cook Inlet beluga and western DPS Steller sea lions might be exposed to pile driving operations (see Section 6.2.9, *Summary of Exposures*, Table 22). We estimate a total of one possible instance where Cook Inlet beluga, and one possible instance where western DPS Steller sea lion might be exposed to pile driving activities during Furie's 2018-2021 operations (0.242, and 0.302 exposures per year over four years respectively). All instances of exposure are anticipated to occur at received levels ≥ 160 dB.

The effects of sounds from pile driving might result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson et al. 1995a, Nowacek et al. 2007, Southall et al. 2007). The effects of pile driving on marine mammals are dependent on several factors, including the size, type, and depth of the animal; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment.

These instances of exposure assume a uniform distribution of animals and do not account for avoidance. The implementation of mitigation measures to reduce exposure to high levels of pile driving sound, the short duration of pile driving operations, and movement of animals, reduces the likelihood that exposure to pile driving would cause a behavioral response that may affect vital functions (reproduction or survival), or result in temporary threshold shift (TTS) or permanent threshold shift (PTS).

Cook Inlet Beluga

The combined data for mid-frequency cetaceans exposed to multiple pulses (such as impact pile driving), do not indicate a clear tendency for increasing probability and severity of responses with increasing received levels (Southall et al. 2007). In certain conditions, multiple pulses at relatively low received levels (~80-90 dB re 1 µPa) temporarily silenced individual vocal behavior for one species (sperm whale). In other cases with slightly different stimuli, received levels in the 120-180 dB range failed to elicit observable reactions from a significant percentage of individuals either in the field or the laboratory (Southall et al. 2007).

As discussed in the *Status of the Species* section, we assume that whale vocalizations are partially representative of beluga hearing sensitivities. NMFS categorizes Cook Inlet beluga whales in the mid-frequency cetacean functional hearing group, with an applied frequency range between 150 Hz and 160 kHz (NMFS 2016c). For their social interactions, belugas emit communication calls with an average frequency range of about 200 Hz to 7 kHz (Garland et al. 2015). At the other end of their hearing range, belugas use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au 2000) to navigate and hunt in dark or turbid waters, where vision is limited. Belugas and other odontocetes make sounds across some of the widest frequency bands that have been measured in any animal group. In the first report of hearing ranges of belugas in the wild, results of Castellote et al. (2014) were similar to those reported for captive belugas, with most acute hearing at middle frequencies, about 10-75 kHz.

A study conducted during the Port of Anchorage Marine Terminal Redevelopment Project in Knik Arm of Cook Inlet, detected hourly click rate was higher during times without (429 detected clicks/h) than with (291 detected clicks/h) construction activity; however, the difference was not statistically significant (Kendall et al. 2014). Lower frequency beluga whale vocalizations (e.g., whistles) were potentially masked, there may be have been an overall reduction in beluga vocalizations, or it is possible belugas were avoiding the area during construction activity.

This information leads us to conclude that beluga whales exposed to sounds produced by pile driving operations are likely to respond.

Of the beluga whales that may occur between 0 and 5.5 km of impact pile driving, some whales are likely to change their behavioral state – reduce the amount of time they spend at the ocean's surface, increase their swimming speed, change their swimming direction to avoid pile driving, change their respiration rates, increase dive times, reduce feeding behavior, and/or alter vocalizations and social interactions (Frid and Dill. 2002, Koski et al. 2009, Funk et al. 2010, Melcon et al. 2012). We anticipate that few (if any) exposures would occur at received levels >160 due to avoidance of high received levels, and shut down mitigation measures.

Some whales may be less likely to respond because they are feeding. The whales that are exposed to these sounds probably would have prior experience with similar pile driving stressors resulting from their exposure during previous years; that experience will make some whales more likely to avoid the construction activities while other whales would be less likely to avoid those activities. Some whales might experience physiological stress (but not distress) responses if they attempt to avoid one construction activity and encounter another construction activity while they are engaged in avoidance behavior.

Prey

Of all known Cook beluga prey species, only coho salmon have been studied for effects of exposure to pile driving noise (Casper et al. 2012, Halvorsen et al. 2012). These studies defined very high noise level exposures (210 dB re 1µPa2.s) as threshold for onset of injury, and supported the hypothesis that one or two mild injuries resulting from pile driving exposure at these or higher levels are unlikely to affect the survival of the exposed animals, at least in a laboratory environment. Hart Crowser Inc. et al. (2009) studied the effects on juvenile coho salmon from pile driving of sheet piles at the Port of Anchorage in Knik Arm of Cook Inlet. The fish were exposed in-situ (in that location) to noise from vibratory or impact pile driving at distances ranging from less than 1 meter to over 30 meters. The results of this studied showed no mortality of any of the test fish within 48 hours of exposure to the pile driving activities, and for the necropsied fish, no effects or injuries were observed as a result of the noise exposure (NMFS 2016b). Noise generated from pile driving can reduce the fitness and survival of fish in areas used by foraging marine mammals; however, given the small area of the project site relative to known feeding areas in Cook Inlet, and the fact that any physical changes to this habitat would not be likely to reduce the localized availability of fish (Fay and Popper 2012), it is unlikely that beluga would be affected. We consider potential impacts to prey resources as insignificant.

Steller sea lion

Information on behavioral reactions of pinnipeds in water to multiple pulses involves exposures to small explosives used in fisheries interactions, impact pile driving, and seismic surveys. Several studies lacked matched data on acoustic exposures and behavioral responses by individuals. As a result, the quantitative information on reactions of pinnipeds in water to multiple pulses is very limited (Southall et al. 2007). However, based on the available information on pinnipeds in water exposed to multiple noise pulses, exposures in the ~150-180 dB re 1µ Pa range (rms values over the pulse duration) generally have limited potential to induce avoidance behavior in pinnipeds (Southall et al. 2007).

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2016c).

The pinniped sighting data from the BlueCrest monitoring program in Cook Inlet reports Steller sea lions first approaching the drill rig and then turning away (Owl Ridge 2014). They also reported that many seals interrupted their normal behavior to view the rig, and then continued along in a normal manner. Marine mammal sighting data during the Apache seismic surveys in Cook Inlet reported the most common behavior of harbor seals during non-seismic periods was “look/sink” followed by “travel,” whereas during periods of active seismic shooting, “travel” was more common than “look/sink” (Lomac-MacNair et al. 2014).

During the early part of the open-water season when impact pile driving is anticipated to occur (May-July), Steller sea lions are occupying rookeries during their pupping and breeding season (late May to early July). No rookeries occur in the mid or upper areas of Cook Inlet. Sighting of Steller sea lions in the mid and upper areas of Cook Inlet are rare and not well documented

(Jacobs 2017). Based on past studies and the NMFS aerial data in Cook Inlet, the majority of all Steller sea lions are expected to be found south of the forelands (Rugh et al. 2005; Shelden et al. 2013, 2015).

Of the Steller sea lions that may occur between 0 and 5.5 km of impact pile driving, some sea lions are likely to change their behavioral state – sea lions that avoid these sound fields or exhibit vigilance and raise their heads above water are not likely to experience significant disruptions of their normal behavioral patterns because the ensonified area is temporary and pinnipeds seem rather tolerant of low frequency noise. We anticipate that few (if any) exposures would occur at received levels >160 due to avoidance of high received levels, and shut down mitigation measures.

6.3.2 Responses to Drilling and Mud Pumping

As we indicated in *Section 6.2.2 Exposure to Drilling and Mud Pumping*, the likelihood of these stressors exposing listed species as part of the proposed action is extremely unlikely to occur as to be considered discountable.

As we discussed in the *Approach to the Assessment* section of this opinion, endangered or threatened animals that are not directly or indirectly exposed to a potential stressor cannot respond to that stressor. Because listed whales and pinnipeds are not likely to be directly or indirectly exposed to these stressors, they are not likely to respond to that exposure or experience reductions in their current or expected future reproductive success as a result of those responses. Even if occasional exposures at low received levels were to occur, these exposures are not anticipated to rise to the level of take. Off the coast of Barrow Alaska, Richardson et al. (1991) played back recordings of drilling noise and reported "overt reactions" by beluga whales; these included: slowing down, milling, and/or reversing direction. However, Richardson et al. (1995) reported belugas outside of Cook Inlet near drill-sites and artificial islands showed little to no disturbance to the associated noise. Blackwell and Greene (2002), suggest that "belugas in industrialized areas have to a large extent habituated to noises from ships and industrial activities, when compared to animals living in remote locations such as the high Arctic."

