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

Hilcorp Cook Inlet Tugs Towing a Jack-up Rig

NMFS Consultation Number: AKRO-2021-03484

Action Agency: National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division

Affected Species and Determinations:

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

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

Jonathan M. Kurland
Administrator, Alaska Region

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TERMS AND ABBREVIATIONS

ADFG	Alaska Department of Fish and Game
AKR	Alaska Region
BA	Biological Assessment
bbl	Billion barrels
BIA	Biological Important Area
BOEM	Bureau of Ocean Energy Management
C°	Celsius
CO_2	Carbon Dioxide
CIPL	Cook Inlet Pipeline Cross-Inlet Extension
CV	Coefficient of Variance
CWA	Clean Water Act
dB re 1µPa	Decibel referenced 1 microPascal
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESCA	Endangered Species Conservation Act
F°	Fahrenheit
FR	Federal Register
ft	Feet
G&G	Geological and Geophysical
HAK	Hilcorp Alaska
hp	Horsepower
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
kHz	Kilohertz
km	Kilometers
m	Meter
mi	Mile
MLLW	Mean lower low water
MMPA	Marine Mammal Protection Act
µPa	Micro Pascal
NCIU	North Cook Inlet Unit

NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
OC	Organochlorine
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
Opinion	Biological Opinion
Pa	Pascals
PAH	Polycyclic aromatic hydrocarbons
PBF	Physical or biological feature
PCB	Polychlorinated biphenyls
ppm	Parts per million
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
RMS	Root Mean Square
SEL	Sound Exposure Level
SPL	Sound pressure level
SPLASH	Structure of Populations, Level of Abundance and Status of Humpback Whales
TTS	Temporary Threshold Shift
UME	Unusual Mortality Event
USFWS	United States Fish and Wildlife Services
VLOS	Very Large Oil Spill

1. Introduction

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

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

In this document, the action agency is NMFS, Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division"), which proposes to issue two incidental harassment authorizations (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. § 1361 et seq.), to Hilcorp Alaska, LLC (Hilcorp) for harassment of marine mammals incidental to the proposed action. Hilcorp plans to carry out activities over two years that involve three ocean-going tugs towing and positioning a jack-up rig in middle Cook Inlet. The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's biological opinion (opinion) on the effects of this proposal on endangered and threatened species and designated critical habitat.

On July 5, 2022, the United States District Court for the Northern District of California issued an order vacating the 2019 regulations adopting changes to 50 CFR part 402 (84 FR 44976, August 27, 2019). This consultation was initiated when the 2019 regulations were still in effect. As reflected in this document, we are now applying the section 7 regulations that governed prior to adoption of the 2019 regulations (https://www.govinfo.gov/content/pkg/CFR-2018-title50-vol11/pdf/CFR-2018-title50-vol11-part402.pdf). For purposes of this consultation, we considered whether the substantive analysis and its conclusions regarding the effects of the proposed actions articulated in the biological opinion and incidental take statement would be any different under the 2019 regulations. We have determined that our analysis and conclusions would not be any different.

The opinion and ITS were prepared by NMFS Alaska Region in accordance with section 7(b) of the ESA (16 U.S.C. § 1536(b)), and implementing regulations at 50 CFR part 402.

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

1.1 Background

This opinion is based on information provided in the proposed IHAs. Other sources of information relied upon include consultation communications, assessment reports, and previous monitoring reports. A complete record of this consultation is on file at NMFS's Anchorage, Alaska office.

This opinion considers the effects of tugs towing a jack-up rig, production drilling, support vessels, aircraft, water jets, and handheld tools including an impact wrench on endangered fin whale (*Balaenoptera physalus*), threatened Mexico distinct population segment (DPS) humpback whale (*Megatera novaeangliae*), endangered Western North Pacific DPS humpback whale, endangered Western DPS Steller sea lion (*Eumetopias jubatus*), endangered Cook Inlet beluga whale (*Delphinapterus leucas)*, and Cook Inlet beluga whale critical habitat. There is no critical habitat for Mexico DPS humpback whales, Western Norther Pacific DPS humpback whales, and Western DPS Steller sea lion in the action area.

1.2 Consultation History

NMFS previously issued Incidental Take Regulations (ITRs) to Hilcorp for a suite of oil and gas activities in Cook Inlet, Alaska (84 FR 37442; July 31, 2019) and issued three letters of authorization (LOAs) under those ITRs. The ITRs covered activities including: two-dimensional and three-dimensional seismic surveys, geohazard surveys, vibratory sheet pile driving, and drilling of exploratory wells. On September 17, 2019, Cook Inletkeeper and the Center for Biological Diversity filed suit in the U.S. District Court in the District of Alaska challenging NMFS's issuance of the ITRs and LOAs and supporting documents including the Environmental Assessment and ESA Biological Opinion. In a decision issued on March 30, 2021, the court ruled largely in NMFS's favor but found a lack of adequate support in NMFS's record for the agency's determination that tug towing of drill rigs in connection with production activity will not cause take of beluga whales. The court issued its judgment and order on remedy on May 27, 2021, partially vacating and remanding the ITRs, environmental assessment, and biological opinion to NMFS for further analysis of tug use under the MMPA, ESA, and National Environmental Policy Act (NEPA).

In 2021, Hilcorp notified NMFS that all activities described in their initial ITR application (2018) and for which incidental take was authorized have already been completed or will not be completed under the ITRs. As a result, the only remaining activity likely to adversely affect listed species and critical habitat is the use of tugs towing a jack-up rig. Based on this new information, NMFS Permits Division proposes to authorize incidental take from the tugs towing a jack-up rig through two sequential IHAs, rather than amend the partially vacated ITRs, given that there are no other activities occurring under the ITRs and no serious injury or mortality is expected. This action effectively withdraws the ITRs for Hilcorp's planned activities post-partial vacatur, replacing the MMPA authorization with the two sequential IHAs. These IHAs cover the few remaining activities mentioned by Hilcorp in their IHA request to NMFS for 2022/2023 and 2023/2024. Thus, NMFS Alaska Region is consulting on the new IHAs, and this biological opinion supersedes the biological opinion for the ITRs for activities in years 4 and 5.

Below outlines the consultation history since the court's ruling:

- June 26, 2021 - NMFS Permits Division provided Hilcorp with a list of information needs.
- August 8, 2021 - Hilcorp provided a response to NMFS attempting to provide the information request needs. The document did not contain the appropriate level of information NMFS needed.
- Sept 9, 2021 - NMFS Permits Division and Alaska Region met with Hilcorp to discuss why the information package Hilcorp provided was incomplete.
- Sept 13, 2021 - NMFS provided Hilcorp with a meeting summary and a copy of the information packages highlighting the gaps in information that are still needed.
- October 29, 2021 - Hilcorp provided an updated information package to NMFS.
- December 8, 2021 - NMFS Permits Division recommended to Hilcorp that they request two IHA's to cover/replace the final two years of the ITR. This process would be faster than attempting to update the ITR.
- December 9, 2021 - NMFS met with Hilcorp to discuss the sound source levels Hilcorp had provided in their information package.
- December 16, 2021 - Hilcorp requested a meeting with NMFS to further discuss what an IHA application would look like.
- December 21, 2021 - NMFS and Hilcorp met to discuss sound source levels and IHA application questions.
- January 4, 2022 - NMFS and Hilcorp met to preliminary discuss mitigation measures.
- January 13, 2022 - Hilcorp submitted an IHA application to NMFS.
- January 27, 2022 - Hilcorp and NMFS started to meet weekly with Hilcorp on Thursdays to discuss information needs.
- February 10, 2022 – NMFS provided Hilcorp with comments and questions on the IHA application.
- February 11, 2022 - Hilcorp requested that the mitigation measures were resolved prior to Hilcorp submitting and updated version of the IHA application. NMFS informed Hilcorp that conversations around mitigation and monitoring will not be resolved in time for this application revision. NMFS will likely continue to have conversations about mitigation measures through the public comment period. This is a normal part of the process and does not necessarily influence the date your application is deemed adequate and complete.
- February 14, 2022 – Hilcorp requested clarification regarding a NMFS question regarding the Level A modeling.
- February 15, 2022 – Hilcorp met with NMFS to discuss Level A modeling.
- February 18, 2022 – Hilcorp submitted an updated IHA application

- February 25, 2022 – Hilcorp submitted an updated IHA application with tables providing detail on the estimated number of calendar days associated with the tugs towing the jack-up rig.
- March 4, 2022 – Hilcorp submitted an updated IHA application
- March 7, 2022 – Hilcorp submitted an updated IHA application with updates to reflect the densities used in the exposure estimate.
- March 8, 2022 – IHA application deemed adequate and complete.
- March 24, 2022 – Hilcorp added an impact wrench to the plug and abandonment description that was not previously included in the proposed action description.
- April 29, 2022 – NMFS Permits Division requests consultation with NMFS Alaska Region
- May 12, 2022 - NMFS Alaska Region requested the Permits Division to submit their determination on each listed species and critical habitat.
- May 16, 2022 – NMFS Permits Division provide their determination on each listed species and critical habitat. NMFS Alaska Region initiates consultation.
- May 24, 2022- NMFS Permits Division and AKR requested Hilcorp resubmit their exposure estimates to remove the mobilization of the jack-up rig that was planning to be moved (and was moved) in early June. NMFS requested that once the jack-up rig was moved they receive a summary of all marine mammal observations and any observed behaviors.
- June 7, 2022 – NMFS AKR provided Hilcorp with a draft of the proposed action and mitigation measures for review of accuracy.
- June 13, 2022 – NMFS had not received an updated exposure estimate, therefore, AKR paused the consultation until the information was received. Hilcorp sent the updated exposure estimate on the same day that they were notified.
- June 14, 2022 – NMFS Permits Division also reminded Hilcorp of the request to receive a summary of marine mammals observed, including any documented behaviors.
- June 20, 2022 – Hilcorp sent their marine mammal monitoring report for 2022 mobilization of the jack-up rig.
- June 22, 2022 – NMFS AKR met with Hilcorp (at Hilcorp's request) to discuss the mitigation measures. During the meeting Hilcorp agreed to provide additional information on aircraft, supply vessels, and drilling activities that may influence mitigation measures.
- July 6, 2022 – Hilcorp provide comments and edits on the draft proposed action and mitigation measures that were sent to Hilcorp on June 7, 2022.
- July 18 and 20, 2022 – NMFS and Hilcorp met to discuss the proposed edits to the mitigation measures.
- July 25, 27, 28, & 29 – Hilcorp provide NMFS with additional information on aircraft,

supply vessels, and drilling activities.

- August 4, 2022 – NMFS provided revised mitigation measures to Hilcorp.

On September 7, 2022, NMFS Alaska Region provided Hilcorp with a copy of the draft biological opinion. On September 8, 2022, Hilcorp submitted comments on the draft opinion. NMFS Alaska Region reviewed all comments submitted and revised the opinion as warranted.

2. Description of the Proposed Action and Action Area

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. 50 C.F.R. § 402.02.

The following description of the proposed action (the issuance of Incidental Harassment Authorizations) derives primarily from the Request for Two Incidental Harassment Authorizations for 2022 to 2023 and 2023 to 2024 Cook Inlet Oil and Gas Activities (Hilcorp 2022) prepared by Hilcorp, and the Proposed Rule (87 FR 27597; May 9, 2022).

2.1.1 Proposed Activities

Hilcorp plans to carry out activities in Cook Inlet, Alaska that will occur over two separate one-year periods. Hilcorp plans to use a jack-up rig towed by three ocean-going tugs to finish plug and abandonment (P&A) of Well 17589 in middle Cook Inlet in Year 1. Hilcorp will use support vessels, water jets, and other handheld tools during P&A activities. In both Years 1 and 2, Hilcorp plans to use the same jack-up rig towed by three ocean-going tugs for production drilling from existing platforms owned and operated by Hilcorp in middle Cook Inlet and Trading Bay. Production drilling will occur over Year 1 and 2 with support from aircraft and vessels delivering personnel and supplies. Table 1 provides the duration of activities related to Hilcorp's P&A and production drilling. For the purposes of this project, lower Cook Inlet refers to waters south of the East and West Forelands; middle Cook Inlet refers to waters north of the East and West Forelands and south of Threemile River on the west and Point Possession on the east; Trading Bay (which is part of middle Cook Inlet) refers to waters from approximately the Granite Point Tank Farm on the north to the West Foreland on the south; and, upper Cook Inlet refers to waters north and east of Beluga River on the west and Point Possession on the east. A map of the specific area in which Hilcorp plans to operate is provided in Figure 1 below.

Table 1. Dates and durations of planned activities in Cook Inlet.

Project Type	Cook Inlet Region	Year(s) Planned	Seasonal Timing	Anticipated Duration
Plug and Abandonment of Well 17589	Middle Cook Inlet	Year 1	April - November	30 days[a]
Production Drilling	Middle Cook Inlet Trading Bay	Years 1 and 2	April - November	180 days[a]

[a]Duration is in reference to the supported activity that requires the jack-up rig to be in a specific location. It is not reflective of the duration of the number of days the jack-up rig is towed.

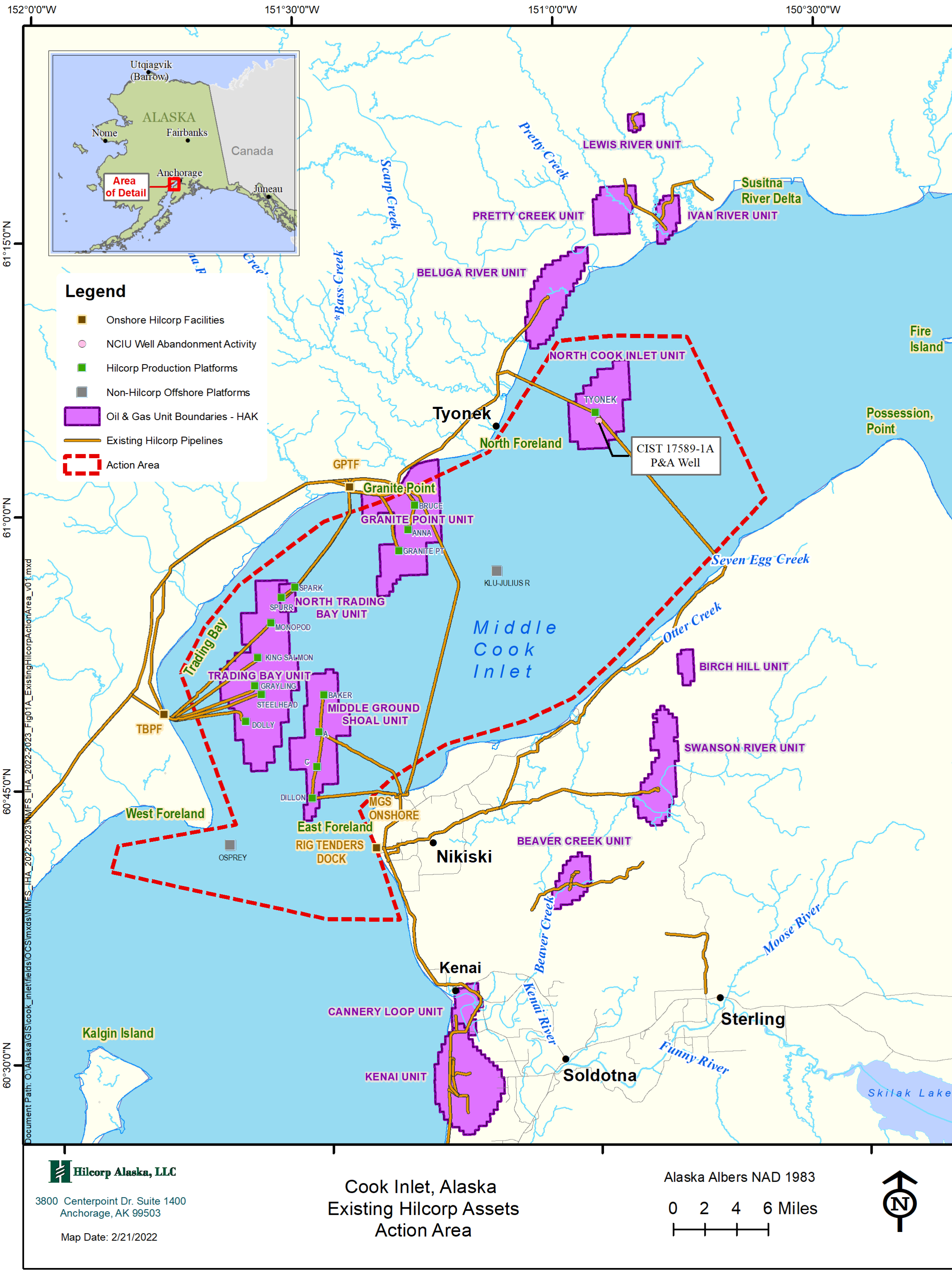

Figure 1. Hilcorp Year 1 and Year 2 areas of activity.

The proposed action is not expected to increase Hilcorp's future oil and gas production but rather Hilcorp will continue to operate in a manner similar to production operations prior to the proposed action. Therefore the project is not expected to increase aircraft, support vessels, and other platform operations outside of the drilling season. Effects during the drilling season are analyzed in Section 6, and effects from all past and ongoing activities are analyzed in Section 5. While the IHAs cover only two drilling seasons, we assume a similar level of activities could be ongoing over the life of the drilling platforms.

2.1.1.1 Year 1 Description of Activity

Jack-up Rig

A jack-up rig will be used to finish P&A of Well 17589 and for production drilling in middle Cook Inlet and Trading Bay. A jack-up rig is a type of mobile offshore drill unit used in offshore oil and gas drilling activities. It is comprised of a buoyant mobile platform (hull) with moveable legs that are adjusted to raise and lower the hull over the surface of the water. The legs of the jack-up rig are designed to penetrate the seabed. A jack-up rig is not self-propelled and tow vessels (tugs or heavy lift ships) are required for transport to an offshore drilling location. The *Spartan 151*, or similar jack-up rig, will be used during P&A activities at Well 17589 and production drilling. It is a 150 H class independent-leg, cantilevered jack-up drill rig that can operate in a maximum water depth up to 46 meters (m; 150 feet [ft]) and has a drilling depth capability of 7,620 m (25,000 ft). The Spartan 151's hull length is 174 feet, the breadth is 162 ft, and the depth is 18 ft, with legs that are 250 ft in length.

Ocean-going Tugs

Hilcorp proposes to use three ocean-going tugs to pull and position a jack-up rig (Spartan 151, or similar) in support of P&A of Well 17589 and production drilling. Three tugs are necessary to safely tow and position the jack-up rig. Each tug has one line attached to the jack-up rig. The lines are in the air when the tugs are pulling the jack-up rig and they are taut. The lines are approximately 100 ft in length and made out of a material called Amsteel blue by a company called Samson. The horsepower (hp) of each tug may range between 4,000 and 8,000, and additional specifications are provided in Table 2. If the listed tugs are unavailable, tugs of similar size and power will be contracted.

Table 2. Description of tugs towing the jack-up rig.

Vessel Name	Specifications
M/V Bering Wind	22-m length x 10-m breadth 144 gross tonnage
M/V Anna T	32-m length x 11-m breadth 160 gross tonnage
M/V Bob Franco	37-m length x 11-m breadth 196 gross tonnage

The jack-up rig will be transported by three tugs from one platform to another and transported back to the Rig Tenders Dock in Nikiski, Alaska at the end of the season. The amount of time the tugs are under load transiting, holding, and positioning the jack-up rig is tide-dependent. The power output of the tugs depends on whether the tugs are towing with or against the tide, and can vary across a tide cycle as the current increases or decreases in speed over time. Hilcorp plans to make every effort to transit with the tide (which requires lower power output) and minimize transit against the tide (which requires higher power output).

A high slack tide is preferred to position the jack-up rig on an existing platform or well site. The relatively slow current and calm conditions at a slack tide enables the tugs to perform the fine movements necessary to safely position the jack-up rig within several feet of the platform. Positioning and securing the jack-up rig is generally performed at high slack tide to pin the legs down at an adequate height and ensure the hull of the jack-up rig remains above the incoming high tide water level.

Twelve hours elapse between each high slack tide, and tugs are generally under load for those 12 hours, as high slack tides are preferred to both attach and detach the jack-up rig from the tugs. Once the tugs are on location with the jack-up rig at high slack tide (12 hours from the previous departure), there is a 1 to 2-hour window when the tide is slow enough for the tugs to initiate positioning the jack-up rig and pin the legs to the seafloor on location. The tugs are estimated to be under load, generally at half-power conditions or less, for up to 14 hours from the time of departure through the initial positioning attempt of the jack-up rig.

If the first positioning attempt takes longer than anticipated, the increasing current speed prevents the tugs from safely positioning the jack-up rig on location. If the first positioning attempt is not successful, the jack-up rig will be pinned down at a nearby location and the tugs will be released from the jack-up rig and no longer under load. The tugs will remain nearby, generally floating with the current. Approximately an hour before the next high slack tide, the tugs will re-attach to the jack-up rig and reattempt positioning over a period of two to three hours. Positioning activities are generally at half power. If a second attempt is needed, the tugs will be under load holding or positioning the jack-up rig on the second day for up to five hours. The vast majority of the time, the jack-up rig can be successfully positioned over the platform in one or two attempts.

Maintaining position of the jack-up rig against the tidal current may require more than half power (up to 90 percent power at the peak tidal outflow). However, greater than half power effort is only needed for short periods during the maximum tidal current, expected to be no more than three hours maximum. During a location-to-location transport, the tugs will transport the jack-up rig traveling with the tide in nearly all circumstances except in situations that threaten the safety of humans and/or infrastructure integrity. There may be a situation wherein the tugs pulling the jack-up rig begin transiting with the tide to their next location, miss the tide window to safely set the jack-up rig on the platform or pin it nearby, and so have to transport the jack-up rig against the tide to a safe harbor. Tugs may also need to transport the jack-up rig against the tide if large pieces of ice or extreme wind events threaten the stability of the jack-up rig on the platform.

Although the variability in power output from the tugs can range from an estimated 20 percent to 90 percent throughout the hours under load with the jack-up rig, as described above, the majority of the hours (spent transiting, holding, and positioning) occur at half power or less.

Plug and Abandonment of Well 17589

P&A of Well 17589 began in 2021 but was not finished due to equipment sourcing issues. Hilcorp has since resolved the issue and intends to finish P&A activities in accordance with Alaska Oil and Gas Conservation Commission regulations.

Hilcorp plans to use the jack-up rig, towed by three tugs, and a sonar and dive support vessel to complete the P&A of Well 17589. The dive support vessel is approximately 70-80 ft (21-24 m) long and typically transits at speeds of 7 knots. Prior to pinning the jack-up rig legs to the seafloor, a multi-beam echosounder may be used to ensure the seafloor is clear of debris that might impede pinning the legs. The multibeam echosounder emits high frequency (240 kilohertz [kHz]) energy in a fan-shaped pattern of equidistant or equiangular beam spacing. The multi-beam echosounder operates at a frequency outside of marine mammal hearing range and is not addressed further in our analysis.

Once the jack-up rig is secure, divers will assist by taking measurements of existing equipment and using handheld tools to finalize P&A activities. They will use lights, measuring tapes, video cameras, radios in their helmets, wire brushes, water jets, an impact wrench, and potentially other handheld tools (such as hydrogrinder, needle scaler, and torque tools). Wire brushes and crescent wrenches are used for attaching tie downs for equipment and cleaning off marine scale. Divers will also use water jets (e.g., a CaviDyne CaviBlaster) to wash away debris and marine growth on the structure. The system operates as a zero-thrust water compressor with the use of a mobile pump which draws water from the location of the work. The water jet will be used intermittently and in intervals of approximately 30 minutes or less. Impact wrenches (e.g., Stanley IW16 or IW12) will be used for torquing the lock-down-screws on the slip-lock wellhead as well as for flanging up the 20” riser from the wellhead connection to the rig blowout preventers. The impact wrenches will also be used to break flanges of the 20” riser and remove the slip-lock wellhead. Over a total of 10 days, impact wrenches will be used approximately 1.5 hours per day.

The transit to finish P&A work at Well 17589 will occur between jack-up rig transports for production drilling activities.

Production Drilling

Hilcorp also plans to tug the jack-up rig to existing platforms in middle Cook Inlet and Trading Bay in support of production drilling activities from existing platforms and wellbores. Hilcorp routinely conducts development drilling activities at offshore platforms. On-platform drilling activities occur from existing platforms within the Cook Inlet through either well slots or existing wellbores inside existing platform legs. There is no proposed well construction associated with the production drilling occurring from the platforms. On-platform production drilling will occur hundreds to thousands of feet below the seafloor.

All Hilcorp platforms (Figure 1) have potential for development drilling activities. Drilling activities from platforms within Cook Inlet are accomplished by using conventional drilling equipment from a variety of rig configurations. Some platforms in Cook Inlet have permanent drilling rigs installed that operate under power provided by the platform power generation systems, while other locations require the use of a mobile drill rig. Mobile offshore drill rigs may be powered by the platform power generation (if compatible with the platform power generation system) or self –generate power with the use of diesel-fired generators.

During on-platform drilling operations, sound producing rig generators are located above the platform's drill deck and run continuously. The platform's drill deck is the top-most deck of the platform, ranging from approximately 80 ft to 140 ft above mean high water, and provides for the external mobilization and placement of drilling rigs, equipment, and consumables onto the platform. Mud pumps are located on the jack up rig and may turn on and off several times a day depending on drilling operations.

Located below the drill deck and above the supportive superstructure of the platform are multiple floors/levels of various production and operations equipment that runs constantly including compressors, generators, turbines, fluids handling and pumping systems. This permanently installed platform production equipment is greater in size and capacity and is closer to the water than production equipment on smaller temporary rigs.

Aircraft

Helicopters will be used to support planned activities. Helicopters transit from the mainland to the production sites to mobilize personnel and supplies. Flights will follow a direct route, and will fly at 457 m (1,500 ft) or higher unless human safety is at risk or it is operationally impossible (e.g., takeoff and landing points are so close together the aircraft cannot reach 450 m) to avoid acoustical harassment of marine mammals. Fix-wing aircraft will be used to conduct beluga aerial surveys prior to the transport of the jack-up rig. In order to effectively detect beluga whales these aerial surveys will be flown at approximately 1,000 ft (Section 2.1.2).

Supply Vessel Operations

Major supplies will be staged on-shore at the OSK Dock in Nikiski. Supplies and equipment will be moved from the staging area to the platform by vessels that are currently in use supporting offshore operations within Cook Inlet. These supply vessels will carry fuel, drilling water, mud materials, drilling tools, cement, casing, and well service equipment, and will be outfitted with fire-fighting systems as part of fire prevention and control as required by Cook Inlet Spill Prevention and Response, Inc. Typical offshore drilling support vessels are 155 to 210 ft in length and are made of steel construction with strengthened hulls to provide the capability of working in extreme conditions. Supply vessels are also capable of moving personnel when severe weather will not allow helicopter flights. These vessels typically travel at 7 knots and cannot exceed 9 knots, due to cooling system constraints.

Vessel trips to and from the platform while drilling is occurring are anticipated to increase (on average) by two trips per day from normal platform operations. When the rig is being set up at the location, approximately five trips will be needed to deliver equipment, mud products, drill pipe, and other tangibles needed for drilling. These trips may occur any time of day for approximately 5 days. Hilcorp's supply vessels do not use dynamic positioning, but rely on bow thrusters for close-quarter maneuvering. Vessel supply trips are typically scheduled during ideal tides and weather conditions. However, vessel captains may need to use bow thrusters for safety purposes during trips with unfavorable environmental conditions. When they are used they are used once or twice per trip for roughly 20-30 seconds to kick the bow away from the dock/platform if the current is pushing them against the dock/platform.

2.1.1.2 Year 2 Description of Activity

Year 2 activity consists of production drilling in middle Cook Inlet and Trading Bay using the same equipment and methodology as that described for Year 1. The jack-up rig will be towed on location using the same or similar three ocean-going tugs, and will be used for production drilling. In Year 2, the jack-up rig (Spartan 151, or similar) will be mobilized and demobilized by the three tugs to and from the Rig Tenders Dock in Nikiski, Alaska. A high slack tide is necessary for the tugs to approach close enough to shore to attach and mobilize the jack-up rig from the Rig Tenders Dock. Because Hilcorp's production platforms/well sites are north of the initial mobilization site, the tugs will begin their transit from Nikiski against an outgoing tide. To minimize transit time against the outgoing tide and reduce power output, the tugs will first tow the jack-up rig to a location near the Offshore Systems Kenai dock, which provides protection from the fast outgoing tidal current. Protection from the outgoing tidal current will allow the tugs to expend less power holding the jack-up rig in position than if they continued to transit against the tide. The tugs will begin transiting north again when the tide changes to an incoming tide, which is about six hours after the high slack tide. Towing the jack-up rig northward with an incoming tide during mobilization requires less than half power, generally only 20 to 30 percent of total power output (Hilcorp 2022). Throughout the season the jack-up rig will be transported from platform to platform with the same equipment and methodology as described above in Year 1 activities. There will be up to a total of 8 moves in Year 2 (1 mobilization, 1 demobilization, and 6 movements between platforms).

Aircraft and supply vessel operations are expected to occur in the same manner and frequency, using the same equipment as in Year 1.

2.2 Mitigation Measures

2.2.1 General Mitigation Measures

1. Hilcorp will inform NMFS of impending in-water activities that require a protected species observer (PSO) a minimum of one week prior to the onset of those activities.
2. Trash will be disposed of in accordance with state law (AS 46.06.080). In addition, the project proponent will ensure that all closed loops (e.g., packing straps, rings, bands) will be cut prior to disposal. In addition, the project proponent will secure all ropes, nets, and other marine mammal entanglement hazards so they cannot enter public waterways.
3. Hilcorp will conduct briefings between vessel captains and crew, dive team, and marine mammal monitoring team prior to the start of all in-water work, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

Tugs Towing the Jack-up Rig

4. Specific to tugs towing jack-up rigs, the terminology "clearance zone" is used to reference the zone in which a PSO will monitor and verify the zone is clear of marine

mammals prior to the towing of the jack-up rig. The terminology "monitoring zone" is used once the towing of the jack-up rig commences because tug operations cannot discontinue controlling rig transport without causing risk to life, property, or the environment, therefore, the terminology shutdown zones cannot be applied to tug operations.

5. Hilcorp will establish a clearance and monitoring zone that extends 1.5 kilometers (km) from the tug or jack-up rig on which the PSOs are positioned.
6. Two NMFS-approved PSOs will be on-watch on one of the tugs or the jack-up rig and will monitor during the entirety (day and night) of the jack-up rig towing and positioning operations.
7. During daylight hours (between sunrise and sunset), two PSOs will scan the clearance zone for 30 minutes prior to commencing tugging or positioning work, and prior to re-starting work after any stoppage of 30 minutes or greater; if no marine mammals are observed within those 30 minutes, activities may commence.
8. During nighttime hours (between sunset and sunrise), two PSOs will scan the clearance zone, to the greatest extent feasible using NMFS-approved night vision devices, for 30 minutes prior to tugging or positioning work, and prior to re-starting work after any stoppage of 30 minutes or greater. If no marine mammals are observed within those 30 minutes, activities may commence.
    a. NMFS-approved night vision devices are used to clear and monitor the clearance and monitoring zones during nighttime activities. Hilcorp will provide the NMFS consultation biologist or section 7 coordinator with the brand and model number of the proposed night vision device at least 30 days prior to the initiation of in-water activities that require a PSO. Hilcorp will not use disapproved devices to clear or monitor the clearance and monitoring zones, and in-water activities will not occur outside of daylight hours (between sunrise and sunset) without the use of NMFS-approved night vision devices.
9. If a marine mammal is observed within the clearance zone during the pre-activity clearing, operations will not commence until:
    a. The PSO observes the animal outside of and on a path away from the clearance zone, or
    b. The PSO confirms that listed species have not been observed in the clearance zone for 30 minutes.
10. Should a marine mammal be observed within the monitoring zone during tugs towing the jack-up rig, the PSO will monitor and carefully record any reactions observed until the towing or positioning is concluded. No new operational activities will be started until the animal leaves the clearance zone. Shifting from towing to positioning without shutting down is not considered a new operational activity.
11. Two PSOs will scan the waters within the monitoring zone for at least 30 minutes after each tugging and positioning event, and after each stoppage of 30 minutes or greater.

12. Hilcorp will conduct tug towing rig operations with a favorable tide (as explained in the proposed action) unless human safety or equipment integrity are at risk.
13. Hilcorp will conduct tug towing rig activities at night only if doing so is necessary to take advantage of a tide in the direction of intended travel, thus reducing acoustic output and travel time.

2.2.2 Other Activities - Shut-Down Zones & Mitigation Measures

14. For each in-water activity, a PSO will monitor waters within the shutdown zone associated with that activity (Table 3). If a listed marine mammal is observed within the shutdown zone, the PSO will call for a delay in commencement of the activity or cease the activity.

Table 3. Shutdown Zones for Each Activity

Activity	Type of Monitor	Shutdown Zone Radius (m)	Description of Monitoring and Shutdown Requirements
Water jets	PSO	1,000	A PSO will monitor the shutdown zone 30 minutes prior and throughout the use of water jets.
Impact wrench	PSO	1,400	A PSO will monitor the shutdown zone 30 minutes prior and throughout the use of an impact wrench.
Hydrogrinder & needle scaler	PSO	400	A PSO will monitor the shutdown zone 30 minutes prior and throughout the use of a needle grinder.
Torque tools & other handheld tools	PSO	1,500	A PSO will monitor the shutdown zone 30 minutes prior and throughout the use of torque tools and other any hand tools that emit sound between 120 dB and 167.7 dB at 1 m.

15. PSOs will be positioned such that they will collectively be able to monitor the entirety of each activity's shutdown zone.
16. Prior to the use of water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, PSOs will scan waters within the associated shutdown zone and confirm no listed species are within the shutdown zone for at least 30 minutes immediately prior to the activity. If one or more listed species are observed within the shutdown zone, the activity will not begin until the listed species exits the shutdown zone of their own accord, or the shutdown zone has remained clear of listed species for 30 minutes immediately prior to commencement of the activity.
17. This pre-in-water activity observation period will take place prior to in-water activities, and following cessation of in-water activities for a period of 30 minutes or longer.
18. The on-duty PSO will continuously monitor the shutdown zone and adjacent waters for the presence of listed species during the use of water jets, impact wrenches, hydrogrinder, needle scaler, torque tools and other handheld tools.

19. The use of water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, activities will only take place:
    a. between sunrise and sunset unless NMFS-approved night vision devices are used to clear and monitor the shutdown zone(s). Hilcorp will provide the NMFS consultation biologist or section 7 coordinator with the brand and model number of the proposed night vision device at least 30 days prior to the initiation of in-water activities that require a PSO. NMFS will provide a brief explanation of lack of approval in instances where the proposed night vision device is not approved. Hilcorp will not use disapproved devices to clear or monitor the shutdown zone(s), and in-water activities producing underwater sound will not occur outside of daylight hours (between sunrise and sunset) without the use of NMFS-approved night vision devices.
    b. during conditions with a Beaufort Sea State of 4 or less; and
    c. when the entire shutdown zone and adjacent waters are visible (e.g., monitoring effectiveness is not reduced due to rain, fog, snow, haze or other environmental/atmospheric conditions).
20. If visibility degrades such that a PSO can no longer ensure that the shutdown zone remains devoid of listed species when water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, are occurring, the crew will cease or delay the activity (unless human safety or equipment integrity are at risk) until the entire shutdown zone is visible and the PSO has indicated that the zone has remained devoid of listed species for at least 30 minutes.
21. The PSO will order activities associated with water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, to immediately cease or be delayed if one or more listed species has entered, or appears likely to enter, the associated shutdown zone. Divers will be immediately notified via radio to cease activity if a listed species is observed within or about to enter either the water jet, impact wrench, or torque tools, hydrogrinder, and needle scaler and other handheld tool shutdown zone.
22. If water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, activities are shut down for less than 30 minutes due to the presence of listed-species in the shutdown zone, activities that were discontinued can recommence when the PSO provides assurance that listed species were observed exiting the shutdown zone. Otherwise, the activities may commence only after the PSO provides assurance that listed species have not been seen in the shutdown zone for 30 minutes (for cetaceans) or 15 minutes (for pinnipeds).
23. Following a lapse of the use of water jets, impact wrenches, hydrogrinder, needle scaler, torque tools, and other handheld tools, activities of more than 30 minutes, the PSO will authorize resumption of activities only after the PSO provides assurance that listed species have not been present in the shutdown zone for at least 30 minutes immediately prior to resumption of operations.
24. If a listed species is observed within a shutdown zone or is otherwise harassed, harmed, injured, or disturbed, PSOs will immediately report that occurrence to NMFS using the contact information specified in Table 4.

Drilling

25. A PSO or crewmember will monitor waters within 330 m of the drilling location for 30 minutes prior to startup of jack-up rig generators and mud pumps. If one or more listed species are observed within 330 m, the activity will not begin until the listed species exits the 330 m zone of their own accord, or the 330 m zone has remained clear of listed species for 30 minutes immediately prior to commencement of the activity. The pre-in water activity observation period does not need to be implemented if only the mud pumps or the generators are off for 30 minutes or longer; rather this observation period applies only when both of these types of equipment are shut off together for 30 minutes or longer.
26. This pre-in-water activity observation period will take place prior to the startup of jack-up rig generators and mud pumps, following cessation of drilling generators and mud pumps for a period of 30 minutes or longer. The pre-in water activity observation period does not need to be implemented if only the mud pumps or the generators are off for 30 minutes or longer; rather this observation period applies only when both of these types of equipment are shut off together for 30 minutes or longer.

Aircraft

27. Except during takeoff and landing, in emergency situations, and beluga aerial surveys, all aircraft will transit at an altitude of at least 457 m (1,500 ft) while maintaining Federal Aviation Administration flight rules (e.g., avoidance of cloud ceiling, etc.). If flights must occur at altitudes less than 457 m (1,500 ft), aircraft will make course adjustments, as needed, to maintain at least a 457 m (1,500 ft) horizontal separation from all observed listed species.
28. Aircraft will not hover or circle over listed species.

Support or Supply Vessels

29. Support or supply vessel operators will:
    a. maintain a watch for marine mammals at all times while underway;
    b. stay at least 91 m (100 yards) away from listed marine mammals,
    c. travel at less than 5 knots (9 km/hour) when within 274 m (300 yards) of a whale;
    d. avoid changes in direction and speed when within 274 m (300 yards) of a whale, unless doing so is necessary for maritime safety;
    e. not position vessel(s) in the path of a whale, and will not cut in front of a whale in a way or at a distance that causes the whale to change direction of travel or behavior (including breathing/surfacing pattern);
    f. check the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged;
    g. reduce vessel speed to 10 knots or less when weather conditions reduce visibility to 1.6 km (1 mi) or less;
30. If a whale's course and speed are such that it will likely cross in front of a support or supply vessel that is underway, or approach within 91 m (100 yds) of the support or

supply vessel, and if maritime conditions safely allow, the engine will be put in neutral and the whale will be allowed to pass beyond the vessel.

31. Support and supply vessels will take reasonable steps to alert other vessels in the vicinity of whale(s).
32. Support and supply vessels will not allow lines to remain in the water unless both ends are under tension and affixed to vessels or gear. No materials capable of becoming entangled around marine mammals will be discarded into marine waters.
33. Hilcorp will not conduct noise-producing activity within 16 km (10 miles) of the mean lower-low water line of the Susitna River Delta (Beluga River to the Little Susitna River) with the southern boundary ending at a line drawn between Tyonek Village and Point Possession between April 15 and November 15, with the exception of work conducted at the pre-existing Tyonek platform.
34. Prior to tugging or positioning the jack-up rig adjacent to the Tyonek platform, Hilcorp will conduct a systematic aerial survey of all marine waters within a 10 mile radius of the Tyonek platform that intersects with the Susitna Delta exclusion zone, termed the aerial survey area (see Figure 2) to ensure the area is clear of beluga whales. Aerial surveys will be flown with a PSO observing for beluga whales at an altitude of approximately 1,000 ft.
    a. This survey will be conducted no more than 12 hours prior to the proposed departure of the rig from its moored or anchored location.
    b. If beluga whales are observed during the above aerial survey prior to mobilizing the jack-up rig to or from the Tyonek platform, Hilcorp will not begin mobilization of the rig until a subsequent aerial survey indicates the aerial survey area contains no beluga whales.
    c. Starting from the proposed departure date, Hilcorp will conduct aerial surveys as described above and if belugas are seen in the aerial survey area will defer moving the jack-up rig if there is another departure date that fits the tide/tug criteria for moving onto and off of the dock within 8 days.
    d. If the rig move is deferred until the next departure window occurring within 8 days of the first proposed departure date, Hilcorp will again conduct aerial surveys and will defer moving the rig until the last available tide for departure that allows the tugs to complete the transport in that second departure timeframe. If beluga whales are observed in the aerial survey area prior to the last available tide in the already deferred second departure time-frame, Hilcorp will move the jack-up rig to its next location.
    e. If there is not another departure date within 8 days of the first proposed departure date, Hilcorp will conduct multiple aerial surveys (weather permitting) and if belugas are seen in the aerial survey area will defer moving the rig until the last available tide in the initial departure window that coincides with tug availability.
    f. If ice or other safety conditions exist that require the tugs to move the jack-up rig to preserve human safety, Hilcorp will move the jack-up rig to its next location even if belugas are observed in the 10-mile radius on aerial surveys.