If exposures occur, acoustic effects of drilling are expected to be fairly minor, although they cannot be effectively mitigated beyond delaying the initiation of drilling activities if marine mammals come into close proximity to the rig. Nevertheless, marine mammals that occur near the rig will not experience harmful acoustic impacts from drilling, and are not expected to experience levels of acoustic harassment that result in consequential energy costs. There are no known attractants at these proposed well sites that would compel a marine mammal to remain in close proximity to an active drill rig.

An action that is not likely to reduce the fitness of individual whales or pinnipeds would not be likely to reduce the viability of the populations those individual whales represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of those populations).

6.3.3 Responses to Active Towing of Drill Rig

As described in the Sections 6.2.3, beluga, humpback, and fin whales, and Steller sea lions are all anticipated to occur in the action area and are anticipated to overlap with noise associated with towing the drill rig. We assume that some individuals are likely to be exposed and respond to this continuous noise source.

If operations are staged out of Nikiski, we estimated zero possible instances where listed marine mammals might be exposed to towing activities for the duration of the action 2017-2021 (see Section 6.2.9, *Summary of Exposures*, Table 22). However, if subsequent operations in years 2019-2021 are staged in either Homer or Port Graham exposures to listed species may occur. We estimated a total of one possible instance where Cook Inlet Beluga, fin whale, and Mexico DPS humpback whale may be exposed, and 22 possible instances where western DPS Steller sea lion might be exposed to towing activities during Furie's 2019-2021 open water operations.[13] All instances of exposure are anticipated to occur at received levels ≥ 120 dB.

The primary sources of sounds from all vessel classes are propeller cavitation, propeller singing, and propulsion or other machinery. Propeller cavitation is usually the dominant noise source for vessels (Ross 1976). Propeller cavitation and singing are produced outside the hull, whereas propulsion or other machinery noise originates inside the hull. There are additional sounds produced by vessel activity, such as pumps, generators, flow noise from water passing over the hull, and bubbles breaking in the wake. The proposed action involves three tugs (two actively towing and one for braking/positioning) transporting the drill rig.

Based on aerial surveys (Rugh et al. 2010), hydroacoustic studies (Castellote et al. 2016), telemetry studies (Shelden et al. 2013, 2015), and observations performed within KLU in 2015, the density of belugas in the project area during the summer is expected to be extremely low (Jacobs 2017). Summer range contraction of Cook Inlet belugas derived from aerial surveys (Figure 5) show that belugas have made little summer use of the KLU since 1998, and even less since 2008. Limited tagging data indicates no presence of belugas in KLU in April through July, although only 1-2 tagged belugas were returning signals during those months. There is a higher potential for overlap with towing operations and belugas in the fall when beluga may be transiting back to critical habitat area 2 for fall/winter feeding (see Figure 3). Estimated Cook Inlet beluga whale distributions for the months of August through March indicate that individuals concentrate their range in the upper region of Cook Inlet through September, but increase their range from October to March, utilizing more area of the Inlet (Jacobs 2017).

During the summer, Belugas have not been seen in the KLU unit on June/July aerial surveys since 1979. However, the opportunistic sightings database has a single record of belugas in the KLU during the April-July time period; in 1998, the vessel Star Princess reported 30-40 belugas heading north in the KLU during July. Summer range contraction of Cook Inlet belugas derived from aerial surveys (Figure 5) show that belugas have made little summer use of the KLU since 1998, and even less since 2008. Limited tagging data indicates no presence of belugas in KLU in April through July, although only 1-2 tagged belugas were returning signals during those months. The lack of beluga presence in the KLU is supported by over 867 hours of observer effort in the area in summer, 2015, with no detections of belugas made (Jacobs 2017).

Baleen whale response distances to towing activities are expected to vary, depending on sound-

[13] Cook Inlet beluga 0.319*3yrs=0.957, Fin whale 0.300 *3yrs= 0.9, Mexico DPS humpback 0.231*3yrs = 0.693, Steller sea lion 7.44*3yrs= 22.32

propagation conditions and whether or not the animals are actively feeding. Reactions of marine mammals to vessels often include changes in general activity (e.g. from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles, and changes in speed and direction of movement (NMFS 2013). Past experiences of the animals with vessels are important in determining the degree and type of response elicited from an animal-vessel encounter. Whale reactions to slow-moving vessels are less dramatic than their reactions to faster and/or erratic vessel movements. Some species have been noted to tolerate slow-moving vessels within several hundred meters, especially when the vessel is not directed toward the animal and when there are no sudden changes in direction or engine speed (Wartzok et al. 1989, Richardson et al. 1995a, Heide-Jorgensen et al. 2003).Considering that tugs towing the drill rig are only anticipated to travel at ~ 5knots, we do not anticipate dramatic reactions to towing noise.

Sea lions may become accustomed to repeated slow vessel approaches, resulting in minimal response. Although low levels of occasional disturbance may have little long-term effect, areas subjected to repeated disturbance may be permanently abandoned. Repeated disturbances that result in abandonment or reduced use of rookeries by lactating females could negatively affect body condition and survival of pups through interruption of normal nursing cycles (NMFS 2008a). Pups are the age-class most vulnerable to disturbance from vessel traffic (NMFS 2008a).

If staging areas shift to Homer or Port Graham during future operations (2019-2021), the 3-mile no transit zones are established and enforced around rookeries in the area for further protection, and NMFS' guidelines for approaching marine mammals discourage vessels approaching within 100 yards of haulout locations.

Vessels produce sound that may elicit behavioral changes in sea lions, mask their underwater communications, mask received noises, and cause them to avoid noisy areas. Richardson (1995) found vessel noise does not seem to strongly affect pinnipeds that are already in the water, explaining that hauled out seals often respond more strongly to the presence of vessels.

Steller sea lion occur infrequently in the action area around KLU. No rookeries occur in the mid or upper areas of Cook Inlet. Based on past studies and NMFS aerial data in Cook Inlet, the majority of Steller sea lions are expected to be found south of the forelands (Jacobs 2017). Of the 670 Steller sea lion sights during the survey, none were sighted north of the forelands (Rugh et al. 2005; Shelden et al. 2013, 2015).

Since towing the drill rig will be continuous noise sources, it is not anticipated that marine mammals would enter into an area where they would suffer from TTS or PTS. In addition, vessel mitigation measures will also avoid separation of whales within groups, slow down during periods of low visibility, and avoid close approaches.

We anticipate that noise associated with towing the drill rig would drop to the 120 dB isopleth within 2,154 meters (or less) of the active tugs. At these distances, a whale or pinniped that perceived the vessel noise is likely to ignore such a signal and devote its attentional resources to stimuli in its local environment. If animals do respond, they may exhibit slight deflection from the noise source, engage in low-level avoidance behavior, short-term vigilance behavior, or short-term masking behavior, but these behaviors are not likely to result in adverse consequences for the animals.

Prey Resources

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

6.3.4 Responses to Vessel Noise

As described in the Sections 6.24, beluga, humpback, and fin whales, and Steller sea lions are all anticipated to occur in the action area and are anticipated to overlap with noise associated with vessel transit. We assume that some individuals are likely to be exposed and respond to this continuous noise source.

Cetaceans (beluga, fin, and humpback whale)

Reactions of marine mammals to vessels often include changes in general activity (e.g. from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles, and changes in speed and direction of movement (NMFS 2013). Past experiences of the animals with vessels are important in determining the degree and type of response elicited from an animal-vessel encounter. Whale reactions to slow-moving vessels are less dramatic than their reactions to faster and/or erratic vessel movements. Some species have been noted to tolerate slow-moving vessels within several hundred meters, especially when the vessel is not directed toward the animal and when there are no sudden changes in direction or engine speed (Wartzok et al. 1989, Richardson et al. 1995a, Heide-Jorgensen et al. 2003).