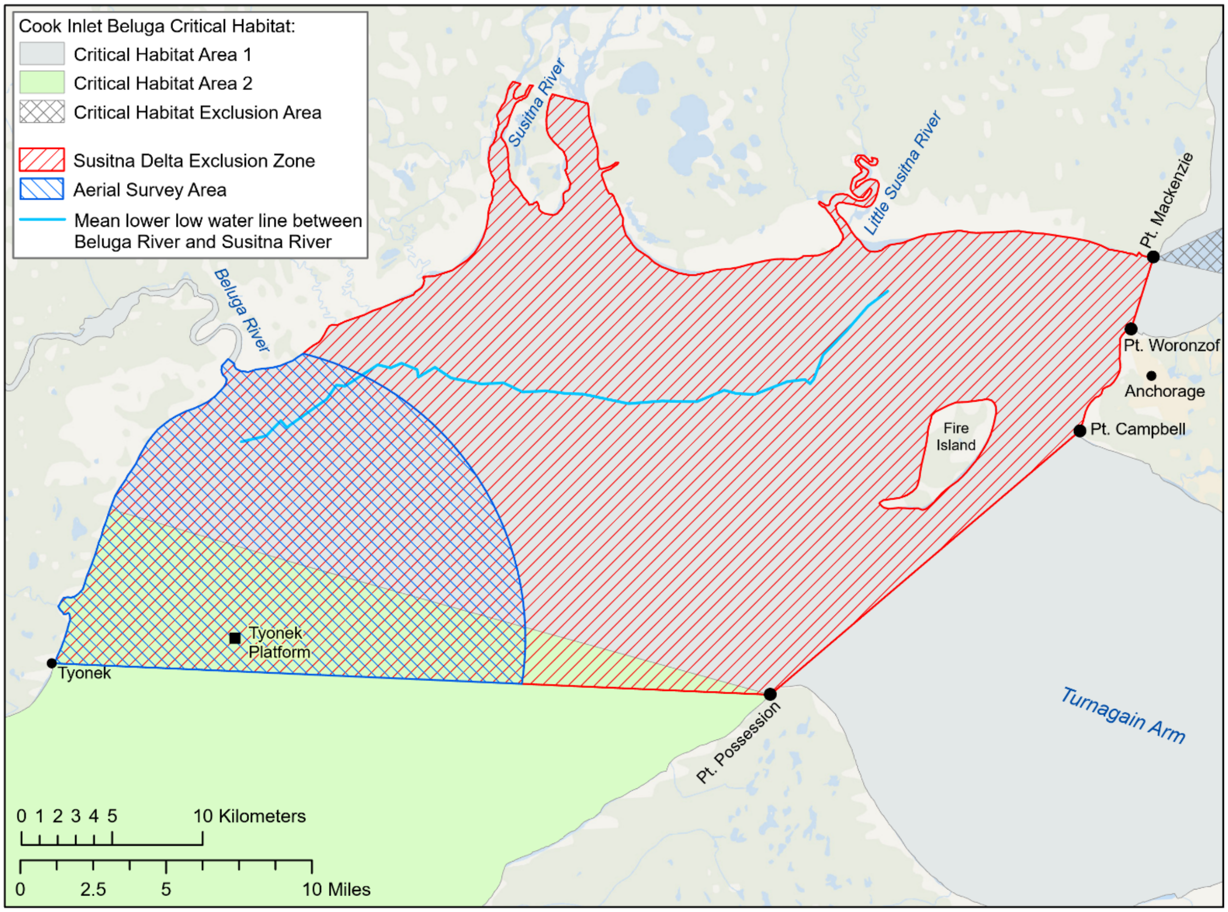

Figure 2. Susitna Delta Exclusion Zone, showing MLLW line between the Beluga and Little Susitna Rivers.

2.2.3 Monitoring Requirements

35. Hilcorp will provide resumes or qualifications of PSO candidates to the NMFS AKR for approval at least one week prior to in-water work. NMFS will provide a brief explanation of lack of approval in instances where an individual is not approved.
36. PSOs will scan the clearance, monitoring, or shutdown zone systematically, alternating between the naked eye, reticle binoculars, and/or NMFS-approved night vision devices.
37. PSOs or trained crewmembers will work in shifts lasting no longer than 4 hours with at least a 1-hour break from monitoring duties between shifts. PSOs will not perform PSO duties for more than 12 hours in a 24-hour period.
38. PSOs or trained crewmembers will be in communication with the vessel captain or operations personnel via VHF radio and/or cell phone at all times in order to alert project personnel to all marine mammal sightings relative to the ongoing activity.
39. The PSOs will have the following equipment to address their duties:
    a. tools which enable them to accurately determine the position of a marine mammal in relationship to the shutdown zone;

b. two-way radios or equivalent gear that allows communication with the crew in real time;

c. tide tables for the project area;

d. watch or chronometer;

e. binoculars (7x50 or higher magnification) with built-in rangefinder or reticles (rangefinder may be provided separately);

f. NMFS-approved night vision devices;

g. instruments that allow observer to estimate geographic coordinates of observed marine mammals; and

h. a legible copy of this LOC and all appendices and legible and fillable observation record forms allowing for required PSO data entry.

40. For activities that require a PSO and doesn't allow the use of a trained crewmember, PSOs will be independent (i.e., not trained crewmembers).

41. PSOs and trained crewmembers will have no other assigned tasks during monitoring periods.

42. At least one PSO will have prior experience performing the duties of a PSO during activity, and shall be appointed as the lead PSO.

43. PSOs and crewmembers conducting monitoring duties on the project will complete training prior to deployment. The training will include:

    a. field identification of marine mammals and marine mammal behavior;

    b. ecological information on marine mammals and specifics on the ecology and management concerns of those marine mammals;

    c. ESA and MMPA regulations;

    d. proper equipment use;

    e. methodologies in marine mammal observation and data recording and proper reporting protocols;

    f. and an overview of PSO roles and responsibilities.

44. PSOs will have the ability and authority to order appropriate mitigation response, including shutdowns, to avoid takes of all listed species.

45. PSOs will:

    a. have the ability to effectively communicate orally, by radio and in person, with project personnel;

    b. be able to collect field observations and record field data accurately and in accordance with project protocols and provide an understandable summary of those observations; and

    c. be able to identify protected species that occur in the action area at a distance equal to the outer edge of the clearance, monitoring, and shutdown zone.

2.2.4 Reporting

Monthly Reports

46. Hilcorp will submit interim monthly PSO monitoring reports, including data sheets. These reports will include a summary of marine mammal species and behavioral observations, shutdowns or delays, and work completed.
47. Monthly reports will be submitted to AKR.section7@noaa.gov by the 15th day of the month following the reporting period. For example the report for activities conducted in June, 2023 will be submitted by July 15th, 2023.

Annual Reports

48. Hilcorp will submit its draft annual monitoring report on all monitoring within 90 calendar days of the end of the calendar year. A final report will be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 30 calendar days of receipt of the draft report, the report may be considered final.
49. All draft and final monitoring reports will be submitted to AKR.section7@noaa.gov.
50. The marine mammal report will contain the informational elements described in the Monitoring Plan and, at minimum, will include:
    a. Dates and times (begin and end) of all marine mammal monitoring;
    b. Activities occurring during each daily observation period, including:
        i. Type of activity (towing or positioning, water jets, impact wrench, etc.);
        ii. Total duration of each type of activity;
        iii. Number of attempts required for positioning jack-up rig; and
        iv. Indications of when nighttime operations were required and if towing against the tide was required.
    c. PSO locations during marine mammal monitoring;
    d. Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility;
    e. Upon observation of a marine mammal, the following information:
        i. Name of PSO who sighted the animal(s), PSO location, and project activity at time of sighting;
        ii. Date and time of sighting;
        iii. Identification of the animal(s) (e.g., genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species;
        iv. Distance and location of each observed marine mammal;

v. Estimated number of animals (min/max/best estimate);

vi. Estimated number of animals by cohort (adults, juveniles, neonates, group composition, etc.);

vii. Animal's closest point of approach and estimated time spent within the harassment zones (i.e. project activity associated with clearance, monitoring, and shutdown zones);

viii. Description of any marine mammal behavioral observations (e.g., observed behaviors such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g., no response or changes in behavioral state such as ceasing feeding, changing direction, flushing, or breaching);

ix. Number of marine mammals detected within the clearance, monitoring, and shutdown zones, by species;

x. Quantify inferred exposures during night time activities or degraded visibility when the entire monitoring or shutdown zone is not visible;

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

xii. When they are used, an evaluation of the effectiveness of the night vision devices, including a general assessment of the distance PSOs can detect marine mammals in given environmental conditions (cloudy, full moon, etc), the distance in which they can detect large whales and pinnipeds, which behaviors were visible through night vision devices (e.g. blows, body, splashing etc.), and any other conditions that influenced visibility and detectability rates (e.g. settings, weather, bridge lighting, ambient light, insider or outside observations, etc); and

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

Unauthorized Take

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

    1. all information to be provided in the annual report (Mitigation Measure 50)
    2. number of animals of each threatened and endangered species affected;
    3. the date, time, and location of each event (provide geographic coordinates);
    4. description of the event;

5. the time the animal(s) was first observed or entered the shutdown zone, and, if known, the time the animal was last seen or exited the zone, and the fate of the animal;
6. mitigation measures implemented prior to and after the animal was taken;
7. if a vessel struck a marine mammal, the contact information for the PSO on duty, or the contact information for the individual piloting the vessel if there was no PSO on duty; and,
8. Photographs or video footage of the animal(s) (if available).

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

52. If PSOs observe an injured, sick, or dead marine mammal (i.e., stranded marine mammal), they will notify the Alaska Marine Mammal Stranding Hotline at 877-925-7773. The PSOs will submit photos and available data to aid NMFS in determining how to respond to the stranded animal. If possible, data submitted to NMFS in response to stranded marine mammals will include date/time, location of stranded marine mammal, species and number of stranded marine mammals, description of the stranded marine mammal's condition, event type (e.g., entanglement, dead, floating), and behavior of live-stranded marine mammals.

Illegal Activities

53. If PSOs observe marine mammals being disturbed, harassed, harmed, injured, or killed (e.g., feeding or unauthorized harassment), these activities will be reported to NMFS Alaska Region Office of Law Enforcement at (Table 4; 1-800-853-1964).
54. Data submitted to NMFS will include date/time, location, description of the event, and any photos or videos taken.

Summary of Agency Contact Information

Table 4. Summary of agency contact information.

Reason for Contact	Contact Information
Consultation Questions & Unauthorized Take	Greg Balogh: greg.balogh@noaa.gov & Bonnie Easley-Appleyard (bonnie.easley-appleyard@noaa.gov)
Reports & Data Submittal	AKR.section7@noaa.gov (please include NMFS AKRO tracking number in subject line)
Stranded, Injured, or Dead Marine Mammal *(not related to project activities)*	Stranding Hotline (24/7 coverage) 877-925-7773
Oil Spill & Hazardous Materials Response	U.S. Coast Guard National Response Center: 1-800-424-8802 & AKRNMFSSpillResponse@noaa.gov

Reason for Contact	Contact Information
Illegal Activities *(not related to project activities; e.g., feeding, unauthorized harassment, or disturbance to marine mammals)*	NMFS Office of Law Enforcement (AK Hotline): 1-800-853-1964
In the event that this contact information becomes obsolete	NMFS Anchorage Main Office: 907-271-5006 Or NMFS Juneau Main Office: 907-586-7236

2.3 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.

We define the action area for this consultation to include the area within which project-related noise levels exceed ≥120 dB re 1 μPa root mean square (rms), and are expected to approach ambient noise levels (i.e., the point where no measurable effect from the project would occur (Figure 1). Tugs towing the jack-up rig are the loudest sound source associated with this project. The sound from tugs towing the jack-up rig attenuate to 120 dB at approximately 3,850 m, therefore, the action area includes the path the jack-up rig travels from Nikiski to each platform and between platforms with a 3,850 m buffer (Figure 1). For more information on the modeling and calculation of the 3,850 m isopleth see Section 6.2.2.

3. Approach to the Assessment

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

To jeopardize the continued existence of a listed species means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934; June 3, 1986).

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

The designation(s) of critical habitat for Cook Inlet beluga whales use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (81 FR 7414; February 11, 2016) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, our use of the term PBF also applies to Primary Constituent Elements and essential features.

We use the following approach to determine whether the proposed action described in Section 2 of this opinion 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 effects on listed species or critical habitat. As part of this step, we identify the action area – the spatial and temporal extent of these 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 range-wide status of critical habitat by examining the condition of its PBFs - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this opinion.
- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; 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 action. 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 PBFs. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.
- Once we identify which listed 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) appreciably diminish the value of critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.
- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.
- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative to the action.

4. Rangewide Status of the Species and Critical Habitat

This opinion considers the effects of the proposed action on the species and designated critical habitats specified in Table 5. Although critical habitat has been designated for Mexico and Western North Pacific DPSs of humpback whale and Steller sea lions, there is no critical habitat for these populations in the action area. Therefore, these critical habitats are not considered further in this opinion.

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

Species	Status	Listing	Critical Habitat
Fin Whale (*Balaneoptera physalus*)	Endangered	NMFS 1970, 35 FR 18319	Not designated
Humpback Whale, Western North Pacific DPS *(Megaptera novaeangliae)*	Endangered	NMFS 2016, 81 FR 62260	NMFS 2021 86 FR 21082 None in the action area
Humpback Whale, Mexico DPS *(Megaptera novaeangliae)*	Threatened	NMFS 2016, 81 FR 62260	NMFS 2021 86 FR 21082 None in the action area
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered	NMFS 2008, 73 FR 62919	NMFS 2011, 76 FR 20180
Steller Sea Lion, Western DPS *(Eumetopias jubatus)*	Endangered	NMFS 1997, 62 FR 24345	NMFS 1993, 58 FR 45269 None in the action area

Hilcorp's proposed activities would take place in Cook Inlet, Alaska. For the purposes of this project, lower Cook Inlet refers to waters south of the East and West Forelands; middle Cook Inlet refers to waters north of the East and West Forelands and south of Threemile River on the west and Point Possession on the east; and upper Cook Inlet refers to waters north and east of Beluga River on the west and Point Possession on the east. Trading Bay (which is a part of middle Cook Inlet) refers to waters from approximately the Granite Point Tank Farm on the north to the West Foreland on the south. The Trading Bay area is defined because the data available on the presence of Cook Inlet belugas in this area is used in the Effects of the Action Section (6). A map of the specific area in which Hilcorp plans to operate is provided below (Figure 1).

4.1 Climate Change

One threat common to all the species we discuss in this opinion is global climate change. Because of this commonality, we present an overview here rather than in each of the species-specific narratives that follow. A vast amount of literature is available on climate change and for more detailed information we refer the reader to these websites which provide the latest data and links to the current state of knowledge on the topic in general, and in the Arctic specifically:

https://www.ipcc.ch/reports/

https://climate.nasa.gov/evidence/

http://nsidc.org/arcticseaicenews/

https://arctic.noaa.gov/Report-Card

Three facets of climate change, increased air temperatures, increased ocean temperatures, and ocean acidification, are presented because they have the most direct impact on marine mammals.

Air temperature

The decadal global land and ocean surface average temperature anomaly for 2011–2020 indicates that it was the warmest decade on record for the globe, with a surface global temperature of +0.82°C (+1.48°F) above the 20th century average[1]. This surpassed the previous decadal record (2001–2010) value of +0.62°C (+1.12°F)[2]. The 2020 Northern Hemisphere land and ocean surface temperature was the highest in the 141-year record at +1.28°C (+2.30°F) above average. This was 0.06°C (0.11°F) higher than the previous record set in 2016[2].

Since 2000, the Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes because of “Arctic amplification,” a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors[3] (Serreze and Barry 2011; Overland et al. 2017) and the average annual temperature is now 3-4° F warmer than during the early and mid-century (Figure 3; Thoman and Walsh 2019). The statewide average annual temperature in 2020 was 27.5°F, 1.5°F above the long-term average even though it was the coldest year since 2012[4]. Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014).

Marine water temperature

Higher air temperatures have led to higher ocean temperatures. More than 90 percent of the excess heat created by global climate change is stored in the world’s oceans, causing increases in ocean temperature (IPCC 2019; Cheng et al. 2020). The upper ocean heat content, which measures the amount of heat stored in the upper 2000 m (6,561 ft) of the ocean, was the highest on record in 2019 by a wide margin and is the warmest in recorded human history (Cheng et al. 2020).

The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect can be seen throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas (Figure 4). Along the west coast, the surface waters were 4–11ºF warmer than average in the summer of 2019 (Thoman and Walsh 2019).

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[1] https://www.ncdc.noaa.gov/sotc/global/202013 viewed on 5/31/2021
[2] https://www.ncdc.noaa.gov/sotc/global/202013 viewed on 5/31/2021
[3] NASA wepbage. State of the Climate: How the World Warmed in 2019. Available at https://www.carbonbrief.org/state-of-the-climate-how-the-world-warmed-in-2019, accessed January 20, 2020.
[4] https://www.ncdc.noaa.gov/sotc/national/202013 viewed on 5/31/2021

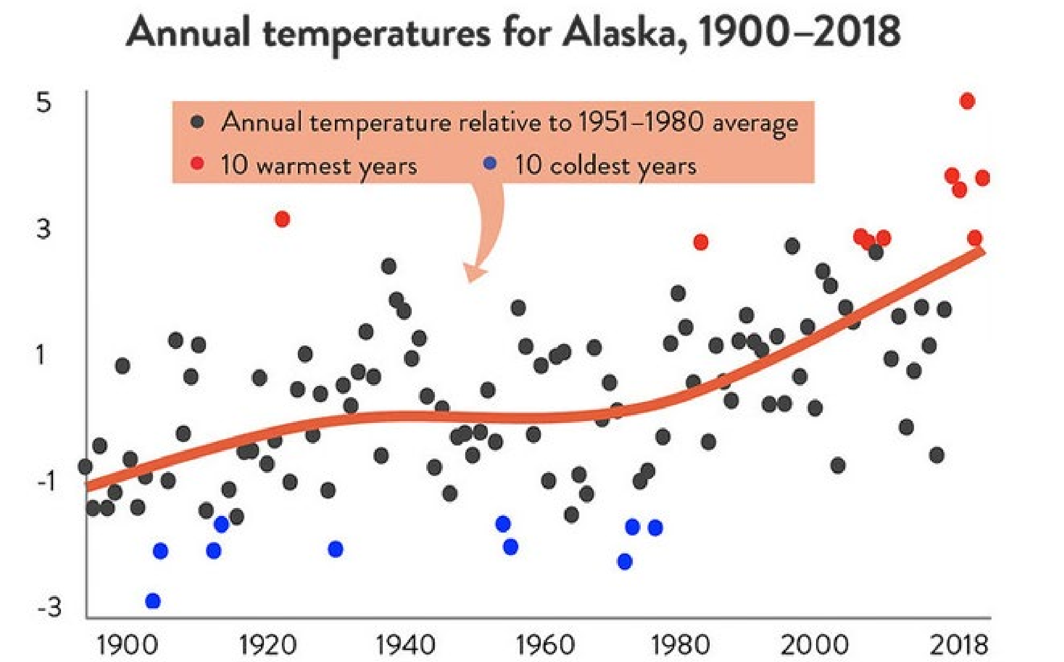

Figure 3. Alaska's ten coldest years on record (blue dots) all occurred before 1980. Nine of its ten warmest years on record have occurred since 1980. Graph by Rick Thoman, Alaska Center for Climate Assessment and Policy.

Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) began declining at an accelerated rate and continues to decline at a rate of approximately minus 2.7 percent per decade (Stroeve et al. 2007; Stroeve and Notz 2018). Although Arctic sea ice loss has been well documented, the seasonal ice cover in Cook Inlet has not been characterized in as much detail, but we expect that the same general trend of later ice formation and earlier melt occurs in that body of water as well. Of the five species we are considering in this biological opinion, beluga whales would be most affected by changing ice conditions in Cook Inlet because their entire life is spent in this single body of water. How changing patterns of ice may affect belugas remains speculative.

In the Pacific Arctic, with the reduction in the cold-water pool in the northern Bering Sea, large scale northward movements of commercial stocks are underway as previously cold-dominated ecosystems warm and fish move northward to higher latitudes (Grebmeier et al. 2006; Eisner et al. 2020). Not only fish, but plankton, crabs and ultimately, sessile invertebrates like clams are affected by these changes in water temperature (Grebmeier et al. 2006; Fedewa et al. 2020).

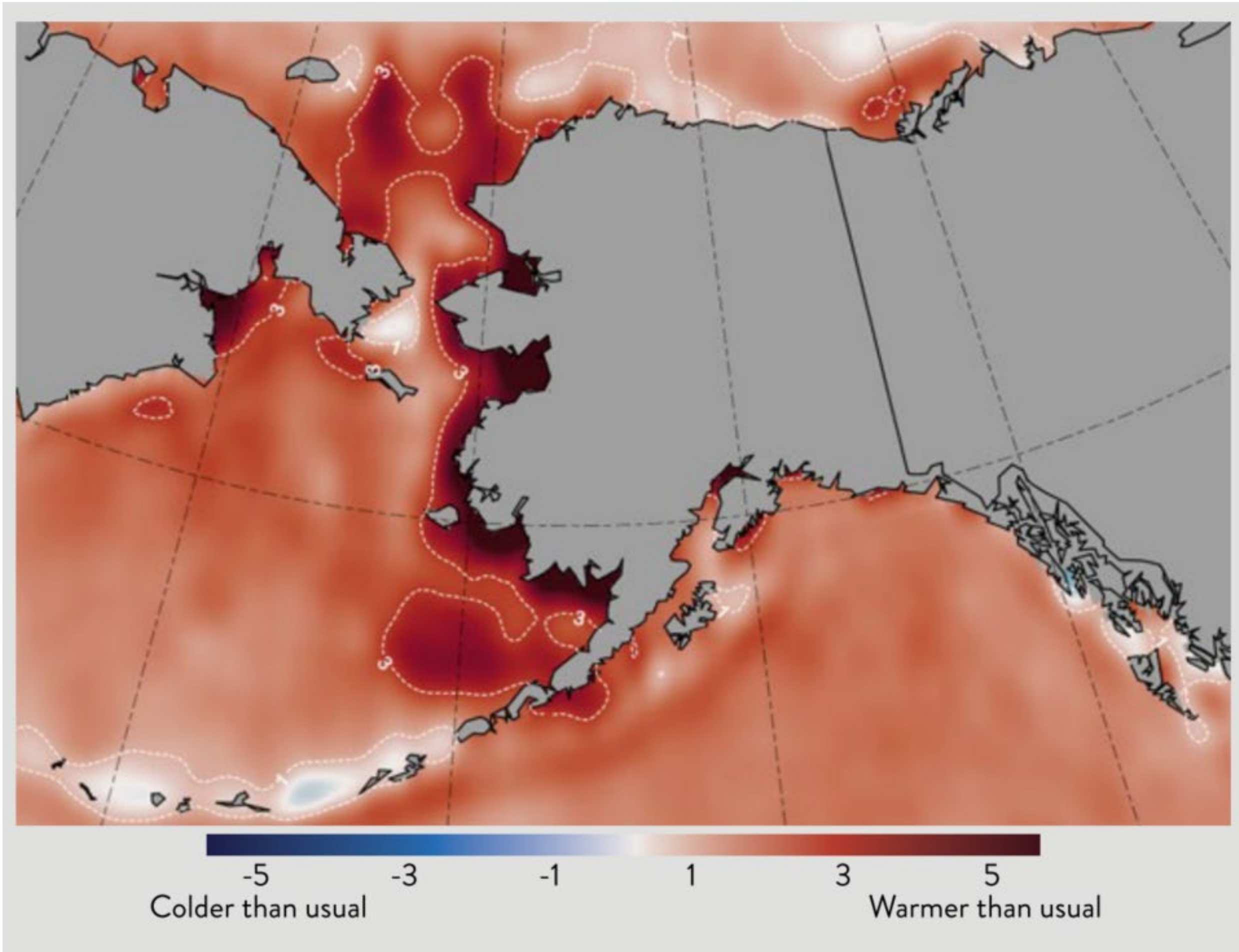

Figure 4. Shades of red indicate summer sea surface temperatures that were warmer than average during 2014-2018, especially along the west coast.

Another ocean water anomaly is described as a marine heat wave. Marine heat waves are described as a coherent area of extreme warm temperature at the sea surface that persists (Frölicher et al. 2018). Marine heatwaves are a key ecosystem driver and there has been an increase from 30 percent in 2012 to nearly 70 percent of global oceans in 2016 experiencing strong or severe heatwaves (Suryan et al. 2021). The largest recorded marine heat wave occurred in the northeast Pacific Ocean from 2013-2015 (Frölicher et al. 2018). Initially called "the blob" the northeast Pacific marine heatwave first appeared off the coast of Alaska in the winter of 2013-2014 and by the end of 2015 it stretched from Alaska to Baja California. In mid-2016, the Pacific marine heatwave began to dissipate, based on sea surface temperature data but warming re-intensified in late-2018 and persisted into fall 2019 (Suryan et al. 2021). Consequences of this event included an unprecedented harmful algal bloom that extended from the Aleutian Islands to southern California, mass strandings of marine mammals, shifts in the distribution of invertebrates and fish, and shifts in abundance of several fish species (Cavole et al. 2016). Cetaceans, forage fish (capelin and herring), Steller sea lions, adult cod, chinook and sockeye salmon in the Gulf of Alaska were all impacted by the Pacific marine heatwave (Bond et al. 2015; Peterson et al. 2016; Sweeney et al. 2018).

The 2018 Pacific cod stock assessment[5] estimated that the female spawning biomass of Pacific cod (an important prey species for Steller sea lions) was at its lowest point in the 41-year time series, following three years of poor recruitment and increased natural mortality as a result of the Pacific marine heatwave. In 2020 the spawning stock biomass dropped below 20 percent of the unfished spawning biomass and the federal Pacific cod fishery in the Gulf of Alaska was closed by regulation to directed Pacific cod fishing (Barbeaux et al. 2020). Twenty percent is a minimum spawning stock size threshold instituted to help ensure adequate forage for the endangered western stock of Steller sea lions.

Ocean Acidification

For 650,000 years or more, the average global atmospheric carbon dioxide (CO_2) concentration varied between 180 and 300 parts per million (ppm), but since the beginning of the industrial revolution in the late 1700s, atmospheric CO_2 concentrations have been increasing rapidly, primarily due to anthropogenic inputs (Fabry et al. 2008; Lüthi et al. 2008). The world's oceans have absorbed approximately one-third of the anthropogenic CO_2 released, which has buffered the increase in atmospheric CO_2 concentrations (Feely et al. 2004; Feely et al. 2009). Despite the oceans' role as large carbon sinks, the CO_2 level continues to rise and is currently at 419 ppm[6].

As the oceans absorb CO_2, the buffering capacity, and ultimately the pH of seawater is reduced. This process is referred to as ocean acidification. Ocean acidification reduces the saturation states of certain biologically important calcium carbonate minerals like aragonite and calcite that many organisms use to form and maintain shells (Bates et al. 2009; Reisdorph and Mathis 2014). When seawater is supersaturated with these minerals, calcification (growth) of shells is favored. Likewise, when the sea water becomes undersaturated, dissolution is favored (Feely et al. 2009).

High latitude oceans have naturally lower saturation states of calcium carbonate minerals than more temperate or tropical waters, making Alaska's oceans more susceptible to the effects of ocean acidification (Fabry et al. 2009; Jiang et al. 2015). Model projections indicated that aragonite undersaturation would start to occur by about 2020 in the Arctic Ocean and by 2050, all of the Arctic will be undersaturated with respect to aragonite (Feely et al. 2009; Qi et al. 2017). Large inputs of low-alkalinity freshwater from glacial runoff and melting sea ice contribute to the problem by reducing the buffering capacity of seawater to changes in pH (Reisdorph and Mathis 2014). As a result, seasonal undersaturation of aragonite was already detected in the Bering Sea at sampling stations near the outflows of the Yukon and Kuskokwim Rivers, and the Chukchi Sea (Fabry et al. 2009). Models and observations indicate that rapid sea ice loss will increase the uptake of CO_2 and exacerbate the problem of aragonite undersaturation in the Arctic (Yamamoto et al. 2012; DeGrandpre et al. 2020).

Undersaturated waters are potentially highly corrosive to any calcifying organism, such as corals, bivalves, crustaceans, echinoderms and many forms of zooplankton such as copepods and pteropods, and consequently may affect Arctic food webs (Fabry et al. 2008; Bates et al. 2009). Pteropods, which are often considered indicator species for ecosystem health, are prey for many

[5]NOAA Fisheries, Alaska Fisheries Science Center website. Available at https://apps-afsc.fisheries.noaa.gov/REFM/stocks/Historic_Assess.htm, accessed December 2, 2020.
[6] NOAA Global Monitoring Laboratory website. Trends in Atmospheric Carbon Dioxide. Available at https://www.esrl.noaa.gov/gmd/ccgg/trends/, accessed May 31, 2021.

species of carnivorous zooplankton, fishes including salmon, mackerel, herring, and cod, and baleen whales (Orr et al. 2005). Because of their thin shells and dependence on aragonite, under increasingly acidic conditions, pteropods may not be able to grow and maintain shells (Lischka and Riebesell 2012). It is uncertain if these species, which play a large role in supporting many levels of the Alaskan marine food web, will be able to adapt to changing ocean conditions (Fabry et al. 2008; Lischka and Riebesell 2012).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Hinzman et al. 2005; Burek et al. 2008; Doney et al. 2012; Huntington et al. 2020). The physical effects on the environment described above have impacted, are impacting, and will continue to impact marine species in a variety of ways (IPCC 2014), including shifting abundances, changes in distribution, changes in timing of migration, changes in periodic life cycles of species. For example, cetaceans with restricted distributions linked to water temperature may be particularly susceptible to range restriction (Learmonth et al. 2006; Isaac 2009). Macleod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters, and preferences for shelf habitats (Macleod 2009). These characteristics describe the habitat used by Cook Inlet beluga whales. Impacts of climate change on Cook Inlet beluga whales are further described in Section 4.3.3.

4.2 Species and Critical Habitat Not Likely to be Adversely Affected by the Action

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 Hilcorp's activities included in this Biological Opinion (i.e. tugs towing a jack-up rig, production drilling, support vessels, aircraft, water jets, and handheld underwater power tools with source levels <167 dB re 1 μPa at 1m) and a listed species or designated critical habitat. The second criterion is the probability of a response given exposure. We applied these criteria to the species listed above and determined that Cook Inlet beluga whale critical habitat is not likely to be adversely affected by the proposed action.

4.2.1 Cook Inlet Beluga Whale Critical Habitat

NMFS designated critical habitat for the Cook Inlet beluga whales on April 11, 2011 (Figure 5; 76 FR 20180). Critical habitat includes two areas: Area 1 and Area 2 that together encompass 7,800 km^2 (3,013 mi^2) of marine and estuarine habitat in Cook Inlet (76 FR 20180). For national security reasons, critical habitat excludes all property and waters of Joint Base Elmendorf-Richardson and waters adjacent to the Port of Alaska. The action area occurs almost entirely in critical habitat Area 2, with a small portion occurring within critical habitat Area 1. Cook Inlet beluga whale critical habitat is codified at 50 CFR § 226.220.

Critical habitat Area 1 consists of 1,909 km^2 (738 mi^2) of Cook Inlet, north of Threemile Creek and Point Possession. Area 1 contains shallow tidal flats or mudflats and mouths of rivers that provide important areas for foraging, calving, molting, and escape from predation. High concentrations of beluga whales are often observed in these areas from spring through fall. Additionally, anthropogenic threats have the greatest potential to adversely impact beluga whales in critical habitat Area 1 (76 FR 20180).

Critical habitat Area 2 consists of 5,891 km^2 (2,275 mi^2) south of critical habitat Area 1 and includes nearshore areas along western Cook Inlet and Kachemak Bay. Critical habitat Area 2 is known fall and winter foraging and transit habitat for beluga whales as well as spring and summer habitat for smaller concentrations of beluga whales (76 FR 20180).

Cook Inlet beluga whale critical habitat includes five Primary Constituent Elements, more recently and henceforth referred to as PBFs (Physical and Biological Features) deemed essential to the conservation of the Cook Inlet beluga whale (50 CFR § 226.220(c)):

1. Intertidal and subtidal waters of Cook Inlet with depths <30 ft (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, 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.

Belugas may avoid critical habitat near the mouth of and within the Kenai River during the peak periods of large salmon runs, presumably due to high levels of human activity, and instead make heavy use of salmon runs elsewhere in Upper Cook Inlet, most notably using waters near the mouth of the Susitna and Beluga rivers, and rivers feeding into Knik Arm and Chickaloon Bay (Goetz et al. 2012). In addition, they continue to use the waters in the lower 9 miles of the Kenai River during periods of low in-river human activity (Ovitz 2019). Overall, salmon returns in Cook Inlet drainages remain strong, however, Brenner et al. (2019) reported that the 2018 Upper Cook Inlet commercial harvest of salmon was 61 percent less than the recent 10-year average annual harvest.

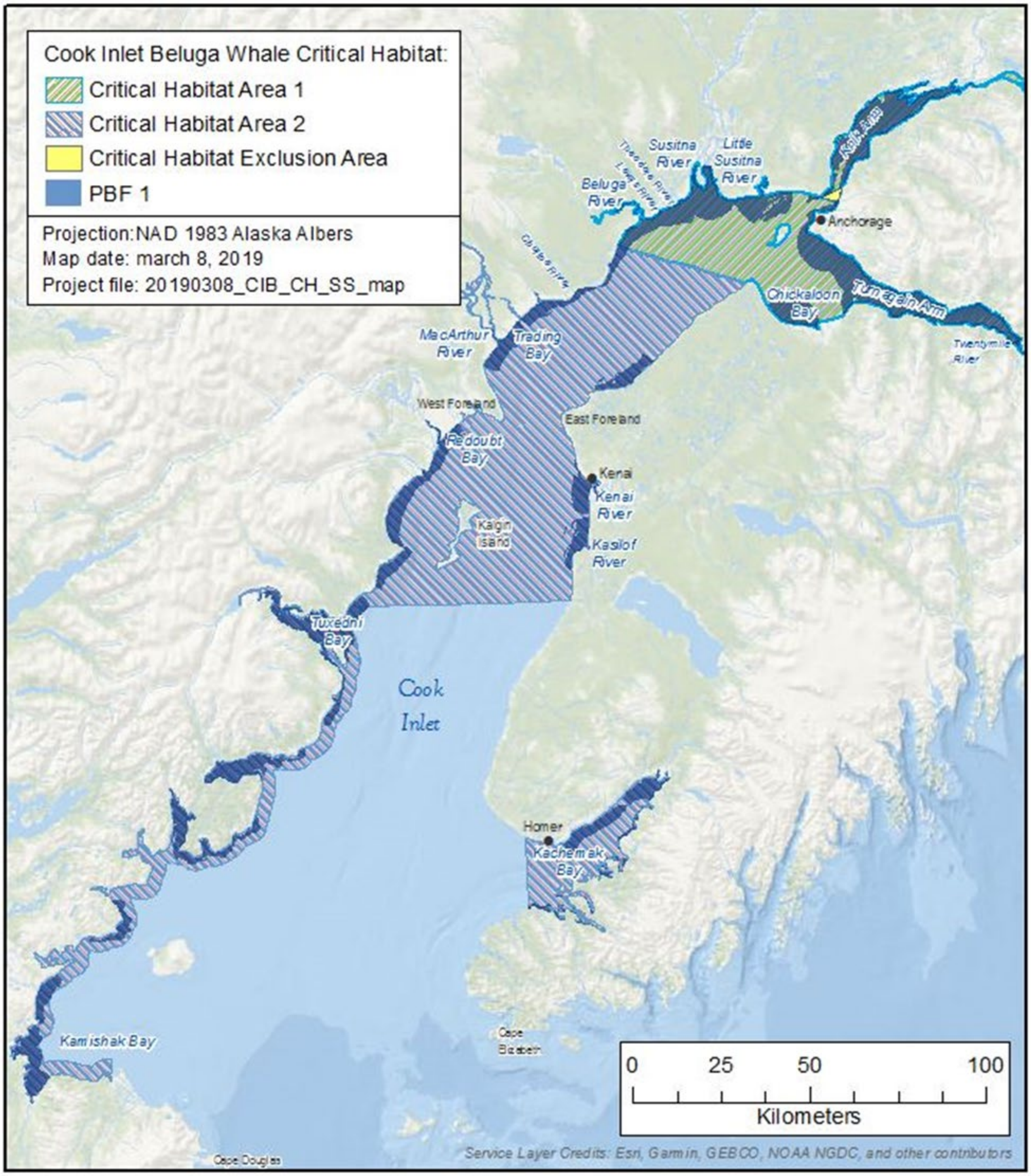

Figure 5. Designated critical habitat for Cook Inlet beluga whales.

4.2.2 Effects on Cook Inlet Beluga Whale Critical Habitat

The action area overlaps entirely with Cook Inlet beluga whale critical habitat (Figure 6). This section describes the effects of Hilcorp's proposed actions on designated Cook Inlet beluga whale critical habitat.

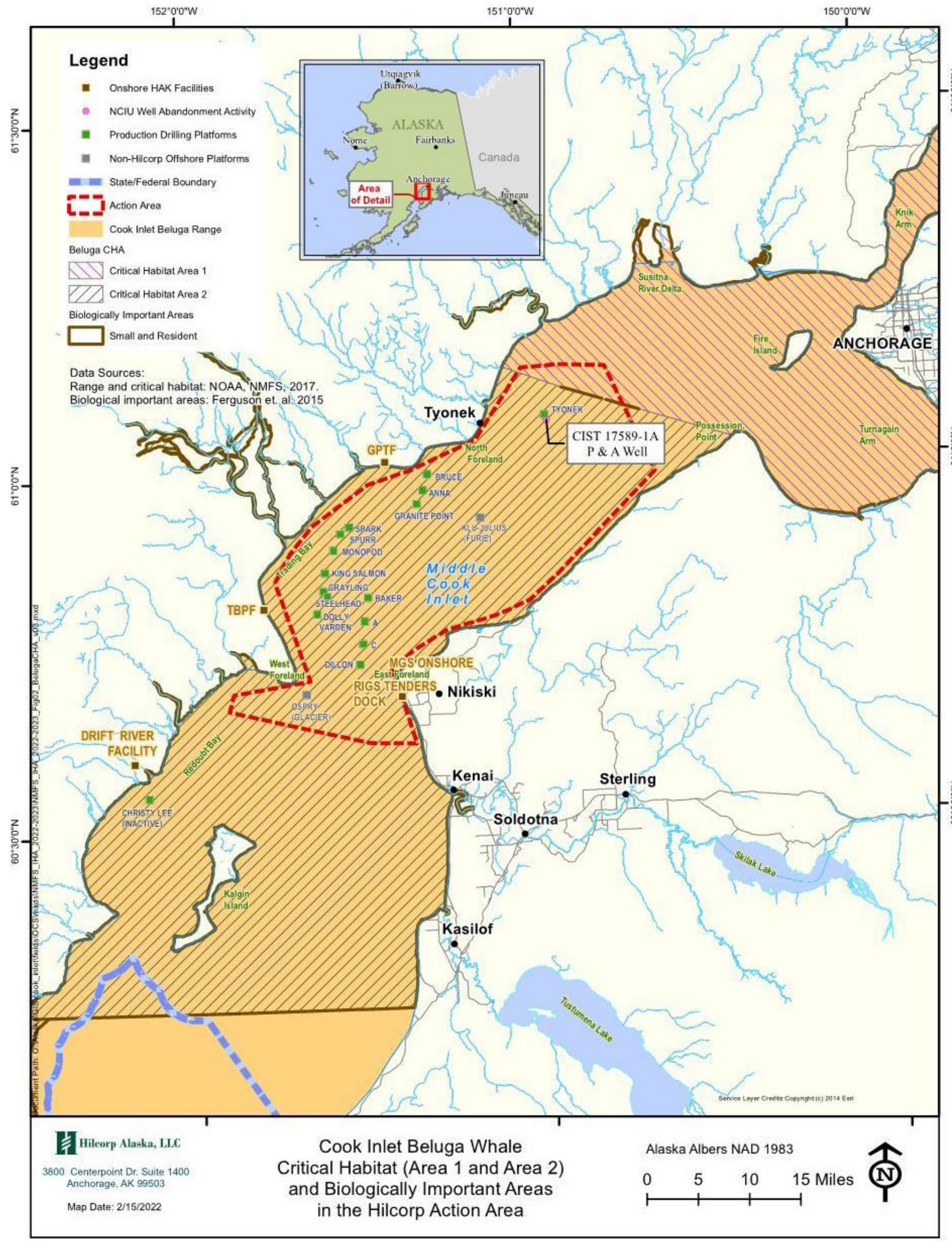

Figure 6. Action area overlapping with Cook Inlet beluga whale critical habitat.