Humpback whale reactions to approaching boats are variable, ranging from approach to avoidance (Payne 1978, Salden 1993). On rare occasions humpbacks “charge” towards a boat and “scream” underwater, apparently as a threat (Payne 1978). Baker et al. (1983) reported that humpbacks in Hawai’i responded to vessels at distances of 2 to 4 km. Bauer and Herman (1986) concluded that reactions to vessels are probably stressful to humpbacks, but that the biological significance of that stress is unknown. Humpbacks seem less likely to react to vessels when actively feeding than when resting or engaged in other activities (Krieger and Wing 1984). Mothers with newborn calves seem most sensitive to vessel disturbance (Clapham and Mattila 1993). Marine mammals that have been disturbed by anthropogenic noise and vessel approaches are commonly reported to shift from resting behavioral states to active behavioral states, which would imply that the incur an energy cost. Morete et al. (2007) reported that undisturbed humpback whale cows that were accompanied by their calves were frequently observed resting while their calves circled them (milling) and rolling interspersed with dives. When vessels approached, the amount of time cows and calves spent resting and milling respectively declined significantly.

Fin whales responded to vessels at distances of about 1 km (Edds and Macfarlane 1987). Watkins (1981) found that fin and humpback whales appeared startled and increased their swimming speed to avoid approaching vessels. Jahoda et al. (2003) studied responses of fin whales in feeding areas when they were closely approached by inflatable vessels. The study concluded that close vessel approaches caused the fin whales to swim away from the approaching vessel and to stop feeding. These animals also had increases in blow rates and spent less time at the surface (Jahoda et al. 2003). This suggests increases in metabolic rates, which may indicate a stress response. All these responses can manifest as a stress response in which the mammal undergoes physiological changes with chronic exposure to stressors, it can interrupt behavioral and physiological events, alter time budget, or a combination of all these stressors (Sapolsky 2000, Frid and Dill 2002).

In more pristine environments like the Canadian Arctic, beluga whales have been observed reacting to noise from ships underway at extremely long distances of 35-50 km (LGL and Greenridge 1986; Finley et al. 1990; Cosens and Dueck 1993). By contrast, observations of beluga whales in Cook Inlet have reported very little response to industrial activities. Blackwell and Greene (2002) reported belugas traveling within a few meters of the hull of a vessel near the Port of Anchorage. Although belugas may have become habituated to industrial noises in Cook Inlet, studies have shown that in certain cases the whales will exhibit behavioral changes. Stewart (2012) studied the interactions between belugas and small boat noise in Knik Arm in an effort to document the belugas' responses to boat presence. On several occasions during this study, changes in group behavior of whales to small boats were observed; these include diving, increased travel speed, and reversing course.

In general, whales react strongly and rather consistently to approaching vessels of a wide variety of types and sizes. Whales are anticipated to interrupt their normal behavior and swim rapidly away if approached by a vessel. Surfacing, respiration, and diving cycles can be affected. The flight response often subsides by the time the vessel has moved a few kilometers away. After single disturbance incidents, at least some whales are expected to return to their original locations. Vessels moving slowly and in directions not toward the whales usually do not elicit such strong reactions (Richardson and Malme 1993).

We anticipate that noise associated with transiting vessels would drop to 120 dB within 100 meters (or less) of most vessels associated with Furie's oil and gas exploration activities (Blackwell and Green 2002). Considering that humpback whale regulations restrict approaching animals within 100 yards, and Furie is applying an exclusion zone for vessel transit out to 100 m (~109 yards), a whale that perceived the vessel noise is likely to ignore such a signal and devote its attentional resources to stimuli in its local environment. If animals do respond, they may exhibit slight deflection from the noise source, engage in low-level avoidance behavior, short-term vigilance behavior, or short-term masking behavior, but these behaviors are not likely to result in adverse consequences for the animals. The nature and duration of response is not anticipated to be a significant disruption of important behavioral patterns such as feeding or resting. During the operational period of the action (April-October), the action area is not considered high quality habitat for Cook Inlet beluga whales, fin whales, or humpback whales so slight avoidance of the area in not likely to adversely affect these species**.**

In addition, with mitigation measures in place which specify procedures for changing vessel speed and/or direction to avoid groups of whales, avoid potential for collision, and PSOs on board to spot nearby whales, the impact of vessel transit on beluga, Mexico DPS and Western North Pacific DPS humpback, and fin whales is not anticipated to reach the level of harassment under the ESA, and is considered insignificant.

Steller sea lion

Few authors have specifically described the responses of pinnipeds to boats, and most of the available information on reactions to boats concerns pinnipeds hauled out on land or ice. However, the mere presence and movements of ships in the vicinity of seals and sea lions can cause disturbance to their normal behaviors (Calkins and Pitcher 1982, Kucey 2005, Jansen et al. 2006), and could potentially cause Steller sea lions to abandon their preferred breeding habitats in areas with high traffic (Kenyon and Rice 1961). Disturbances from vessels may motivate seals and sea lions to leave haulout locations and enter the water (Richardson 1998, Kucey 2005). The possible impact of vessel disturbance on Steller sea lions has not been well studied, yet the response by sea lions to disturbance will likely depend on the season and life stage in the reproductive cycle (NMFS 2008a).

Vessels that approach rookeries and haulouts at slow speed, in a manner that allows sea lions to observe the approach, should have less effects than vessels that appear suddenly and approach quickly (NMFS 2008a). Sea lions may become accustomed to repeated slow vessel approaches, resulting in minimal response. Although low levels of occasional disturbance may have little long-term effect, areas subjected to repeated disturbance may be permanently abandoned. Repeated disturbances that result in abandonment or reduced use of rookeries by lactating females could negatively affect body condition and survival of pups through interruption of normal nursing cycles (NMFS 2008a). Pups are the age-class most vulnerable to disturbance from vessel traffic (NMFS 2008a).

If staging areas shift to Homer or Port Graham during future operations (2019-2021), the 3-mile no transit zones are established and enforced around rookeries in the area for further protection, and NMFS' guidelines for approaching marine mammals discourage vessels approaching within 100 yards of haulout locations.

Vessels produce sound that may elicit behavioral changes in sea lions, mask their underwater communications, mask received noises, and cause them to avoid noisy areas. Richardson (1995) found vessel noise does not seem to strongly affect pinnipeds that are already in the water, explaining that hauled out seals often respond more strongly to the presence of vessels.

Steller sea lion occur infrequently in the action area around KLU. No rookeries occur in the mid or upper areas of Cook Inlet. Based on past studies and NMFS aerial data in Cook Inlet, the majority of Steller sea lions are expected to be found south of the forelands (Jacobs 2017). Of the 670 Steller sea lion sights during the survey, none were sighted north of the forelands (Rugh et al. 2005; Shelden et al. 2013, 2015).

The nature and duration of response is not anticipated to be a significant disruption of important behavioral patterns such as feeding, breeding, or resting. During the operational period of the action (April-October), the action area is not considered high quality habitat for Steller sea lions so slight avoidance of the area in not likely to adversely affect these species or rise to the level of harassment under the ESA.

6.3.5 Responses to Oil and Gas Spill

The historical evidence available suggests that oil spills are highly unlikely. If they did occur, we cannot predict when or where they would occur, or determine if marine mammals would be present at that time and location. Nevertheless, we assume that any individuals that overlap in time and space with a potential spill may be exposed.

There are different probabilities of potential occurrence between the various sized oil spills (small, large, and very large oil spill [VLOS]). It is more likely that a small oil spill could occur in association with oil exploration activities than a VLOS. However, the general responses of individual animals to exposure to oil do not differ with the size of a spill. The size of the spill determines the number of individuals that will be exposed and duration of exposure.

Toxic substances can impact animals in two major ways. First, the acute toxicity caused by a major point source of a pollutant (such as an oil spill or hazardous waste) can lead to acute mortality or moribund animals with a variety of neurological, digestive and reproductive problems. Second, toxic substances can impair animal populations through complex biochemical pathways that suppress immune functions and disrupt the endocrine balance of the body, causing poor growth, development, reproduction and reduced fitness. Toxic substances come in numerous forms, with the most-recognized being the organochlorines (OCs; mainly PCBs and DDTs), heavy metals and polycyclic aromatic hydrocarbons (PAHs). There are also a number of “emerging” contaminants, e.g., flame retardant polybrominated diphenyl ethers (PBDEs), which could also be impacting marine mammals.

If an oil spill were to occur, marine mammals and their habitats may be adversely impacted. Marine mammals could experience adverse effects from contact with hydrocarbons, including:

- Inhalation of liquid and gaseous toxic components of crude oil and gas;
- Ingestion of oil and/or contaminated prey;
- Fouling of baleen (fin and humpback whales);
- Oiling of skin, eyes, and conjunctive membranes causing corneal ulcers, conjunctivitis, swollen nictitating membranes and abrasions.

Available evidence suggests that mammalian species vary in their vulnerability to short-term damage from surface contact with oil and ingestion. While vulnerability to oil contamination exists due to ecological and physiological reasons, species also vary greatly in the amount of information that has been collected about them and about their potential oil vulnerability.

Ingestion of hydrocarbons can irritate and destroy epithelial cells in the stomach and intestine of marine mammals, affecting motility, digestion, and absorption, which may result in death or reproductive failure (Geraci and St. Aubin 1990). Direct ingestion of oil, ingestion of contaminated prey, or inhalation of volatile hydrocarbons transfers toxins to body fluids and tissues causing effects that may lead to death, as suspected in dead gray and harbor seals found with oil in their stomachs (Engelhardt 1982, Geraci and St. Aubin 1990, Frost et al. 1994, Spraker et al. 1994, Jenssen 1996). Additionally, harbor seals observed immediately after oiling appeared lethargic and disoriented, which may be attributed to lesions observed in the thalamus of the brain (Spraker et al. 1994).

All accidental discharges occurring as part of the proposed action will occur within designated Cook Inlet beluga critical habitat (see Figure 3). An accidental discharge could render areas containing the identified essential physical and biological features for beluga unsuitable for use. In such an event waters may contain toxins or other agents harmful to Cook Inlet beluga whales, and spill may restrict passage. Primary prey species could become contaminated, experience mortality, or be otherwise adversely affected by spilled oil.

Whales (beluga, fin, and humpback)

Depending on the timing of the spill, beluga, fin, and humpback whales could briefly be exposed to small spills of refined oil. The rapid dissipation of toxic fumes into the atmosphere from rapid aging of fresh refined oil and disturbance from response related noise and activity limits potential exposure of whales to prolonged inhalation of toxic fumes. Surface feeding whales could ingest surface and near surface oil fractions with their prey, which may be contaminated with oil components. Ingestion of oil may result in temporary and permanent damage to whale endocrine function and reproductive system function, but is not likely for small oil spills.

Research has shown that while cetaceans are capable of detecting oil, they do not seem to be able to avoid it. For example, during the spill of Bunker C and No. 2 fuel oil from the *Regal Sword*, researchers saw humpback and fin whales, and a whale tentatively identified as a right whale, surfacing and even feeding in or near an oil slick off Cape Cod, Massachusetts (Geraci and St. Aubin 1990).

The greatest threat to cetaceans is likely from the inhalation of the volatile toxic hydrocarbon fractions of fresh oil which can damage the respiratory system (Hansen 1985, Neff 1990), cause neurological disorders or liver damage (Geraci and St. Aubin 1990), have anaesthetic effects (Neff 1990), and cause death (Geraci and St. Aubin 1990). However, for small spills there is anticipated to be a rapid dissipation of toxic fumes into the atmosphere from rapid aging of fresh refined oil which limits potential exposure of whales to prolonged inhalation of toxic fumes.

Whales could be exposed to a multitude of short and longer term additional human activity associated with initial spill response, cleanup and post event human activities that include primarily increased and localized vessel and aircraft traffic associated with reconnaissance and monitoring. These activities would be expected to be intense during the spill cleanup operations and continue at reduced levels for potentially decades post-event. Specific cetacean mitigation would be employed as the situation requires and would be modified as needed to meet the needs of the response effort. The response contractor would be expected to work with NMFS and state officials on wildlife management activities in the event of a spill. Oil spill response activities have been previously consulted on by NMFS as part of the *Unified Plan* (AKR-2014-9361).

Based on the localized nature of small oil spills, the relatively rapid weathering expected for <1,000 bbl of oil, the small number of refueling activities in the proposed action, and the safeguards in place to avoid and minimize oil spills, we conclude that the probability of a Furie authorized activity within 2017-2021 causing a small oil spill and exposing beluga, fin, or humpback whales is extremely unlikely to occur. If exposure were to occur, due to the ephemeral nature of small, refined oil spills, NMFS does not expect detectable responses from whales and would consider exposure insignificant.

Steller Sea Lions

In the event of a small oil spill, Steller sea lions could be briefly exposed depending on habitat use, densities, season, and various spill characteristics.

Sea lions exposed to oil spills may become contaminated with PAHs through inhalation, dermal contact and absorption, direct ingestion, or by ingestion of contaminated prey (Albers and Loughlin 2003). After the Exxon Valdez oil spill, Calkins et al. (1994) recovered 12 Steller sea lion carcasses from the beaches of Prince William Sound and collected 16 additional Steller sea lions from haul out sites in the vicinity of Prince William Sound, the Kenai coast, and the Barren Islands. The highest levels of PAHs were in animals found dead following the oil spill in PWS. Furthermore, sea lion bile samples collected seven months after the spill had levels of PAH metabolites consistent with exposure to PAH compounds (Calkins et al. 1994). However, histological examinations found no lesions that could be attributed to hydrocarbon contamination and, hence, no evidence of damage due to oil toxicity (Calkins et al. 1994).

Surface contact with petroleum hydrocarbons, particularly the low-molecular-weight fractions, to pinnipeds can cause temporary damage of the mucous membranes and eyes (Davis et al. 1960) or epidermis (Walsh et al. 1974, Hansbrough et al. 1985, St. Aubin 1988). Other acute effects of oil exposure which have been shown to reduce seal health and possibly survival include skin irritation, disorientation, lethargy, conjunctivitis, corneal ulcers, and liver lesions. Direct ingestion of oil, ingestion of contaminated prey, or inhalation of hydrocarbon vapors can cause serious health effects including death (Geraci and Smith 1976, Geraci and St. Aubin 1990). However, for small spills there is anticipated to be a rapid dissipation of toxic fumes into the atmosphere from rapid aging of fresh refined oil which limits potential exposure of seals to prolonged inhalation of toxic fumes

Based on the localized nature of small oil spills, the relatively rapid weathering expected for <1,000 bbl of oil, the small number of refueling activities in the proposed action, and the safe guards in place to avoid and minimize oil spills, we conclude that the probability of a Furie authorized activity within 2017-2021 causing a small oil spill and exposing Steller sea lions is extremely unlikely to occur as to be considered discountable. If exposure were to occur, due to the ephemeral nature of small, refined oil spills, NMFS does not expect detectable responses from sea lions and would consider exposure insignificant.

6.3.6 Responses to Other Stressors

As we indicated in *Sections 6.2.5-6.2.8 Exposure to Aircraft Noise, Vessel Strike, Seafloor Disturbance, and Geophysical Surveys*, the likelihood of these stressors exposing listed species as part of the proposed action is extremely unlikely to occur as to be considered discountable, or the exposures that would occur would not reach the level that constitutes a take.

As we discussed in the *Approach to the Assessment* section of this opinion, endangered or threatened animals that are not directly or indirectly exposed to a potential stressor cannot respond to that stressor. Because listed whales and pinnipeds are not likely to be directly or indirectly exposed to these stressors, they are not likely to respond to that exposure or experience reductions in their current or expected future reproductive success as a result of those responses.

An action that is not likely to reduce the fitness of individual whales or pinnipeds would not be likely to reduce the viability of the populations those individual whales represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of those populations).

7. CUMULATIVE EFFECTS

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

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

7.1 Fisheries

Fishing, a major industry in Alaska, is expected to continue in Cook Inlet. As a result, there will be continued risk of prey competition, ship strikes, harassment, entanglement in fishing gear, and possible displacement from former summer foraging habitat for Cook Inlet beluga whales (e.g., waters within and near the outlets of the Kenai and Kasilof Rivers during salmon season) (

)(Castellote et al. 2016). ADF&G will continue to manage fish stocks and monitor and regulate fishing in Cook Inlet to maintain sustainable stocks. It remains unknown whether and to what extent Cook Inlet beluga prey might be made less available due to commercial, subsistence, personal use, and sport fishing, especially near the mouths of streams up which salmon and eulachon migrate to spawning areas. The Cook Inlet Beluga Recovery Team considered reduction in availability of prey due to activities such as fishing to be a moderate threat to the population.