Section 4.2.1 describes the geographical extent and PBFs of designated Cook Inlet Beluga Whale Critical Habitat. The proposed action may affect critical habitat primarily through noise from the sources, including tugs towing the jack-up rig, drilling operations, well plugging and abandonment, water jets, handheld underwater power tools with source levels <167 dB re 1 μPa at 1 m, support vessels, and support aircraft. Project activities may also affect critical habitat via disturbance to the seafloor, possible release of pollutants, and effects to prey.

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

There are eight anadromous fish streams and approximately 145.6 km^2 (56.3 mi^2) of intertidal and sub tidal waters and habitat that are within 8 km (5 mi) of the action area (Table 6). Anadromous fish streams could be affected by project sound, release of pollutants, and through direct effects on prey species. Effects of sound on critical habitat is discussed below in PBF5, effects of pollutants on critical habitat is discussed in PBF3 and as effects on the species in Section 6.2.1.8, and the effects on prey species from sound and pollutants is discussed in PBF2 and Section 6.2.2.6.

Sound source levels may increase above 120 decibels (dB) in anadromous streams, however, this is expected to be temporary and limited to sound as the tugs towing the jack-up rig are passing anadromous streams. Tugs towing the jack-up rig would occur on 16 non-consecutive calendar days a year and would not pass all anadromous streams in middle Cook Inlet in one day. Other proposed activities including water jets, production drilling, and handheld underwater power tools with source levels <167 dB re 1 μPa at 1 m are occurring at existing platforms (within 5 miles of anadromous streams) and have behavioral harassment thresholds of 120 dB at 1,500 meters or less. Project activities will not increase ambient noise above the 120 dB at the MLLW at the Susitna Delta between April 15 and November 15 which is known as a primary foraging location and time for Cook Inlet beluga whales (Section 4.3.3). The stressor with the largest acoustic threshold is the tugs towing the jack-up rig, which produces a 120 dB threshold at 3.8 km (Section 6.2.2.3). The Tyonek platform is more than 10 km away from the MLLW near Beluga River (Figure 2). Additionally, Hilcorp will attempt to defer towing the jack-up rig if belugas are within 10 miles of the Susitna Delta (Section 2.1.2). A very small proportion of primary prey species may be temporarily disturbed from sound or non-acoustic sources of disturbance, with a geographic extent much smaller than the project action area. As described in Section 6.2.2.6, any impacts to prey species from sound is expected to be minor.

A concern with respect to all of the anadromous streams is the possibility of an oil spill, and the resulting impacts to beluga prey. Large spills are rare and therefore, unlikely to occur from the proposed action. A small spill is expected to rapidly disperse due to tide-induced turbulence and mixing. We expect no project-related measurable impact to beluga prey. The probability of an oil spill adversely affecting anadromous streams and prey species is very small.

The probability of Hilcorp's proposed activities (tugs towing jack-up rig, production drilling, well plugging and abandonment, water jets, handheld underwater power tools with source levels <167 dB re 1 μPa at 1m, support vessels, and aircraft) adversely affecting anadromous streams is very small, and thus adverse effects to PBF1 are expected to be minor and undetectable.

Table 6. Anadromous fish streams and the 8 km (5 mi) area surrounding the mouths of these streams that are part of PBF 1 in the middle Cook Inlet that are also within the action area.

Middle Inlet	Area km2 (mi2)
Chuitna River	3.0 (1.2)
Indian Creek	0.7 (0.3)
McArthur River	46.1 (17.8)
Middle River	29.0 (11.2)
Nikolai Creek	23.2 (9.0)
Old Tyonek Creek	34.7 (13.4)
Threemile Creek	0.4 (0.1)
Tyonek Creek	8.5 (3.3)
Total Area:	145.6 (56.3)

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 primary impacts from the proposed action to PBF2 are from sound, non-acoustic disturbance, seafloor disturbance (including substrate vibrations), and unauthorized pollution (e.g., oil spills). Effects on prey species are also discussed in Section 6.2.2.6.

Prey species use sound to communicate, detect prey and predators, determine orientation, migrate, select habitat, and conduct mating behavior (Popper and Hawkins 2019). Anthropogenic sound can result in mortality to fish but may also cause temporary hearing impairment, physiological changes, changes in behavior and the masking of biologically important sounds (Popper et al. 2014; Erbe et al. 2016; Popper and Hawkins 2019). Fish behavioral responses may vary with their age and condition, environmental conditions, different sound sources, and the received sound source level. Sound pressure levels generated by activities of the proposed action (vessel traffic, drilling, etc.) may cause temporary behavioral changes of prey species at close range, such as a startle or stress response. Literature reviews on the effects of sound on fish conclude little is known about noise effects and it is not possible to extrapolate from one experiment to other signal parameters of the same sound, to other types of sound, to other effects, or to other species. NMFS uses 150 dB re 1 μPa (rms) as the sound pressure level that may result in onset of behavioral effects to fish species. The loudest activity associated with Hilcorp's activities is the use of tugs towing a jack-up rig at a 185 dB re 1 μPa,, when using a transmission loss coefficient of 15, this results in an 150 dB isopleth at 200 m radius. Given the slow speed of the tugs towing the jack-up rig through open water, where there is ample amount of space available to prey species to move, it is expected that any effects to prey species will be minor and undetectable.

Project-related sound is not expected to cause direct injury to fish, and will behaviorally affect fish only at close range. Hawkins et al. (2021) discusses the potential effects of vibrations (or particle motion) from anthropogenic equipment and associated sounds can have on substrate and the fish and invertebrates that use benthic habitat. Relatively few studies have been conducted on the effects of vibration on substrate; thus, the authors admit there are limited data to understand how fish and invertebrates may be affected. Sound-detection organs vary greatly among species of fish and invertebrates. Therefore, it is likely that each species has a different sensitivity to these perturbations. Further studies are needed to better assess the behavioral implications when fish and invertebrates are exposed to vibrations from anthropogenic sources (Hawkins et al. 2021).

The species most likely to be affected by substrate vibration are the species that live in, on, or just above the substrate. Marine mammals that feed near the substrate could also detect vibrations. It is unknown if vibrations detected by fish, invertebrates, and potentially marine mammals interfere with biologically important vibrations similar to how anthropogenic sounds interfere with biologically important sounds in the water column for fish (Popper and Hawkins 2019; Popper et al. 2022) and marine mammal vocalizations.

A very small proportion of primary prey species may be temporarily disturbed due to non-acoustic sources of disturbance (e.g., boat wakes, spinning propellers, divers). These forms of disturbance would be temporary, with a geographic extent much smaller than the project action area. The risk of vessels striking prey species may exist, but vessels will be operating at speeds that will allow primary prey to avoid collisions. We expect no entanglement of prey species in project-related gear.

Prey species could be impacted by pollutants or spills. Hilcorp will follow state and federal regulations that minimize the likelihood that prey species would be exposed to pollutants. A large spill such as a well blowout is a potential risk, although it is an extremely rare event (Section 6.2.2.6). Small spills are expected to rapidly disperse due to tide-induced turbulence and mixing. We expect no project-related measurable change in primary prey in terms of prey population levels, distribution, or availability to belugas. Large and very large spills and blowouts are considered a low-probability, but high-impact event for Cook Inlet belugas and their critical habitat, including the effects of oil spill prey. The probability of an oil spill adversely affecting prey species is very small because large and very large oil spills are very rare and small oil spills disperse rapidly and affect only very small areas, thus adverse effects to PBF2 are improbable.

As discussed in Section 6.2.2.6, fish may be affected by sound, substrate vibrations, non-acoustic disturbances, and oil spills, however, any impacts to PBF2 are expected to be minor and undetectable or improbable.

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

As discussed in Section 6.2.1.8, authorized discharges of pollutants are regulated through National Pollution Discharge Elimination System (NPDES) permits which undergo separate ESA section 7 consultations (NMFS 2010b). As discussed in PBF2 above, unauthorized spills could also occur, and while small spills are likely (Section 6.2.1.8), small spills are expected to rapidly disperse due to tide-induced turbulence and mixing. However, a large or very large oil spill or blowout is considered a low probability, high impact event.

Beluga whales are thought to be vulnerable to incremental long-term accumulation of pollutants given their extreme longevity. Chronic exposure to small spills could affect individual whales within their lifetime (BOEM 2016) through accumulation of contaminants, which 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 (Geraci 1990; Geraci and St. Aubin 1990).

A large or very large spill or blowouts would have significant impacts to Cook Inlet beluga critical habitat, and PBF3 in particular. The Cook Inlet Beluga Recovery Plan indicated that a spill in certain areas of Cook Inlet beluga habitat will increase the exposure of the animals and increase the severity of the impact, to the point recovery of the population could be delayed (NMFS 2016).

We expect no toxins to be released into the environment that would be of a quantity harmful to Cook Inlet belugas. The probability of an oil spill adversely affecting prey species is very small. We conclude that any adverse effects to PBF3 are improbable.

PBF 4: Unrestricted passage between the critical habitat areas

PBF4 may be affected by the proposed action. Cook Inlet beluga whales are unlikely to be physically restricted from passing through critical habitat; however, sound and presence of vessels and other infrastructure could cause belugas to avoid certain areas while activities are occurring. Multiple activities that will result in underwater sound will occur in the Upper Inlet within critical habitat including tugs towing the jack-up rig, water jets, drilling, vessel traffic, and handheld underwater power tools with source levels <167 dB re 1 μPa at 1 m. However, in general, during the summer and fall, beluga whales occur in shallow coastal waters (Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b) and Hilcorp's platforms associated with the proposed action are located deeper water. Platforms are surrounded by open water, therefore, belugas will be able to maneuver around noise producing activities and away from project related sound. In more limited or enclosed areas, beluga avoidance of ensonified areas could have the potential to restrict their passage from one critical habitat area to another; however, given the location of the platforms and with the implementation of mitigation measures (e.g., shutdown zones, vessel mitigations, etc.) for these activities, the impact of project sound on beluga passage between critical habitat areas is very unlikely, and thus the adverse effects to PBF4 will be improbable.

Based on the localized nature of small oil spills, the relatively rapid weathering expected for <1,000 billion barrels (bbl) of oil, and the safe guards in place to avoid and minimize oil spills, we conclude that the adverse effects to PBF4 will be very minor. A large oil spill could disrupt access to affected beluga whale critical habitat areas. A large spill (5,100 bbl from a production platform, or a 1,700 bbl from a pipeline), would have limited potential to affect beluga critical habitat due to existing spill response plans, the dispersion/weathering of the spill over hours or days, and the large spatial extent of critical habitat (BOEM 2017). The probability of a large oil spill occurring and thus restricting beluga passage between critical habitat areas is extremely small.

PBF5: Waters with in-water noise below levels resulting in abandonment of critical habitat areas by Cook Inlet Belugas

PBF5 is likely to be affected by the proposed action. The proposed activities that will result in underwater sound will occur in the Upper Inlet within critical habitat including tugs towing the jack-up rig, water jets, drilling, vessel traffic, and handheld underwater power tools with source levels <167 dB re 1 µPa at 1 m. Hilcorp will implement mitigation measures including shutdown zones and vessel mitigation. The Susitna Delta is an important foraging area for Cook Inlet belugas. Project related sound in excess of the 120 dB threshold will not occur between the shoreline and the MLLW line in the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and November 15 (Section 4.3.3). The stressor with the largest acoustic threshold is the tugs towing the jack-up rig, which produces a 120 dB threshold at 3.8 km (Section 6.2.2.3). The Tyonek platform is more than 10 km away from the MLLW near Beluga River (Figure 2). Additionally, Hilcorp will attempt to defer towing the jack-up rig if belugas are within 10 miles of the Susitna Delta (Section 2.1.2). These mitigation measures will reduce the likelihood that increased in-water sound levels will cause Cook Inlet beluga whales to abandon critical habitat. Therefore, we conclude that it is improbable that any project related sound would result in Cook Inlet belugas abandoning critical habitat.

The proposed action may affect critical habitat through noise, disturbance to the seafloor, possible release of pollutants, and effects to prey from the sources, including tugs towing the jack-up rig, drilling operations, well plugging and abandonment, water jets, handheld underwater power tools with source levels <167 dB re 1 µPa at 1 m, support vessels, and support aircraft. Based on our analyses of the evidence available, we determined that all effects to critical habitat will be either insignificant or discountable and the quantity or availability of the essential features of critical habitat are not likely to decline as a result of being exposed to oil and gas activities that are a part of the proposed action. We conclude that the proposed action may affect but is not likely to adversely affect designated critical habitat for Cook Inlet beluga whales.
Status of Listed Species and Critical Habitat Likely to be Adversely Affected by the Action

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

For each species, we present a summary of information on the population structure and distribution of the species to provide a foundation for the exposure analyses that appear later in this opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determinations we make later in this opinion. That is, we rely on a species' status and trend to determine whether an action's effects are likely to increase the species' probability of becoming extinct. For designated critical habitat, we present a summary of the critical habitat designation, the geographical area of the designation, and any physical or biological features essential to the conservation of the species, as well as any relevant threats and management considerations. That is, we rely on the status of critical habitat and its function as a whole to determine whether an action's effects are likely to diminish the value of critical habitat for the conservation of listed species.

4.2.3 Fin Whales

Fin whales are distributed widely in every ocean except the Arctic Ocean (where they have recently begun to appear). In the North Pacific, fin whales are found in summer foraging areas in the Gulf of Alaska, Bering Sea/Aleutian Islands, and as far north as the northern Chukchi Sea (Muto et al. 2018).

Additional information on fin whale biology and habitat is available at:

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

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

Status and Population Structure

The fin whale was listed as an endangered species under the Endangered Species Conservation Act (ESCA) on December 2, 1970 (35 FR 18319), and continued to be listed as endangered following passage of the ESA (39 FR 41367). Critical habitat has not been designated for fin whales. A Final Recovery Plan for the Fin Whale was published on July 30, 2010 (NMFS 2010c).

There are no reliable estimates of current and historical abundances for the entire Northeast Pacific fin whale stock. Several studies provide information on the distribution and occurrence of fin whales in the Northeast Pacific, as well as estimates of abundance in certain areas within the range of the stock, however, many of these are over a decade or more old. Until recently, the best provisional estimate of the fin whale population west and north of the Kenai Peninsula in U.S. waters was 1,368 whales, the greater of the minimum estimates from the 2008 and 2010 surveys (Friday et al. 2013). However, the Gulf of Alaska surveys (Rone et al. 2017) are more recent. The higher of the two abundances computed for fin whales in this region, 3,168 whales (CV = 0.26), better represents a minimum abundance for the Northeast Pacific stock because it is more precise and because it represents a broader survey coverage. Using the best provisional estimate (N) of 3,168 from the 2013 survey and the associated CV(N) of 0.26 results in an NMIN of 2,554 whales. However, this is an underestimate for the entire stock because it is based on surveys which covered only a small portion of the stock's range (Muto et al. 2021).

Distribution

In the U.S. Pacific waters, fin whales are found seasonally in the Gulf of Alaska, Bering Sea, and as far north as the northern Chukchi Sea (Muto et al. 2019). Surveys conducted in coastal waters of the Aleutians and the Alaska Peninsula found fin whales occurred primarily from the Kenai Peninsula to the Shumagin Islands and were abundant near the Semidi Islands and Kodiak Island (Zerbini et al. 2006). An opportunistic survey conducted on the shelf of the Gulf of Alaska found fin whales concentrated west of Kodiak Island in Shelikof Strait, and in the southern Cook Inlet region. In the northeastern Chukchi Sea, visual sightings and acoustic detections have been increasing, which suggests the stock may be re-occupying habitat used prior to large-scale commercial whaling (Muto et al. 2019). Most of these areas are feeding habitat for fin whales. Watkins et al. (2000), and Stafford et al. (2007) documented high rates of calling along the Alaska coast beginning in August/September and lasting through February. Fin whales are regularly observed in the Gulf of Alaska during the summer months, even though calls are seldom detected during this period (Stafford et al. 2007). Instruments moored in the southeast Bering Sea detected calls over the course of a year and found peaks from September to November as well as in February and March (Stafford et al. 2010). Delarue et al. (2013) detected calls in the northeastern Chukchi Sea from instruments moored from July through October from 2007 through 2010.

Fin whales are usually observed as individuals traveling alone, although they are sometimes observed in small groups. Rarely, large groups of 50 to 300 fin whales can travel together during migrations (NMFS 2010c). Fin whales in the Cook Inlet have only been observed as individuals or in small groups. Fin whales are vulnerable to natural and anthropogenic variables. Impacts on prey quality and distribution could affect distribution and energetics. The natural range of fin whales could be expanded due to sea ice melting and expanded available habitat. This could also result in increased exposure to shipping and other commercial activities. Toxicity and resulting deaths, as seen in recent years, from harmful algal blooms producing biotoxins could result from warming waters (Muto et al. 2021).

Presence in Cook Inlet

Fin whales are rarely observed in Cook Inlet and most sightings occur near the entrance of the inlet. During the NMFS aerial surveys in Cook Inlet from 2000 to 2018, 10 sightings of an estimated 26 fin whales in lower Cook Inlet were recorded (Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017; Shelden and Wade 2019). There were eight sightings of 23 fin whales recorded in the 2019 Hilcorp lower Cook Inlet seismic survey in the fall, with group size ranging from one to 15 individuals (Fairweather Science 2020). This higher number of fin whale sightings suggests these offshore waters of lower Cook Inlet may be utilized by fin whales in greater numbers than previously estimated, particularly during the fall period.

Foraging, Prey Selection and Diving Behavior

In the North Pacific, 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 1980). Feeding may occur in shallow waters on prey such as sand lance (Overholtz and Nicolas 1979) and herring (Nøttestad et al. 2002), but most foraging is observed in high-productivity, upwelling, or thermal front marine waters (Panigada et al. 2008).

The percentage of time fin whales spend at the surface varies. Some authors have reported that fin whales make 5 to 20 shallow dives with each of these dives 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 depth and 6.3 min duration for foraging fin whales, while non-foraging dives are 59 m and 4.2 min (Croll et al. 2001). However, Lafortuna et al. (2003) 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.).

Reproduction

Fin whale age to sexual maturity varies by region, and estimates range from 6 to 12 years. Reproductive females give birth about every two years. The gestation period is somewhat less than a year and calves are nursed for 6-7 months. The generation time may be as long as 25.9 years (NMFS 2019).

Hearing, Vocalizations, and Other Sensory Capabilities

Fin whales produce a variety of low-frequency sounds in the 10 Hz to 0.2 kHz range (Watkins 1981; Watkins et al. 1987; Edds 1988; Thompson et al. 1992). While there is no direct data on hearing in low-frequency cetaceans, the applied frequency range is expected to be between 7 Hz and 35 kHz (NMFS 2018e). Estimates based on scans of a fin whale calf skull indicate the range of best hearing for fin whale calves to range from approximately 20 Hz to 10 kHz, with maximum sensitivities between 1 to 2 kHz (Cranford and Krysl 2015).

4.2.4 Western North Pacific DPS and Mexico DPS Humpback Whales

Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the Northern Hemisphere and from tropical to near-ice-edge waters in the Southern Hemisphere.

Additional information on humpback whale biology and natural history is available at:

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

http://alaskafisheries.noaa.gov/pr/humpback

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

Status and Population Structure

In 1970, the humpback whale was listed as endangered worldwide, under the ESCA of 1969 (35 FR 18319; December 2, 1970), primarily due to overharvest by commercial whalers. Congress replaced the ESCA with the ESA in 1973, and humpback whales continued to be listed as endangered, and were considered "depleted" under the MMPA.

Following the cessation of commercial whaling, humpback whale numbers increased. NMFS conducted a global status review (Bettridge et al. 2015) and published a final rule on September 8, 2016 (81 FR 62260) recognizing 14 DPSs. Four of these were designated as endangered and one as threatened, with the remaining nine not warranting ESA listing status.

Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, Wade (2021) concluded that whales feeding in Alaskan waters belong primarily to the Hawaii DPS (recovered), with small numbers from the Western North Pacific DPS (endangered) and Mexico DPS (threatened). Humpback whales in Cook Inlet (which is considered part of the Gulf of Alaska summer feeding area) are comprised of approximately 89 percent Hawaii DPS individuals, 11 percent Mexico DPS individuals, and less that 1 percent Western North Pacific DPS individuals (Table 7).

Approximately 1,084 animals (CV=0.09) comprise the Western North Pacific DPS (Wade 2021) The population trend for the Western North Pacific DPS is unknown. Humpback whales in the Western North Pacific remain rare in some parts of their former range, such as the coastal waters of Korea, and have shown little signs of recovery in those locations. The Mexico DPS is comprised of approximately 2,913 animals (CV=0.07; Wade 2021) with an unknown population trend (81 FR 62260). The Hawaii DPS is comprised of 11,540 animals (CV=0.04). The annual growth rate of the Hawaii DPS is estimated to be between 5.5 and 6.0 percent.

Table 7. Probability of encountering humpback whales from each DPS in the North Pacific Ocean (columns) in various feeding areas (on left). Gray highlighted area includes the action area. Adapted from Wade et al. (2021).

Summer Feeding Areas	North Pacific Distinct Population Segments			
	Western North Pacific DPS (endangered)	Hawaii DPS (not listed)	Mexico DPS (threatened)	Central America DPS (endangered)
Kamchatka	91%	9%	0%	0%
Aleutian Islands; Bering/Chukchi/Beaufort Seas	2%	91%	7%	0%
Gulf of Alaska	<1%	89%	11%	0%
Southeast Alaska / Northern BC	0%	98%	2%	0%
Southern BC / WA	0%	69%	25%	6%
OR/CA	0%	0%	58%	42%

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

Critical habitat was designated for the Western North Pacific and Mexico DPSs on April 21, 2021 (Figure 7; 86 FR 21082). Only one PBF was identified, adequate prey resources. Although humpback whales are generalist predators and prey availability can vary seasonally and spatially, data indicate that their diet is consistently dominated by euphausiid species and small pelagic fishes such as northern anchovy, Pacific herring, Pacific sardine, and capelin (84 FR 54354). Critical habitat for the Western North Pacific DPS or the Mexico DPS occurs in lower Cook Inlet, but not near the action area.

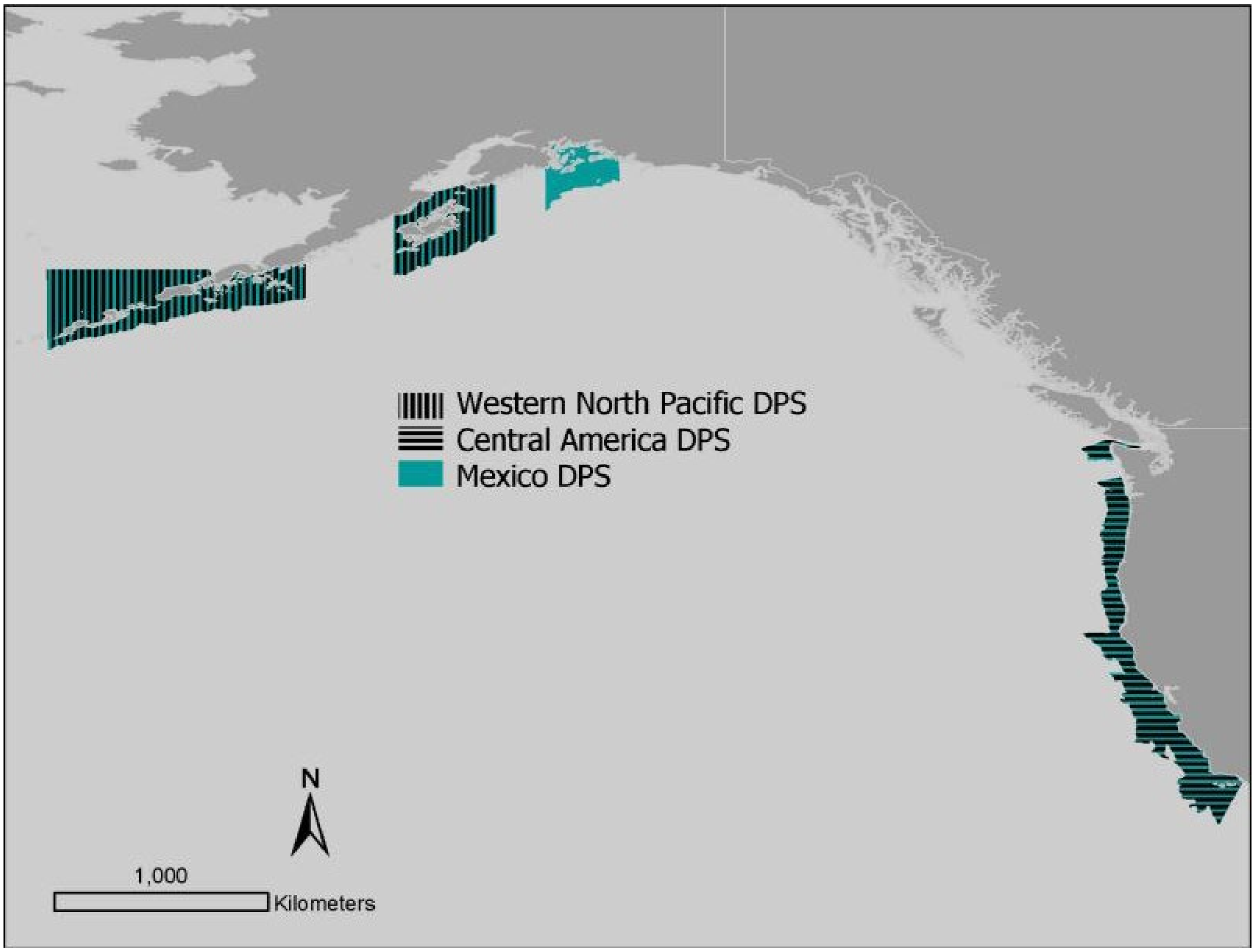

Figure 7. Critical habitat for humpback whales in Alaska and the Pacific Coast of North America.

Distribution

Humpback whales generally undertake seasonal migrations from their tropical calving and breeding grounds in winter to their high-latitude feeding grounds in summer, although some individuals may remain in Alaska waters year-round. Most humpbacks that feed in Alaska winter in temperate or tropical waters near Mexico, Hawaii, or in the western Pacific near Japan. In the spring, those animals migrate back to Alaska, where food is abundant. They tend to concentrate in several areas, including Southeast Alaska, Prince William Sound, Kodiak, the mouth of Cook Inlet, and along the Aleutian Islands (Ferguson et al. 2015).

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 2021).

Presence in Cook Inlet

Humpback whales have been observed throughout Cook Inlet, however, they are primarily seen in lower and mid Cook Inlet. During the NMFS aerial beluga whale surveys between 1993 and 2018, there were 88 sightings of an estimated 192 individual humpback whales (Figure 8), all of which occurred in the lower inlet (Rugh et al. 2000; Rugh et al. 2005; Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017; Shelden and Wade 2019). No humpbacks were observed in 2018. Additionally, during the 2013 marine mammal monitoring program, marine mammal observers reported 29 sightings of 48 humpback whales (Owl Ridge 2014) at Cosmopolitan State well site #A-1 (on the eastern part of lower Cook Inlet, about six miles north of Ninilchik), and during the 2014 Apache seismic surveys in Cook Inlet (south of the action area), marine mammal observers reported six individuals (Lomac-MacNair et al. 2014).

Recent studies and monitoring events have also documented humpback whales further north in Cook Inlet, indicating that humpbacks occasionally use the upper inlet. Marine mammal monitoring conducted north of the Forelands in May and June of 2015 reported two humpback whales (Jacobs Engineering Group 2017). Shortly after these observations were made, a dead humpback was found in the same area, suggesting that this animal may have entered the area in a compromised state. PSOs observed two humpback whales near the mouth of Ship Creek, near Anchorage, in early September 2017 during dock renovation work (ABR 2017). In 2017, a dead humpback whale was seen floating in Knik Arm, finally beaching at Kincaid Park; necropsy results were inconclusive. Recent monitoring by Hilcorp in upper Cook Inlet during the CIPL project also included 3 humpback whale sightings near Ladd Landing, north of the Forelands (Sitkiewicz et al. 2018). In spring 2019, a young humpback whale stranded in Turnagain Arm. It was able to free itself on a high tide but a few days later a humpback whale was found dead in Cook Inlet and it was likely the same animal.

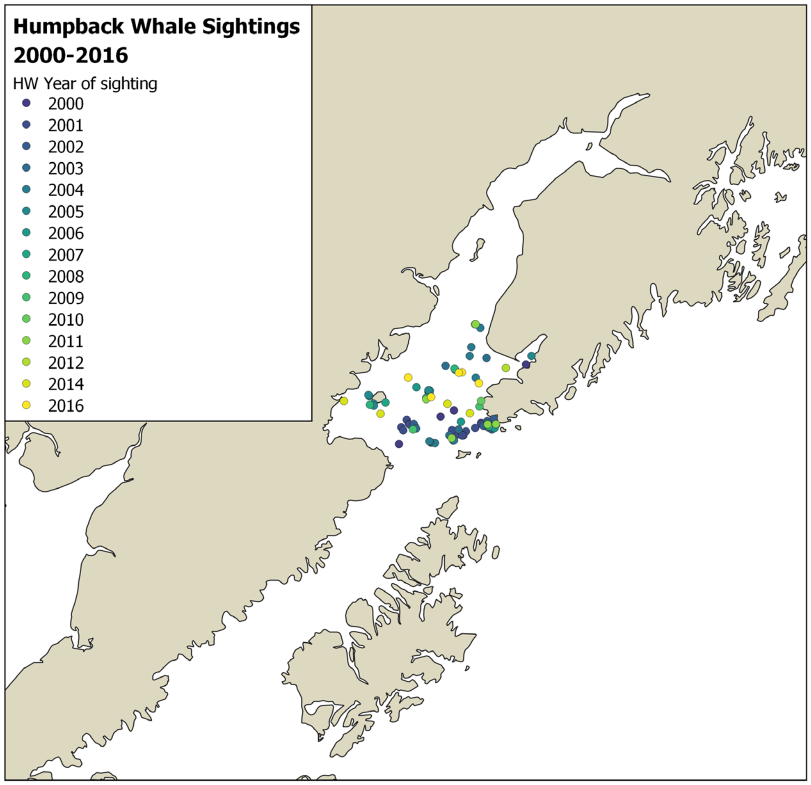

Figure 8. Humpback whale observations during aerial surveys for belugas in Cook Inlet, 2000-2016. (Rugh et al. 2000; Rugh et al. 2005; Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017)

Foraging and Prey Selection

Humpback whales in the North Pacific forage in the coastal and inland waters along California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomilin 1967; Johnson and Wolman 1984). Of the four Biologically Important Areas (BIA) in the Gulf of Alaska described by (Ferguson et al. 2015) that are important feeding areas for humpback whales, Kodiak Island is the closest to the action area.

Their diverse diet is comprised of species including herring (*Clupea pallasii*), mackerel (*Scomber japonicus*), sand lance (*Ammodytes hexapterus*), juvenile walleye pollock (*Theragra chalcogramma*), capelin (*Mallotus villosus*), eulachon (*Thaleichthys pacificus*), Atka mackerel, Pacific cod (*Gadus microcephalus*), saffron cod (*Eleginus gracilis*), Arctic cod (*Boreogadus saida*), juvenile salmon (*Oncorhynchus* spp.), and rockfish (*Sebastes* spp.) (Hain et al. 1982; Baker 1985; Geraci et al. 1989).

Humpback whales exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively (Clapham 1993). Humpback whales are 'gulp' or 'lunge' feeders, capturing large mouthfuls of prey during feeding rather than continuously filtering food, as may be observed in some other large baleen whales (Goldbogen et al. 2008; Simon et al. 2012). When lunge feeding, whales advance on prey with their mouths wide open, then close their mouths around the prey and trap them by forcing engulfed water out past the baleen plates.

Reproduction

Sexual maturity of humpback whales in the Northern Hemisphere occurs at approximately 5-11 years of age, and appears to vary both within and among populations (Clapham 1992; Gabriele et al. 2007; Robbins 2007). Average age of sexual maturity in the Southern Hemisphere is estimated to be 9-11 years. In the Northern Hemisphere, calving intervals are between one and five years, though 2-3 years appears to be most common (Wiley and Clapham 1993; Steiger and Calambokidis 2000). Estimated mean calving rates are between 0.38 and 0.50 calves per mature female per year (Clapham and Mayo 1990; Straley et al. 1994; Steiger and Calambokidis 2000) and reproduction is annually variable (Robbins 2007).

Humpback whale gestation is 11-12 months and calves are born in tropical waters (Matthews 1937). Lactation lasts from 10.5-11 months (Chittleborough 1965). Weaning begins to occur at about age six months and calves attain maternal independence around the end of their first year (Clapham and Mayo 1990). Humpback whales exhibit maternally directed fidelity to specific feeding regions (Martin et al. 1984; Baker et al. 1990)

Hearing, Vocalization, and Other Sensory Capabilities

Because of the lack of captive subjects and logistical challenges of bringing experimental subjects into the laboratory, no direct measurements of mysticete hearing are available. Consequently, hearing in mysticetes is estimated based on other means such as vocalizations (Wartzok and Ketten 1999), anatomy (Ketten 1997; Houser et al. 2001), behavioral responses to sound (Edds-Walton 1997), and nominal natural background sound conditions in their likely frequency ranges of hearing (Clark and Ellison 2004). The combined information from these and other sources strongly suggests that mysticetes are likely most sensitive to sound from an estimated tens of hertz (Hz) to ~10 kHz (Southall et al. 2007). However, evidence suggests that humpbacks can hear sounds as low as 7 Hz up to 24 kHz, and possibly as high as 30 kHz (Ketten 1997; Au et al. 2006). These values fall within the NMFS (NMFS 2018e) generalized low-frequency cetacean hearing range of 7 to 35 kHz.

Because of their size, no audiogram has been produced for humpback whales. However, Helweg et al. (2000) and Houser et al. (2001) modeled a predicted audiogram based on the relative length of the basilar membrane (within the inner ear) of a humpback whale, integrated with known data on cats and humans. The result shows sensitivity to frequencies from about 700 Hz to 10 kHz, with maximum relative sensitivity between 2 to 7 kHz. Because ambient noise levels are higher at low frequencies than at mid frequencies, the absolute sound levels that humpback whales can detect below 1 kHz are probably limited by increasing levels of natural ambient noise at decreasing frequencies (Clark and Ellison 2004).

4.2.5 Cook Inlet DPS Beluga Whale

Status and Population Structure

Beluga whales inhabiting Cook Inlet are one of five distinct stocks found in Alaska (Muto et al. 2020). The best historical abundance estimate of the Cook Inlet beluga population was from a survey in 1979, which estimated a total population of 1,293 belugas (Calkins 1989). NMFS began conducting comprehensive, systematic aerial surveys of the Cook Inlet beluga population in 1993. These surveys documented a decline in abundance from 653 belugas in 1994 to 347 belugas in 1998. In response to this nearly 50 percent decline, NMFS designated the Cook Inlet beluga population as depleted under the Marine Mammal Protection Act in 2000 (65 FR 34590; May 31, 2000). The lack of population growth since that time led NMFS to list the Cook Inlet beluga as endangered under the ESA on October 22, 2008 (73 FR 62919).

The best current population estimate is 279 animals and derives from the 2018 Cook Inlet beluga whale aerial survey data (95 percent probability interval of 250 to 317; Shelden and Wade 2019). A comparison of the population estimates over time is presented in Figure 9. Over the most recent 10-year time period (2008-2018), the estimated trend in abundance is approximately -2.3 (-4.1-0.6) percent/year (Figure 9; Shelden and Wade 2019). This is a steeper decline than the previously estimated decline of -0.5 percent/year (Shelden et al. 2017). The methods presented in Shelden and Wade (2019) were developed by incorporating additional data and an improved methodology for analyzing the results of aerial population surveys. NMFS used a new group size estimation method (Boyd et al. 2019) and new criteria to determine whether certain data from aerial surveys could be used reliably. Shelden and Wade (2019) report abundance estimates dating back to 2004 that have been adjusted using the new methodology.

Based on an analysis of stranding deaths from 2005 to 2017 (95 individuals), McGuire et al. (2021) suggest a minimum mean annual mortality estimate of 2.2 percent (SE = 0.36 percent) calculated from the ratio of reported dead Cook Inlet beluga whales to aerial survey-based estimates of population size. This is a minimum estimate because reported dead Cook Inlet beluga whales are a subset of the total number that died because of the challenges in discovering stranded animals in Cook Inlet. Cook Inlet has over 2,400 km of shoreline (Zimmermann and Prescott 2014) and a tiny fraction of that coastline is bordered by roads, the railroad, recreational areas with coastal access for hiking, biking, or off-road vehicles or is regularly traversed by established flight paths or vessel routes where someone could spot and report a stranded animal. In addition, nearly all (96 percent) dead belugas were reported between April and October (only 4 from November through March) when visibility and access are better. It is reasonable to assume that some belugas die in the winter months and are never seen. Consequently, it is very likely that more belugas die than are found dead. McGuire et al. (2021) suggest the mean number of reported Cook Inlet beluga whale carcasses represents less than one third of the total number of dead belugas each year.

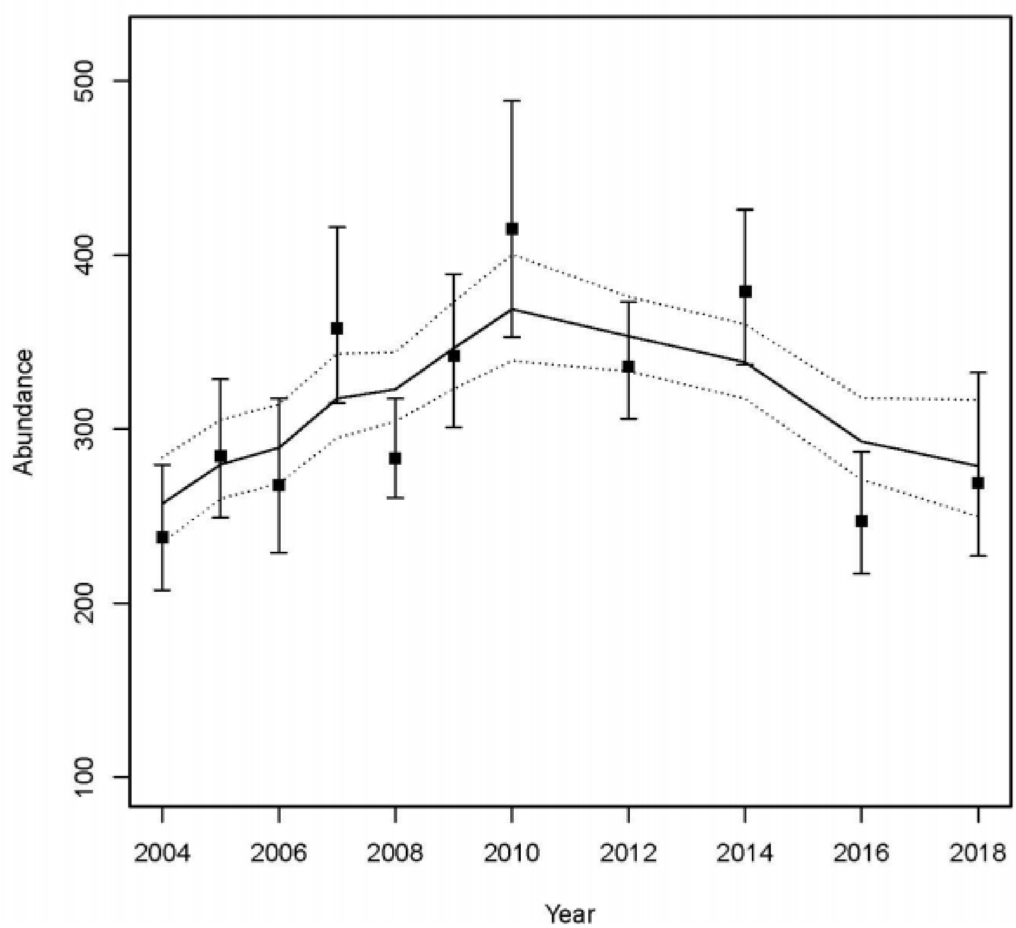

Figure 9. Cook Inlet beluga whale annual abundance estimates (squares), the moving average (solid line), and 95 percent probability intervals (dotted lines) (Shelden and Wade 2019).