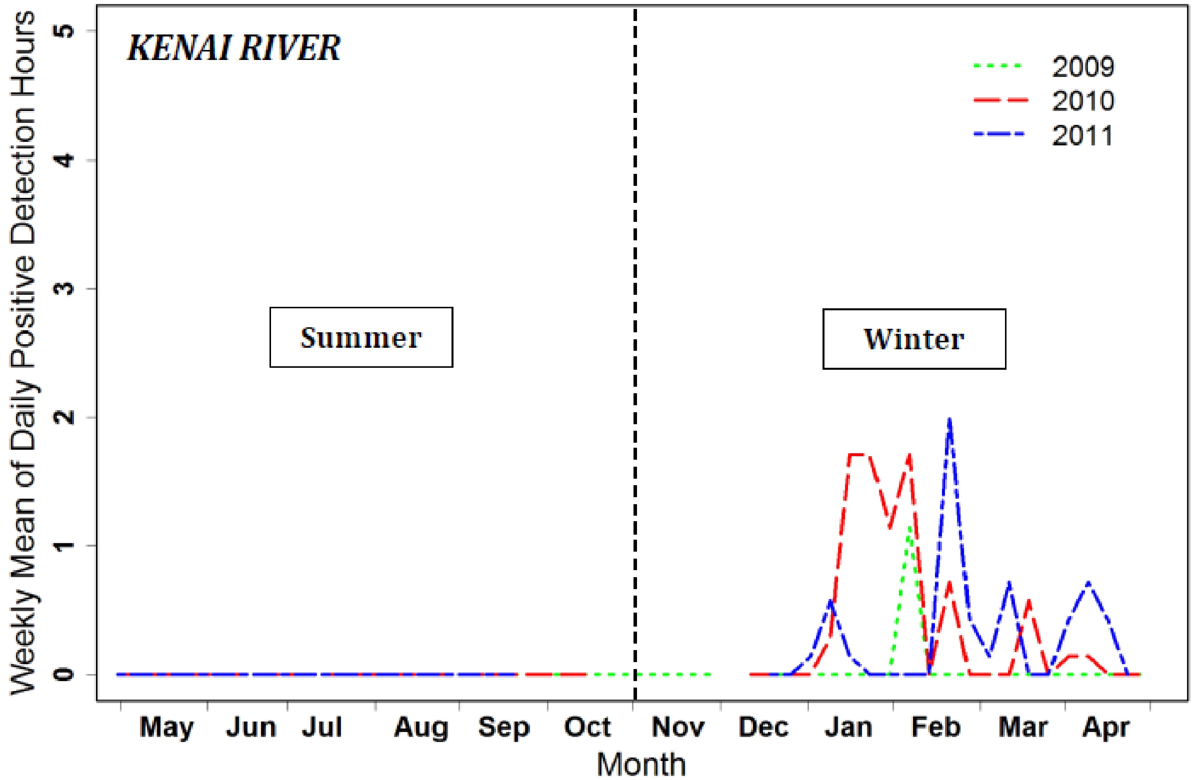

Figure 14. Acoustic detections of Cook Inlet belugas in the Kenai River from 2009 through 2011. From Castellote et al. (2016).

7.2 Oil and Gas Development

It is likely that oil and gas development will continue in Cook Inlet with associated risks to marine mammals from seismic activity, vessel and air traffic, well drilling operations, wastewater discharge; habitat loss, and potential for oil spills and natural gas leaks and well blowouts. For existing infrastructure there is still the potential for future oil spills and gas leaks. Any such proposed development or oil spill/gas leak would undergo ESA section 7 consultation and therefore the associated effects are not cumulative effects pursuant to the ESA.

7.3 Coastal Development

Coastal development may result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated both with construction and with the activities associated with the projects after construction. Any projects with a Federal nexus (e.g. Chuitna Coal Mine, ORPC Tidal Energy Projects, Port of Anchorage expansions) will require section 7 consultation. However as populations in the area increases, coastal development with unspecified impacts to Cook Inlet could occur, and vessel traffic in the area could increase.

7.4 Pollution

As the population in urban areas continue to grow, an increase in pollutants entering Cook Inlet is likely to occur. Hazardous materials may be released into Cook Inlet from vessels, aircraft, and municipal runoff. There is a possibility an oil spill could occur from vessels traveling within the action area, or that oil could migrate into the action area from a nearby spill. There are many nonpoint sources of pollution within the action area; such pollution is not federally-regulated.

Pollutants can pass from streets, construction and industrial areas, and airports into Cook Inlet and beluga habitat. However, the EPA and the ADEC will continue to regulate the amount of pollutants that enter Cook Inlet from point and nonpoint sources through NPDES/APDES permits. As a result, permittees will be required to renew their permits, verify they meet permit standards, and potentially upgrade facilities.

7.5 Tourism

There currently are no commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the near future. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards (e.g., shallow waters, extreme tides, and currents). We are aware, however, that some aircraft have circled around groups of Cook Inlet beluga whales, disrupting their breathing pattern, and possibly their feeding activities. NMFS has undertaken outreach efforts to educate local pilots of the potential consequences of such actions, providing guidelines encouraging pilots to "stay high and fly by".

Vessel-based whale-watching, should it occur, may cause additional stress to the beluga population through increased noise and intrusion into beluga habitat not ordinarily accessed by boats. Avoidance reactions have often been observed in beluga whales when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably; larger vessels that do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008a). The small size and low profile of beluga whales, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale watchers to approach the beluga whales more closely than usually recommended for marine mammals.

Watercraft that may or may not have been engaged in fishing-related activities have been observed to harass belugas in the Twentymile River during April. It is likely that such harassment also occurs during late summer coho salmon runs in the same area. NMFS is cooperating with partners to assess the degree to which such boating activities may be a cause for concern due to the associated reduction in beluga foraging opportunities.

7.6 Subsistence Hunting

Alaska Natives do not currently hunt Cook Inlet belugas, but can hunt harbor seals and Steller sea lions in Cook Inlet for subsistence purposes. Such hunts are typically boat-based and could temporarily increase noise in the environment and increase the potential for accidental ship strikes of Cook Inlet belugas and other marine mammals. Any future hunts of Cook Inlet belugas will require a Federal authorization and are not considered under the ESA definition of cumulative impacts. Harvests of harbor seals and western DPS Steller sea lions occur under co-management agreements with NMFS, and occur at or well below sustainable levels of harvest.

8. INTEGRATION AND SYNTHESIS

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

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

8.1 Cetacean Risk Analysis

Based on the results of the *Exposure Analysis* without the implementation of mitigation measures, we expect Cook Inlet beluga whales, fin whales, and Mexico DPS humpback whales may be exposed to impact pile driving noise and towing operations. No exposures to Western North Pacific DPS humpback whales are anticipated (see Table 21). Exposure to vessel noise from transit, aircraft noise, noise from geohazard surveys, seafloor disturbance, and small oil spills may occur but the expected effects are considered insignificant and would not rise to the level of take. As discussed below, exposure to vessel strike and marine debris is extremely unlikely to occur and therefore the expected effects are considered discountable, and because the probability of large and very large oil spills are extremely unlikely to occur, effects from those events are also considered discountable.

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

The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animal's energy budget, time budget, or both (the two are related because foraging requires time). Large whales such as fin and humpbacks have an ability to store substantial amounts of energy, which allows them to survive for months on stored energy during migration and while in their wintering areas, and their feeding patterns allow them to acquire energy at high rates. For smaller cetaceans, like Cook Inlet beluga whales, foraging is anticipated to occur year-round on seasonally available prey. During spring and summer beluga whales congregate in upper Cook Inlet feeding mainly on gadids and anadromous fish, including eulachon and Pacific salmon near river mouths outside the action area. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to reduce the energy budgets of these whales (i.e., reduce the amount of time they spend at the ocean's surface, increase their swimming speed, change their swimming direction to avoid tug operations, change their respiration rates, increase dive times, reduce feeding behavior, or alter vocalizations and social interactions) and their probable exposure to noise sources are not likely to reduce their fitness or current or expected future reproductive success or reduce the rates at which they grow, mature, or become reproductively active. As a result, the whales' probable responses to impact pile driving, or close approaches by tugs, OSVs, or observation vessels 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.

In total, the proposed action is anticipated to result in approximately three instances of exposure to beluga whales, one instance of exposure to fin whales, and one instance of exposure to Mexico DPS humpback whales, and zero instances of exposure to Western North Pacific humpback whales at received sound levels sufficiently high to potentially cause harassment over five years (see Table 21).[14] No cetaceans are anticipated to be exposed to sound levels that could result in TTS or PTS.

These estimates represent the total number of takes that could potentially occur, over five years, not necessarily the number of individuals taken, as a single individual may be taken multiple times over the course of the proposed action. These exposure estimates are likely to be overestimates because they assume a uniform distribution of animals, do not account for avoidance, and sum exposures over years.

While a single individual may be exposed multiple times over the course the open water season, the short duration towing combined with a moving vessel, and intermittent transmission of pile driving, and implementation of mitigation measures to reduce exposure to high levels of sound, reduce the likelihood that exposure to pile driving and towing sound would cause a behavioral response that may affect vital functions, or cause TTS or PTS.

These exposures may cause some individual whales to experience changes in their behavioral states (e.g. slight avoidance), however, these responses are not likely to alter the physiology, behavioral ecology, or social dynamics of individual whales in ways or to a degree that would reduce their fitness because the whales are actively foraging in waters around the towing, drilling, or pile driving operations or traveling through the action area.

In addition, our *Exposure Analysis* concluded that belugas, fin whales, or humpback whales were not likely to be exposed to vessel noise or the potential for vessel strike because only six vessels are anticipated for the proposed action and noise associated with the vessel operations is anticipated to drop to 120 dB within 100 m (or less). The limited number of vessels and small ensonified area reduce the probability of exposure to listed whales to levels we would consider discountable.

The implementation of mitigation measures will further reduce the instances of exposure and minimize the effects on these species.

[14] Impulsive sound: 160 dB re 1 μPa rms (pile driving), continuous sound: 120 dB re 1μPa rms (towing, drilling, and vessel noise).

The strongest evidence supporting the conclusion that pile driving, towing operations, vessel noise, and drilling operations will likely have minimal impact on fin and humpback whales is the estimated growth rate of the whale populations in the North Pacific. The Northeast Pacific fin whale stock has been increasing at approximately 4% (Wade and Angliss 1997). Zerbini et al.(2006) estimated the rate of increase for fin whales in coastal waters south of the Alaska Peninsula to be around 4.8% (95% CI: 4.1-5.4%) for the period 1987-2003. While there is no accurate estimate of the maximum productivity rate for humpback whales, it is assumed to be 7% (Wade and Angliss 1997, Allen and Angliss 2015). Despite exposure to oil and gas exploration activities in Cook Inlet since the early1960s, a small number of humpback and fin whale entanglements in fishing gear, and a single subsistence take of one humpback whale in 2006, this increase in the number of listed whales suggests that the stress regime these whales are exposed to in the action area has not prevented them from increasing their numbers and humpback and fin whales expanding their range in the action area.

As discussed in the *Environmental Baseline* section of this opinion, beluga, fin, and humpback whales have been exposed to oil and gas activities in the Cook Inlet, including associated vessel, drilling, pile driving, and aircraft traffic, for generations. Although we do not know if more listed whales might have used the action area or the reproductive success of Cook Inlet beluga whales would be higher absent their exposure to these activities, the rate at which listed whales occur in Cook Inlet suggests that fin and humpback whale numbers have increased substantially in the north Pacific Ocean despite exposure to earlier oil and gas operations, and Cook Inlet beluga whales have shown no sign of negative consequences from earlier oil and gas operations although the population status is depressed.

NMFS estimated the Cook Inlet beluga population to be about 340 animals as of 2014, with a 10-year (2004-2014) declining trend of 0.4 percent per year (Shelden et al. 2015). The 2-6 percent per year recovery that we expected following the discontinuation of subsistence harvest has not occurred. Summer range has contracted steadily since the late 1970s (see Figure 5). Whereas Cook Inlet belugas formerly made more extensive summer use of the waters off of the Kenai and Kasilof Rivers, they now make little to no use of this salmon-rich habitat during summer salmon runs (see Figure 14). This represents a substantial reduction in usage of summer prey. The Susitna River Delta area (including the Beluga and Little Susitna rivers) has become their core summer habitat, with additional high use areas in Knik and Turnagain Arms. Little is known about late fall, winter or early spring habitat use, although we know that belugas make use of the Kenai River when salmon runs (and various salmon fisheries) are not underway. Coastal development, especially near Anchorage, has the potential to disrupt beluga behavior, and may alter movements among important summer habitat patches through acoustic disruption (e.g. pile driving may hinder passage to or from Knik Arm from the Susitna Delta area). Boat traffic in the Twentymile River has been documented as having caused behavioral disruption of belugas present in the river, while they were presumably feeding there, but fled the river channel to Turnagain Arm when boats encountered them. Seismic exploration in upper Cook Inlet has caused both Level A and Level B takes of Cook Inlet belugas. We have no data indicating whether other vessel activities, such as commercial shipping, have caused acoustic harassment of these belugas. Aircraft have been observed to cause behavioral changes in feeding groups of Cook Inlet belugas in the Susitna Delta when aircraft circled those groups.

While Cook Inlet beluga are facing an annual decline of 0.4% (Shelden et al. 2015), the best available information indicated that human activities including those associated with oil and gas development, were not a contributing factor in the stock becoming in danger of extinction (65 FR 38778; 22 June 2000). Pollution and contaminants were listed as low relative concern for impeding the recovery of Cook Inlet beluga whales (NMFS 2016b). For the contaminants that have been studied, Cook Inlet belugas generally had lower contaminant loads than did belugas from other populations (Becker et al. 2000, Lebeuf et al. 2004, NMFS 2008a, Becker 2009, DFO 2012, Reiner et al. 2011, Wetzel et al. 2010, Hoguet et al. 2013). Only one known beluga mortality associated with fisheries interaction was reported in over 10 years. There is no current harvest on Cook Inlet beluga (Allen and Angliss 2015).

The activities the Corps proposes to authorize under the proposed action are significantly smaller in magnitude as compared to previous oil and gas activities in the area, and these permitted activities are not likely to affect the population trends of beluga, fin, or humpback whales in the action area.

Due to the location and timing of the project as well as implementation of mitigation measures, exposures at received levels that could cause harassment to listed species are expected to be extremely minimal. Effects of this project would have been greater had the project been located further to the north during summer. Data we have presented suggest that belugas are almost entirely absent from the KLU during April, May, June, and July, but are present at low densities during project activities occurring in August, September, and October. Fin, Mexico DPS humpback, and Western North Pacific humpback whales occur in low densities in mid and upper Cook Inlet.

Although the impact pile driving and towing activities are likely to cause individual whales to experience changes in their behavioral states that might have adverse consequences (Frid and Dill 2002), these responses are not likely to alter the physiology, behavioral ecology, or social dynamics of individual whales in ways or to a degree that would reduce their fitness.

As a result, the activities the Corps plans to authorize between 2017 and 2021 are not likely to appreciably reduce the listed whales' likelihood of surviving or recovering in the wild.

8.2 Western DPS Steller Sea Lion Risk Analysis

Based on the results of the *Exposure Analysis* without the implementation of mitigation measures, we expect a total 47 western DPS Steller sea lions may be exposed to noise associated with the proposed action at received levels sufficiently high to cause harassment (see Table 21). However, with the implementation of standard mitigation measures with clearance and shutdown zones, only 24 total instances of exposure are anticipated for the five year duration of the action (see Table 22). Exposure to vessel noise from transit, aircraft noise, noise from geohazard surveys, seafloor disturbance, and small oil spills may occur but are considered insignificant and would not rise to the level of take. As discussed below, exposure to vessel strike and marine debris is extremely unlikely to occur and therefore associated effects are considered discountable, and because the probability of large and very large oil spills are considered extremely unlikely to occur, the effects from those events are also considered discountable.