Reported mortality was greatest for adults of reproductive age, followed by calves, with fewer subadults and no adults older than 49 years in the stranding data set. McGuire et al. (2021) note that this is an unusual result and that if the Cook Inlet beluga whale population was similar to other healthy mammal populations, higher mortality of the very old and the very young compared to other age groups would be expected. The results from McGuire et al. (2021) are consistent with Vos et al. (2019), suggesting that adult Cook Inlet beluga whales are dying (of as-yet unknown causes) at relatively younger but still reproductive ages, with few surviving to reach their potential lifespan of seventy plus years as reported in other beluga populations.

The Cook Inlet Beluga Recovery Plan (NMFS 2016) examined potential obstacles to the recovery of Cook Inlet belugas. Climate change, while considered a potential threat to beluga recovery, is not addressed as a separate threat in the recovery plan, but rather is discussed with respect to how it may affect each of the listed threats.

The Cook Inlet, Alaska regional warming is part of a larger Arctic-wide warming trend that is projected to increase over time (IPCC 2021). Alterations in habitat use by belugas, triggered by climatic changes, as well as direct impacts of climate change to prey populations, could change the availability and nutritional quality of prey, potentially leading to nutritional stress and diminished reproduction. Additionally, changing water temperature and currents could impact the timing of environmental cues important for navigation and the location of important habitat for the DPS. Climate change has the potential to affect the frequency of catastrophic events (e.g., intense storms, disease outbreaks), which could result in habitat degradation or loss, and in illness, injury or death of individuals. Skovrind et al. (2021) compared beluga genomes from populations throughout the Arctic with habitat models, and found a past association between climate, genetics, population size, and available habitat. The authors concluded that, across all beluga populations, habitat loss from climate change is expected to be more substantial in the southern part of the current range; however, local populations will not be impacted similarly and a population-specific approach that accounts for variables such as site fidelity, spatial flexibility in prey availability, and anthropogenic activities is key to understanding how climate change may impact individual populations such as Cook Inlet belugas (Skovrind et al. 2021). Continued research is needed to provide quantitative data on possible changes that could occur as a result of climate change, and what impacts, if any, would occur to the Cook Inlet beluga whale population and to their prey.

The Recovery Plan discusses the fact that there are inherent risks associated with small populations, such as loss of genetic or behavioral diversity. Small populations are more susceptible to disease, inbreeding, predator pits, or catastrophic events than large populations. The Recovery Plan addresses ten principal threats to the Cook Inlet beluga population and considers how they may be exacerbated by the inherent risks due to small population size. Based on a population viability analysis (PVA), NMFS determined that the Allee effect is not a relevant concern for the Cook Inlet beluga whale unless the population falls to less than 50 individuals and that inbreeding depression and loss of genetic diversity do not pose a significant risk unless the population is reduced to fewer than 200 individuals (Hobbs 2006). To date, no new data have become available that suggest this assessment should be revisited.

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

Presence in Cook Inlet

Cook Inlet beluga whales are geographically and genetically isolated from other beluga whale stocks in Alaska (Figure 10; Muto et al. 2021). Their distribution overlaps with the action area. Although they remain year-round in Cook Inlet, they demonstrate seasonal movements within the inlet. In general, during the summer and fall, beluga whales occur in shallow coastal waters and are concentrated near the Susitna River Delta, Knik Arm, Turnagain Arm, and Chickaloon Bay, Fire Island in the upper inlet (Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b), and the Kenai River Delta in the lower Inlet (McGuire et al. 2020b). During the winter, they are more dispersed, occurring 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. While ice formation in the upper inlet was once thought to restrict beluga's access to nearshore habitat (Ezer et al. 2013), tagging data, acoustic studies, and opportunistic sightings indicate that Cook Inlet belugas continue to occur in the upper inlet throughout the winter months, in particular the coastal areas from Trading Bay to Little Susitna River, with foraging behavior detected in lower Knik Arm and Chickaloon Bay, and also detected in several areas of the lower inlet such as the Kenai River, Tuxedni Bay, Big River, and NW Kalgin Island (C. Garner, pers. comm.; Castellote et al. 2011; Shelden et al. 2015b; Shelden et al. 2018; Castellote et al. 2020; Castellote et al. 2021).

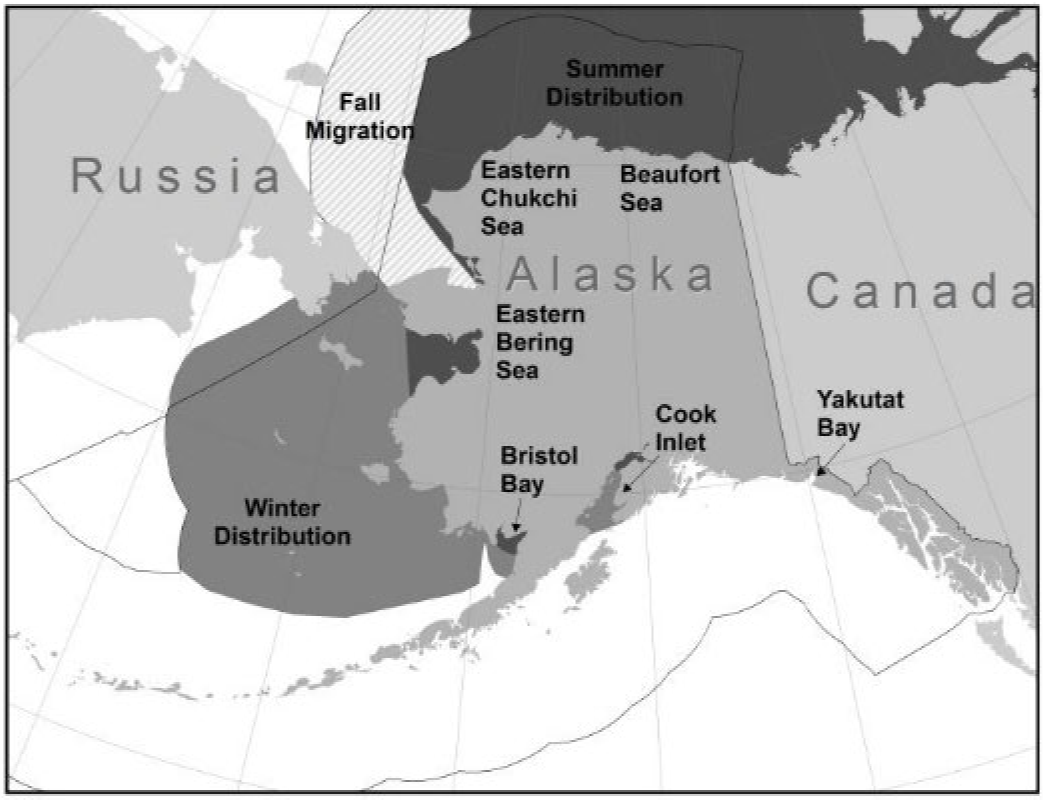

Figure 10. Approximate distribution of all five beluga whale stocks. The Cook Inlet beluga whale stock occupies the entire inlet and shows relatively small seasonal shifts in distribution. Summering areas are dark gray and wintering areas are lighter gray (from Muto et al. 2021)

Information on Cook Inlet beluga distribution, including aerial surveys and acoustic monitoring, indicates that the species' range in Cook Inlet has contracted markedly since the 1990s ((Figure 11; Shelden and Wade 2019). This distributional shift and range contraction coincided with the decline in abundance (Moore et al. 2000; NMFS 2008a; Goetz et al. 2012).

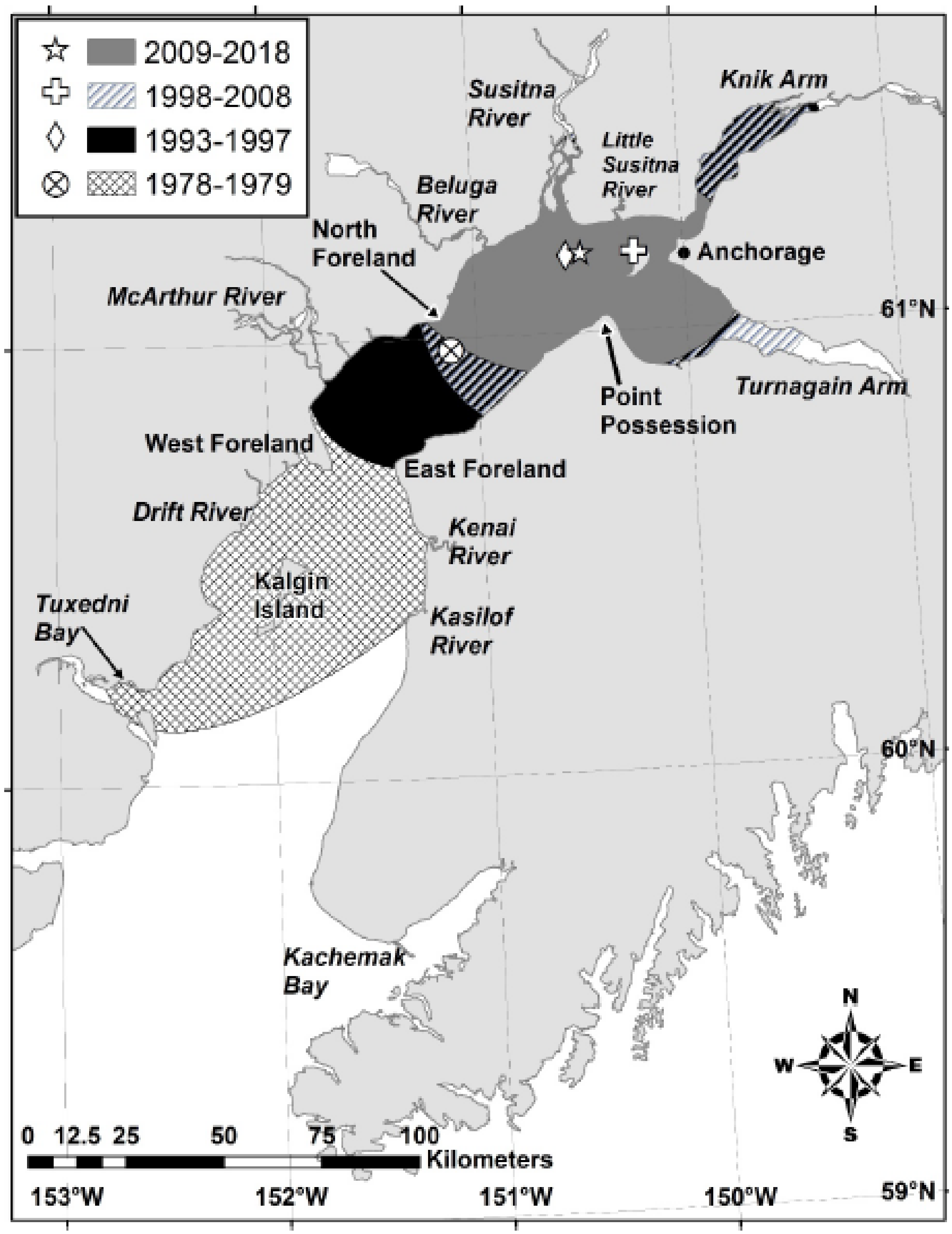

Figure 11. Summer range contraction over time as indicated by ADFG and NMFS aerial surveys. Adapted from Shelden and Wade (2019). The 95 percent core summer distribution contracted from 7,226 sq. km in 1978–79 to 2,110 sq. km in 2009–18 (29 percent of the 1978–79 range).

Beginning in 1993, aerial surveys have been conducted annually or biennially in June and August by NMFS Marine Mammal Laboratory (NMFS 2008a; Hobbs et al. 2012). Historic aerial surveys for beluga whales also were completed in the late 1970s and early 1980s (Harrison and Hall 1978; Murray and Fay 1979). 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 2008a; Rugh et al. 2010). While the surveys in the 1970s showed whales dispersing into the lower inlet by mid-summer, almost the entire population is now found only in northern Cook Inlet from late spring into the fall.

The Susitna Delta, in upper Cook Inlet, is a very important area for Cook Inlet beluga whales, particularly in the summer-fall months (Shelden et al. 2015b; Castellote et al. 2020; McGuire et al. 2020b). Groups of 200 to 300 individuals – almost the entire population – including adults, juveniles, and neonates, have been observed in the Susitna Delta area (McGuire et al. 2014; McGuire et al. 2020b). NMFS refers to this preferred summer-fall habitat near the Susitna Delta 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.

While belugas are concentrated primarily in the upper inlet during the summer and fall months, the area around the East Forelands between Nikiski, Kenai, and Kalgin Island appears to provide important habitat in winter, early spring, and fall. Aerial surveys funded by the Bureau of Ocean Energy Management (BOEM) and conducted in early spring and late autumn 2018-2021 have provided additional information on beluga distribution outside of the summer months (V.A. Gill, pers. comm.). Groups were still present in the upper inlet during early spring and late autumn but belugas were also observed in the Kenai and Kasilof rivers, Tuxedni Bay, and near Kalgin Island in the lower inlet.

Belugas were historically seen in and around the Kenai and Kasilof rivers during June aerial surveys conducted by ADFG in the late 1970s and early 1980s and by NMFS starting in 1993 (Shelden et al. 2015b), and throughout the summer by other researchers and local observers. In recent years sightings in and near these rivers have been more typical in the spring and fall (Ovitz 2019; Castellote et al. 2020). It is unknown if this is due to increased monitoring efforts in the area or an increase in belugas using this area. While visual sightings indicate peaks in spring and fall, acoustic detections indicate that belugas can also be present in the Kenai River throughout the winter (Figure 12;Castellote et al. 2016a; Castellote et al. 2020). Despite the historic sightings (1970s – 1990s) of belugas throughout the summer (June through August) in the area, recent acoustic detections and visual sightings indicate that there appears to be a steep decline in beluga presence in the Kenai river during the summer, regardless of an annual return of 1–1.8 million[7] sockeye salmon in recent years, which are important beluga prey.

[7]https://www.adfg.alaska.gov/sf/FishCounts/index.cfm?ADFG=main.displayResults&COUNTLOCATIONID=40&SpeciesID=420

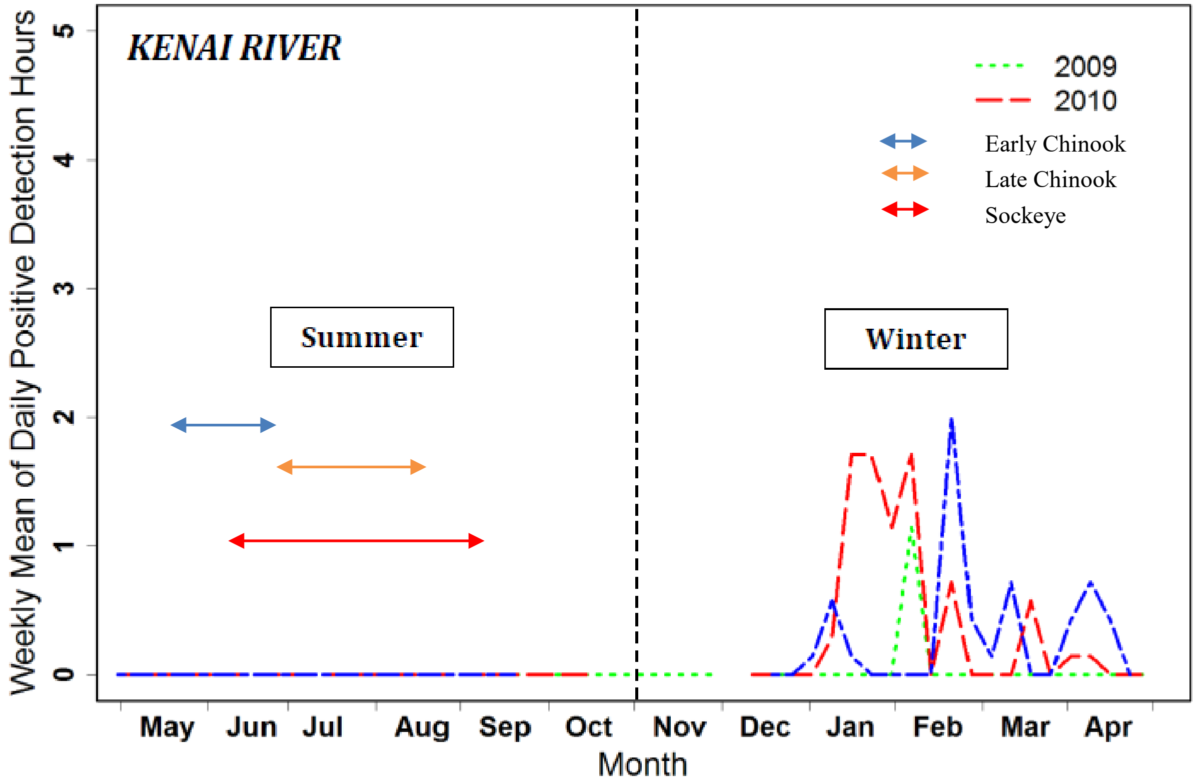

Figure 12. Acoustic detections of Cook Inlet beluga whales in the Kenai River from 2009 through 2011 compared to Chinook and Sockeye run timing. From Castellote et al. (2016) and fish run timing data at http://www.adfg.alaska.gov/sf/FishCounts/index.cfm?adfg=main.home (accessed August 3, 2017).

Belugas may be present in Tuxedni Bay throughout the year, with peaks in January and especially in March (Figure 13; Shelden et al. 2015b; Castellote et al. 2016b)). Belugas were seen in March 2018 and 2019, September 2019, and April 2021 in Tuxedni Bay during NMFS winter distribution aerial survey s (NMFS unpublished data).

From December 2015 through January 2016, Tyonek Platform personnel observed 200 to 300 Cook Inlet beluga whales, including calves, regularly. They appeared to be drifting by the platform on the afternoon tides, in the open water areas between ice sheets. One operator, working in Cook Inlet for 30 years, stated that he'd never seen them in the winter before the 2015 to 2016 season (S. Callaway, pers. comm. 01/19/2016). Hilcorp recently reported 143 sightings of beluga whales from May-August while conducting pipeline work in upper Cook Inlet (Sitkiewicz et al. 2018).

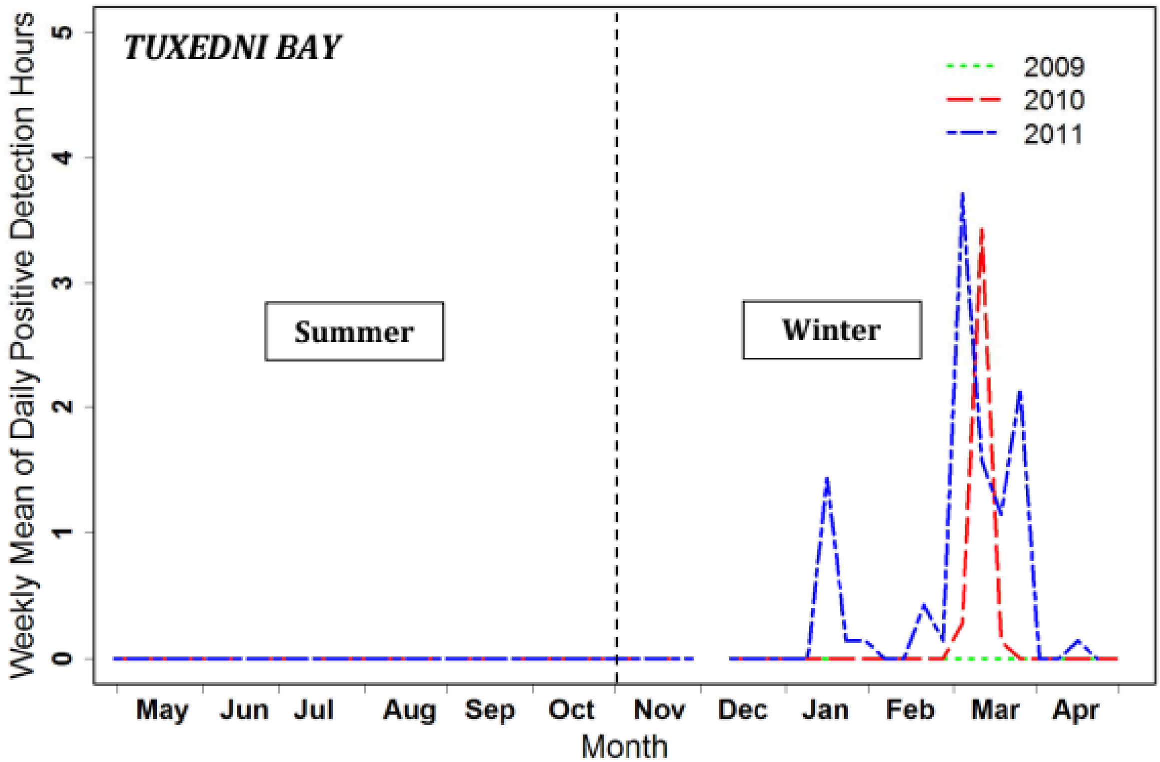

Figure 13. Detections of belugas in Tuxedni Bay using acoustic monitors from 2009-2011. (Figure 4G from Castellote et al 2015).