Our consideration of probable exposures and responses of western DPS Steller sea lions to oil and gas exploration activities associated with the proposed action is designed to help us assess whether those activities are likely to increase the extinction risks or jeopardize the continued existence of this DPS.

Out of the total 24 instances of exposure to Steller sea lions, no exposures are anticipated to result in TTS or PTS. These estimates represent the total number of takes that could potentially occur over five years, not necessarily the number of individuals taken, as a single individual may be taken multiple times over the course of the proposed action. These exposure estimates are likely to be overestimates because they assume a uniform distribution of animals, do not account for avoidance, and sum exposures over years.

The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animal's energy budget, time budget, or both (the two are related because foraging requires time). Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (NMFS 2008a). While the pupping and breeding season overlaps with the proposed action activities, no rookeries or haulouts are within the KLU. The endangered western DPS Steller sea lion population is increasing 2.17 percent per year. In the region of this project, the population of non-pups is increasing at 2.61percent per year, while the number of pups counted are increasing at 2.14 percent per year. High concentrations of Steller sea lions occur in and around lower Cook Inlet, in areas well south of KLU, but closer to the southern portions of the action area potentially impacted by tug, rig, and vessel movement along routes that would take the Yost to overwintering ports in Homer or Port Graham. Even if exposure from vessel transit were to occur, the individual and cumulative energy costs of the behavioral responses we have discussed are not likely to reduce the energy budgets of Steller sea lions. As a result, the sea lion's probable responses (i.e., tolerance, avoidance, short-term masking, and short-term vigilance behavior) to close approaches by towing operations and their probable exposure to or noise from impact pile driving are not likely to reduce their current or expected future reproductive success or reduce the rates at which they grow, mature, or become reproductively active. Therefore, these exposures are not likely to reduce the abundance, reproduction rates, or growth rates (or increase variance in one or more of these rates) of the population those individuals represent.

Coastal development can affect western DPS Steller sea lions, especially where new facilities are built in harbors with fish processing facilities, as sea lions tend to be frequently or continuously present near these sites. Such temporary and minor effects are likely not hindering recovery, however. Commercial fishing likely affects prey availability throughout much of the DPS's range, and causes a small number of direct mortalities each year. Predation has been considered a potentially high level threat to this DPS, and may remain so. Subsistence hunting occurs at fairly low levels for this DPS, and likely occurs at very low levels within the action area. Illegal harvest is also a continuing threat, but it probably does not occur at levels that are preventing recovery. Ship strikes do not seem to be of concern for this species due to its maneuverability and agility in water. Despite exposure to oil and gas exploration activities in Cook Inlet since the early1960s, the increase in the number of western DPS Steller sea lions suggests that the stress regime these sea lions are exposed to in the action area has not prevented them from increasing their numbers and expanding their range in the action area.

Western DPS Steller sea lions occur in the KLU at very low densities, but may occur there throughout all months of project activity as a result of year-round presence on or around nearby haulouts. We used the derived density for Western DPS Steller sea lions for the KLU from Jacobs (2017), but used the raw density for OSV and tug traffic that was bound for, or departing from, Port Graham or Homer.

For towing and pile driving, PSOs are required. However, drilling and mud pumping operations do not have the ability to shut down if marine mammals enter the harassment zone. While this will not mitigate the potential impacts associated with drilling operations, PSOs will ensure the harassment zone (330 m) is clear of marine mammals prior to drilling commencing. Considering that this will be a continuous source of underwater noise, it is not anticipated that marine mammals would enter into an area where they would suffer from acoustic harassment.

Although these towing and pile driving activities are likely to cause some individual Steller sea lions to experience changes in their behavioral states that might have adverse consequences (Frid and Dill. 2002), these responses are not likely to alter the physiology, behavioral ecology, or social dynamics of individual Steller sea lions in ways or to a degree that would reduce their fitness. In most circumstances, Steller sea lions are likely to avoid ensonified areas that may cause TTS. Steller sea lions that avoid these sound fields or exhibit vigilance are not likely to experience significant disruptions of their normal behavior patterns because the vessels are transiting and the ensonified area is temporary, and pinnipeds seem rather tolerant of low frequency noise. Southall et al. (2007) reviewed literature describing responses of pinnipeds to continuous sound and reported that the limited data suggest exposures between ~90 and 140 dB re 1 μPa generally do not appear to induce strong behavioral responses in pinnipeds exposed to continuous sounds in water.

In addition, our *Exposure Analysis* concluded that western DPS Steller sea lions are not likely to be exposed to vessel noise or the potential for vessel strike because only six vessels are associated with the proposed action and noise associated with the vessel operations is anticipated to drop to 120 dB within 100 m (or less). The limited number of vessels and small ensonified area reduce the probability of exposure to Steller sea lions to levels such that we consider the risk of effects from such activities as extremely unlikely to occur and therefore discountable.

The implementation of mitigation measures will further reduce the instances of exposure and minimize the effects on the species.

As we discussed in the *Approach to the Assessment* section of this opinion, an action that is not likely to reduce the fitness of individual sea lions would not be likely to reduce the viability of the population those individual sea lions represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of the western DPS). For the same reasons, an action that is not likely to reduce the viability of the population is not likely to increase the extinction probability of the species; in this case, the western DPS Steller sea lion. As a result, the impact pile driving, drilling, and towing operations the Corps plans to authorize between 2017 and 2021 are not likely to appreciably reduce the western DPS Steller sea lion’s likelihood of surviving or recovering in the wild.

9. CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Cook Inlet beluga whale (*Delphinapterus leucas*), fin whale (*Balaenoptera physalus*), Mexico DPS humpback whale (*Megaptera novaeangliae*), or western DPS Steller sea lion (*Eumetopias jubatus*).

In addition, the proposed action is not likely to adversely affect the endangered Western North Pacific DPS of humpback whale (*Megaptera novaeangliae*), or designated critical habitat for Steller sea lion or Cook Inlet beluga.

10. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR 402.02). Based on recent NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 U.S.C. §1362(18)(A)(i) and (ii)). For this consultation, the Corps anticipates that any take will be by Level B harassment only. No Level A takes are contemplated or authorized.

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

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

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

10.1 Amount or Extent of Take

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or utilize a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14 (i)(1); see also 80 FR 26832 (May 11, 2015).

As discussed in the *Approach to the Assessment* section of this opinion, 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 guidance that interprets “harass”); and (3) adding the number of exposure events that could produce responses that we would consider “take.” These estimates include whales and sea lions that are likely to be exposed and respond to impact pile driving and towing operations that are likely to result in behavioral changes that we would classify as “harassment.” This incidental take statement does not exempt take resulting from vessel strikes or accidental oil spill or gas release. No whales or sea lions are likely to die or be wounded as a result of their exposure to the proposed action. The results of our incidental take estimates are presented in Table 23.

For Cook Inlet beluga, fin, and Mexico DPS humpback whales, and Steller sea lions, based on the best scientific and commercial information available, we would not anticipate responses to impulsive pile driving noise at received levels < 160 dB re 1 μPa rms would rise to the level of “take” as defined under the ESA. For this reason, the total instances of harassment for whales and sea lions from impact pile driving only considered exposures at received levels ≥ 160 dB re 1 μPa rms. For continuous noise sources, we only considered exposures at received levels ≥120 dB re 1 μPa rms.

For purposes of this opinion, the endangered Cook Inlet beluga whale, endangered fin whale, threatened Mexico DPS humpback whale, and endangered western DPS Steller sea lion are the only species for which take is anticipated for years 2018-2021. No take is anticipated or authorized for Furie’s proposed 2017 oil and gas exploration activities.

Table 22 Summary of instances of exposure associated with Furie's proposed oil and gas exploration activities resulting in the incidental take of Cook Inlet beluga whales, fin whale, Mexico DPS humpback whale, and western DPS Steller sea lion by behavioral harassment.

Species	Estimated Instances of Exposure		Total Amount of Take Associated with Proposed Action (2018-2021)
	2017	2018-2021 per year	
Cook Inlet Beluga Whale	0	0-1	3
Fin Whale	0	0-1	2
Mexico DPS Humpback Whale	0	0-1	1
Western DPS Steller Sea Lion	0	0-8	24

10.2 Effect of the Take

Studies of marine mammals and responses to impact pile driving and loud vessel noise have shown that beluga, fin, and humpback whales, and Steller sea lions are likely to respond behaviorally upon hearing these noise sources. The only takes authorized during the proposed action are takes by acoustic harassment. No serious injury or mortalities are anticipated or authorized as part of this proposed action. Although the biological significance of those behavioral responses remains unknown, this consultation has assumed that exposure to major noise sources might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses of these whales and sea lions to major noise sources and any associated disruptions are not expected to affect the reproduction, survival, or recovery of these species.

10.3 Reasonable and Prudent Measures (RPMs)

"Reasonable and prudent measures" 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 Cook Inlet beluga whale, fin whale, Mexico DPS humpback whale, and western DPS Steller sea lion 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 beluga, fin, and humpback whales, and Steller sea lion shall be by incidental harassment only. The taking by serious injury or death is prohibited and may result in the modification, suspension or revocation of the ITS.

3. The Corps must implement measures to reduce the probability of exposing beluga, fin, and humpback whales, and Steller sea lion to impact pile driving and towing noise from the proposed activities.

4. The Corps must 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.

5. The Corps shall submit reports to NMFS AKR that evaluate its mitigation measures and report the results of its monitoring program.

10.4 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, the Corps or any applicant must comply with the following terms and conditions, which implement the RPMs described above, as well as the mitigation measures set forth in Section 2.1.2 of this opinion. The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14).

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

To carry out RPM #1, Corps or Furie must undertake the following:

A. At all times when conducting impact pile driving or towing operations during 2018-2021, the Corps must require Furie to possess on board the vessel a current and valid Incidental Harassment Authorization issued by NMFS under section 101(a)(5) of the MMPA. Any take must be authorized by a valid, current, IHA issued by NMFS under section 101(a)(5) of the MMPA, and such take must occur in compliance with all terms, conditions, and requirements included in such authorizations.

To carry out RPM #2, Corps or Furie must undertake the following:

A. The taking of any marine mammal in a manner other than that described in this ITS must be reported within 24 hours to NMFS AKR, Protected Resources Division at 907-271-3023 and/or by email to Greg.Balogh@noaa.gov.

B. In the unanticipated event that the specified activity causes the take of a marine mammal in a manner prohibited by the ITS, such as a take during 2017 operations, or serious injury, or mortality (e.g., ship-strike, gear interaction, and/or entanglement), Furie must immediately cease the specified activities and immediately report the incident to the Alaska Region Protected Resources Division 907-271-3023 and/or by email to

Greg.Balogh@noaa.gov, and the Alaska Regional Stranding Coordinator at 907-271-1332 and/or by email to Mandy.Migura@noaa.gov). The report must include the following information: (i) Time, date, and location (latitude/longitude) of the incident; (ii) the name and type of vessel involved; (iii) the vessel's speed during and leading up to the incident; (iv) description of the incident; (v) status of all sound source use in the 24 hours preceding the incident; (vi) water depth; (vii) environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, and visibility); (viii) description of marine mammal observations in the 24 hours preceding the incident; (ix) species identification or description of the animal(s) involved; (x) the fate of the animal(s); (xi) and photographs or video footage of the animal (if equipment is available).

Activities must not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Furie to determine what is necessary to minimize the likelihood of further prohibited take and ensure ESA compliance. Furie may not resume its activities until notified by NMFS via letter, email, or telephone.

To carry out RPM #3 and #4, the Corps or Furie must undertake the following:

A. All mitigation measures as outlined in Section 2.1.2 of this biological opinion, must be implemented, upon authorization from the Corps.

To carry out RPM #5, the Corps or Furie must undertake the following:

A. Furie must adhere to all monitoring and reporting requirement as detailed in the Section 2.1.2 of the opinion.

B. Monthly PSO reports and completed marine mammal observation record form (developed by Furie) will be required. Items 1 through 4, below, provide details about what must be included in the reports.

1. The reporting period for each monthly PSO report will be the entire calendar month, and reports will be submitted by close of business on the 5th business day of the month following the end of the reporting period (e.g., the monthly report covering July 1 through 31, 2017, will be submitted to NMFS Alaska Region by close of business [i.e., 5:00 pm, AKDT] on August 7, 2017).
    - 1.1. Completed marine mammal observation record forms, in electronic format, will be provided to NMFS Alaska Region in monthly reports.
    - 1.2. Observer report data will include the following for each listed marine mammal observation (or "sighting event" if repeated sightings are made of the same animal[s]):
        - 1.2.1. Species, date, and time for each sighting event
        - 1.2.2. Number of animals per sighting event and number of adults/juveniles/calves/pups per sighting event
        - 1.2.3. Primary, and, if observed, secondary behaviors of the marine mammals in each sighting event
        - 1.2.4. Geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system)

1.2.5. Time and description of most recent project activity prior to marine mammal observation
1.2.6. Environmental conditions as they existed during each sighting event, including, but not limited to:
1.2.6.1. Beaufort Sea State
1.2.6.2. Weather conditions
1.2.6.3. Visibility (km/mi)
1.2.6.4. Lighting conditions

1.3. Observer report data will also include the following for each take of a marine mammal that occurs in the manner and extent as described in Section 10.1 of this opinion:
1.3.1. All information listed under Item1, above
1.3.2. The distance marine mammals were spotted from operations and associated noise isopleth for active sound source, and cause of take (e.g. Cook Inlet beluga whale within the Level B 120 dB isopleth approximately 1,500 meter from tug during towing operations)
1.3.3. For takes of humpback whales, the observer report will estimate the probability of occurrence of ESA-listed DPSs out of the total estimated takes (e.g., Out of a total of 5 humpback whales estimated to be taken, Western DPS 0.005(5)= 0.025, and Mexico DPS 0.105(5) = 0.525 whales may have been taken)
1.3.4. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.3.5. Any mitigation measures implemented prior to and after the animal entered the zone
1.3.6. An estimate of the number (by species) of: (i) pinnipeds or cetaceans that have been exposed to the impact pile driving (extrapolated from visual observation) at received levels greater than or equal to 160 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited; and (ii) pinnipeds or cetaceans that have been exposed to the towing operations or drilling (extrapolated from visual observation) at received levels greater than or equal to 120 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited.

2. An annual technical report will be submitted to NMFS Alaska Region within 90 days after the annual oil and gas exploration activities have been completed and vessels have been housed for the winter. The report will summarize all project activities and results of marine mammal monitoring conducted during project activities. The annual technical report will include all elements from Item 1, above, as well as:
2.1. Summaries that include monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors that affect visibility and detectability of marine mammals)
2.2. Analyses on the effects from various factors that influences detectability of marine mammals (e.g., sea state, number of observers, fog, glare, etc.)
2.3. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
2.4. Species composition, occurrence, and distribution of marine mammal takes, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover

2.5. Analyses of effects of project activities on listed marine mammals

2.6. Number of marine mammals observed and taken (by species) during periods with and without project activities (and other variables that could affect detectability), such as:

  2.6.1. Initial sighting distances versus project activity at time of sighting

  2.6.2. Observed behaviors and movement types versus project activity at time of sighting

  2.6.3. Numbers of sightings/individuals seen versus project activity at time of sighting

  2.6.4. Distribution around the action area versus project activity at time of sighting

12. CONSERVATION RECOMMENDATIONS

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

1. To the maximum extent practicable, the Corps should encourage operators to schedule impact pile driving operations during daylight hours and conditions of good visibility when marine mammals can more easily be sighted.

2. If practicable, the Corps should require Furie to stage operations out of Nikiski to avoid higher density areas of listed marine mammals in Homer and/or Port Graham.

3. To the maximum extent practicable, the Corps should require Furie to conduct sound source verification measurements for its 2017 operations. Pile driving with this hammer model and type and size of pile has not been conducted in the KTU. This information would be critical for subsequent analysis.

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

13. REINITIATION OF CONSULTATION

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 incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

14. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

14.1 Utility

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

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

14.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

14.3 Objectivity

- ***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq.
- ***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.
- ***Referencing:*** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.
- ***Review Process:*** This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

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