Goetz et al. (2012) developed a habitat-based model to identify Cook Inlet beluga whale densities throughout Cook Inlet (Figure 14). The Goetz et al. (2012) model was based on sightings (prior to 2012), depth soundings, coastal substrate type, environmental sensitivity index, anthropogenic disturbance, and anadromous fish streams to predict densities throughout Cook Inlet. The result of this work is a beluga density map of Cook Inlet, which predicts spatially explicit density estimates for Cook Inlet belugas. Figure 14 shows the Goetz et al. (2012) density estimates and some of the action area. Using data from the GIS files provided by NMFS and the different project locations, the resulting estimated density is shown in Table 8.

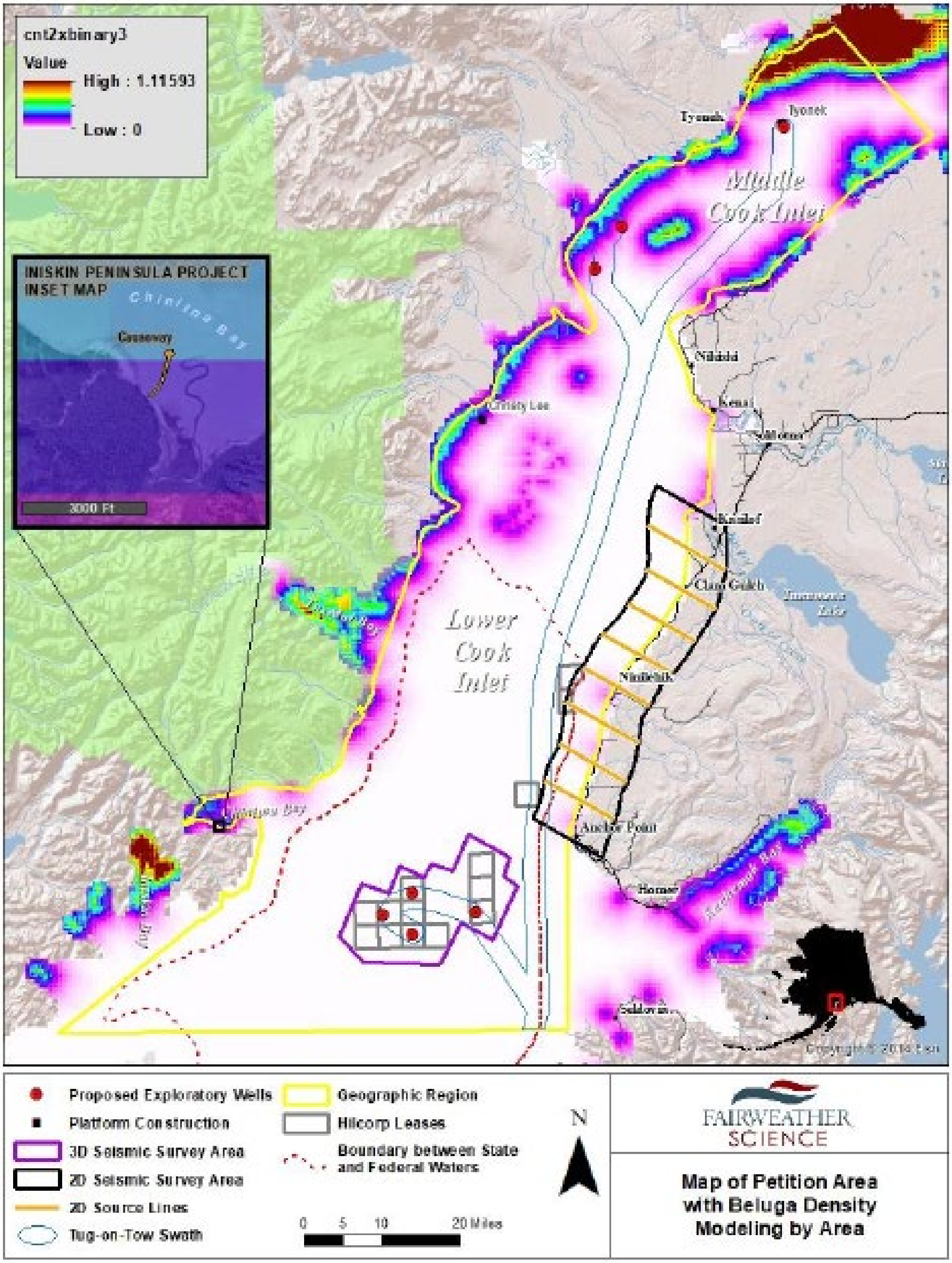

Figure 14. Beluga whale density as defined by Goetz et al. (2012) in middle and lower Cook Inlet (from Hilcorp 2018).

Table 8. Comparison of Cook Inlet beluga whale density based on the Goetz et al. (2012) habitat model and MML aerial surveys in relation to project activities part of the proposed action.

Cook Inlet Area	MML Density (indiv/km^2)	Goetz Density (indiv/km^2)
Lower Cook Inlet	0.000023	0.011106
Middle Cook Inlet	0.001110	0.001664
Trading Bay	Not available	0.015053

Behavior and Group Size

Beluga whales are extremely social and often interact in close, dense groups. McGuire and Stephens (2017) observed increasing maximum group size of Cook Inlet beluga whales since 2012, and as mentioned above, groups of 200 or more individuals (maximum group size of 313 whales – almost the entire population at that time) have been seen in the Susitna River Delta area. Mean group sizes during the summer and fall were largest in July (57) and smallest in October (13.9), with the largest groups seen during mid-July and early August in the Susitna River Delta, while the smallest group sizes were in the Kenai River Delta. These patterns of high seasonal concentrations have continued to be documented since 2012 (McGuire et al. 2020b).

Reproduction

The age of reproductive maturity in Cook Inlet belugas is being actively investigated. Shelden et al. (2020a) examined 28 sexually mature female Cook Inlet belugas, which died by harvest or stranding, and ranged from 14-47 years old. Reproductive senescence, which is the transition to menopause (Ellis et al. 2018), was not evident, possibly because few females were older than 40 year old and declines in ovarian corpora counts and pregnancy rates in other beluga populations suggest senescence begins between 40-50 years old (Burns and Seaman 1986; Suydam 2009; Ferguson et al. 2020). Pregnant Cook Inlet belugas ranged in age from 14 to 41 years old. The uterus of a 10-year-old examined during necropsy was small and thick-walled, suggesting immaturity, though ovaries were not examined. Photo-identification records of a 14-year-old female show close association with a calf at ages 10 and 13 (McGuire et al. 2020a; Shelden et al. 2020a). It was not possible to conclusively determine the earliest age at first reproduction for Cook Inlet belugas because there have been few females younger than 10 years old sampled (Shelden et al. 2020a). However, the age of maturity in other beluga populations is approximately 8 years (Hobbs et al. 2015).

Two of the three documented observations of a Cook Inlet beluga whale birth occurred during July (2015, 2016) in the Susitna River Delta (McGuire et al. 2020a)[8], which corroborates the importance of the Susitna River Delta as a Cook Inlet beluga whale calving ground (McGuire and Stephens 2017; Shelden and Wade 2019; McGuire et al. 2020a). Shelden and Wade (2019) predicted birth dates of stranded neonates, fetuses, and calves of the year and suggested that calving could occur through the entire ice-free period from April through November. Neonates have been photographed in Cook Inlet as early as mid-July and as late as October, during a field season that generally runs May through October. Recent comparisons of body measurements

[8] The third documented birth was occurred on September 13, 2016, in Turnagain Arm (McGuire et al. 2020).

from living fetuses in pregnant belugas in aquaria to measurements from deceased Cook Inlet fetuses and newborns suggests that most Cook Inlet whales are conceived in March-May and are born in July-October (Shelden et al. 2020b). These periods match when most aquaria females were ovulating and conceiving (Robeck et al. 2005), when researchers observe newborns in Cook Inlet during photo-identification surveys (McGuire et al. 2020b) and when probably mating behavior has been photo-documented in Cook Inlet (April and May in Trading Bay) (Lomac-MacNair et al. 2016). Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Colbeck et al. 2013). Cook Inlet beluga calves up to 8 years of age have been photographed alongside their mothers although most are 1–4 years old (McGuire et al. 2020a).

Feeding and Prey Selection

Cook Inlet beluga whales have diverse diets (Quakenbush et al. 2015; Nelson et al. 2018), foraging on fish and benthos, often at river mouths. Primary prey species consist of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole. Belugas seasonally shift their distribution within Cook Inlet in relation to the timing of fish runs and seasonal changes in ice and currents (NMFS 2016). Passive acoustic monitoring has been used to detect locations and timing of beluga foraging. Year-round passive acoustic monitors have been placed throughout Cook Inlet to detect beluga presence and foraging. These locations included Eagle Bay, Fish Creek, Six Mile Creek (Knik Arm), Cairn Point, Ship Creek, Point Woronzof, Little Susitna River, Susitna Delta, Beluga River, Chuitna River, Trading Bay, Point Possession, Bird Point, Six Mile Creek (Turnagain Arm), and Fire Island in the upper inlet; as well as Tuxedni Bay, Kalgin Island, Big River, Kenai River, Kasilof River, Chinitna Bay, Iniskin Bay, Port Graham, Homer Spit, and offshore in the lower inlet (Castellote et al. 2020, unpublished data). Increased foraging activity coincided with anadromous fish runs from spring to fall. Recent (2018) data show intense foraging continues to occur at the Susitna Delta area (near the Beluga River and Little Susitna areas sampled in 2008-2013), with peaks in beluga foraging off the Susitna Delta in May, likely on smelt during the spawning run, and foraging June-September, likely on salmon during Chinook, pink, and coho salmon runs.

Acoustic studies of feeding activity in winter suggest that large prey aggregations may be absent, belugas are feeding in unmonitored waters, or are feeding on benthic prey. According to data from acoustic recorders deployed during 2008-2013, the most active foraging occurred at Little Susitna River, in the upper inlet, in May, July, and August, at Beluga River in June, and at Eagle Bay in September (Castellote et al. 2020). Active foraging has also identified in April at Beluga River and December at Trading Bay (Castellote et al. 2020). Other winter foraging areas in the upper inlet detected by the acoustic recorders include lower Knik Arm and Eagle Bay. Of the locations monitored in the lower inlet (Tuxedni Bay, Kenai River, and Homer Spit), the only area where winter foraging terminal buzzes were detected by acoustic recorders was Tuxedni Bay (Castellote et al. 2020).

The seasonal availability of energy-rich prey such as eulachon and salmon is very important to the energetics of belugas (Abookire and Piatt 2005; Litzow et al. 2006). Eating fatty prey and building up fat reserves throughout spring and summer may allow beluga whales to sustain themselves during periods of reduced prey availability in winter or through times of stress when metabolic needs are higher (NMFS 2007). Saupe et al. (2014) found that the biomass and individual sizes of benthic fauna available to beluga whales were low in Cook Inlet in the winter. They concluded based on the small body sizes and apparent low density of benthic fauna that belugas may not be acquiring a maintenance ration during winter, consistent with previous observations that belugas in the spring have much lower fat reserves than after feeding on abundant eulachon and salmon in the spring and summer (NMFS 2007; Saupe et al. 2014).

Hearing, Vocalizations, and Other Sensory Capabilities

Like other odontocetes, 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 (well within the human hearing range) (Garland et al. 2015), and the variety of audible whistles, squeals, clucks, mews, chirps, trills, and bell-like tones they produce have led to their nickname of "canaries of the sea" (Castellote et al. 2014). Belugas and other odontocetes make sounds across some of the widest frequency bands that have been measured in any animal group.

At the higher frequency 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. Beluga whales are one of five non-human mammal species for which there is convincing evidence of frequency modulated vocal learning (Payne and Payne 1985; Tyack 1999; Stoeger et al. 2012).

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. Multiple studies have examined hearing sensitivity of belugas in captivity (Awbrey et al. 1988; Johnson et al. 1989; Klishin et al. 2000; Ridgway et al. 2001; Finneran et al. 2002a; Finneran et al. 2002b; Finneran et al. 2005; Mooney et al. 2008), however, the results are difficult to compare across studies due to varying research designs, complicating factors such as ototoxic antibiotics (e.g., Finneran et al. 2005), and small sample sizes (Ridgway et al. 2001). In the first report of hearing ranges of belugas in the wild, Castellote et al. (2014) reported a wide range of sensitive hearing from 20-110 kHz, with minimum detection levels around 50 dB. In general, these results were similar to the ranges reported in the captive studies, however, the levels and frequency range indicate that the belugas in the Castellote et al. (2014) study have sensitive hearing when compared to previous beluga studies and other odontocetes (Houser and Finneran 2006; Houser et al. 2018). More recently, Mooney et al. (2020) used auditory evoked potentials to measure the hearing of a wild, stranded Cook Inlet beluga whale (now in captivity) as part of its rehabilitation assessment. This has been the first time hearing has been measured in a wild individual from the Cook Inlet population. The beluga showed broadband (4–128 kHz) and sensitive hearing (<80 dB) for a wide-range of frequencies (16–80 kHz), reflective of a healthy odontocete auditory system. Hearing was similar to healthy, wild adult belugas from the Bristol Bay stock measured during health assessments (Castellote et al. 2014; Mooney et al. 2018).

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 sound levels (Au et al. 1985).

Mooney et al. (2020) compared their hearing data with measurements of pile driving and container ship noise in Cook Inlet, two sounds sources of concern, and determined that masking is likely at frequencies belugas use for communication and navigation.

4.2.6 Western DPS Steller sea lion

Status and Population Structure

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; May 5, 1997). At that time, the eastern DPS (which includes animals from east of Cape Suckling, Alaska, at 144°W longitude) was listed as threatened and the Western DPS (which includes animals from west of Cape Suckling, at 144°W longitude) was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66140). Information on Steller sea lion biology, threats, and habitat (including critical habitat) is available in the revised Steller Sea Lion Recovery Plan (NMFS 2008b) and 5-year Status Review (NMFS 2020a).

As summarized most recently by Muto et al. (2020), the Western DPS of Steller sea lions decreased from an estimated 220,000 to 265,000 animals in the late 1970s to fewer than 50,000 in 2000. Factors that may have contributed to this decline include incidental take in fisheries, competition with fisheries for sea lion prey, legal and illegal shooting, predation, exposure to contaminants, disease, and ocean regime shift climate change (NMFS 2008b). The most recent comprehensive aerial photographic and land-based surveys of Western DPS Steller sea lions in Alaska (Fritz et al. 2016; Sweeney et al. 2018) estimated a total Alaska population (both pups and non-pups) of 52,932 (Muto et al. 2020). There are strong regional differences in trends in abundance of Western DPS Steller sea lions, with mostly positive trends in the Gulf of Alaska and eastern Bering Sea east of Samalga Pass (~170°W longitude) and generally negative trends to the west in the Aleutian Islands.

The population trends in the Gulf of Alaska were observed to be increasing until 2015 (Sweeney et al. 2018); however, in 2017, NMFS surveys observed anomalously low pup counts in these areas (Sweeney et al. 2018), which may be related to low availability of prey associated with warm ocean temperatures in the Gulf of Alaska during 2014-2016. The 2020 Pacific cod stock assessment indicated a continued low biomass level, and NMFS closed the Gulf of Alaska Pacific cod directed fishery for the 2020 season (50 CFR 679.20(d)(4)).

Distribution

Steller sea lions range along the North Pacific rim from northern Japan to California, with centers of abundance in the Gulf of Alaska and Aleutian Islands (Figure 15; Loughlin et al. 1984). Although Steller sea lions seasonally inhabit coastal waters of Japan in the winter, breeding rookeries outside of the U.S. are located only in Russia (Burkanov and Loughlin 2005). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late-May to early-July; Jemison et al. 2013; Muto et al. 2020).

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

Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (Pitcher and Calkins 1981; Gisiner 1985), and exhibit high site fidelity (Sandegren 1970). During the breeding season some juveniles and non-breeding adults occur at or near the rookeries, but most are on haulouts (Rice 1998; Ban 2005; Call and Loughlin 2005).

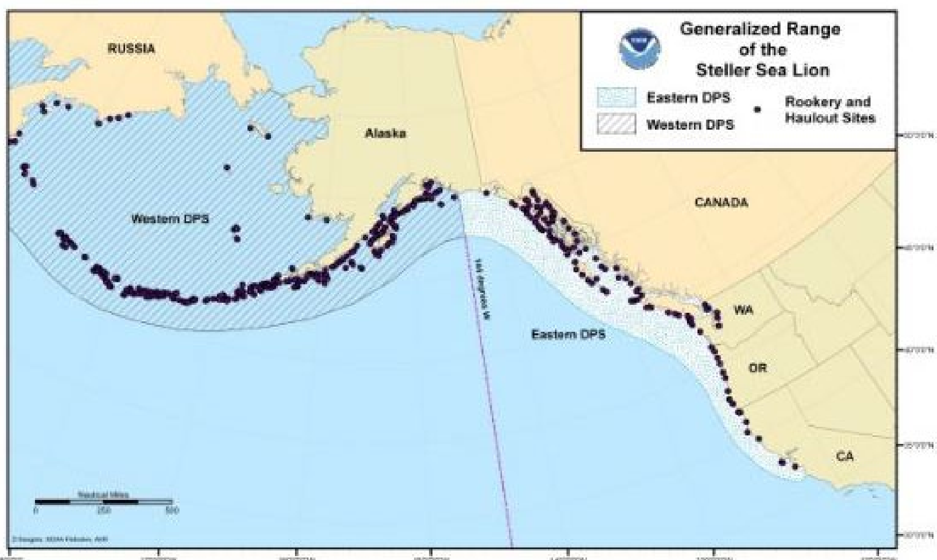

Figure 15. Generalized ranges of Western DPS and Eastern DPS Steller sea lions.

Presence in Cook Inlet

About 3,600 sea lions use terrestrial sites in the lower Cook Inlet area (Sweeney et al. 2017), with additional individuals venturing into the area to forage. However, important terrestrial sites (including rookeries and haulouts) have not been identified near the action area in the mid-inlet (Figure 16). There is no designated critical habitat for Steller sea lions in the mid- or upper inlet (Figure 17).

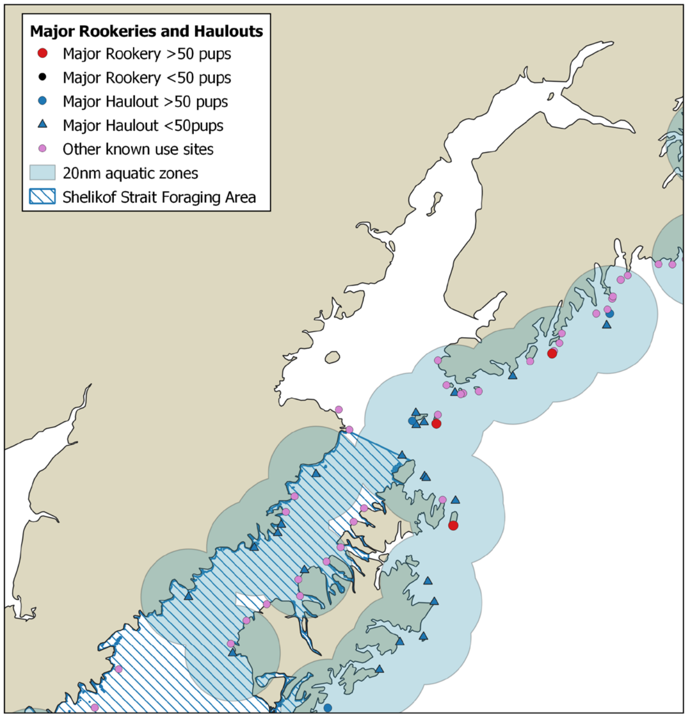

Figure 16. Steller sea lion sites in and near Cook Inlet. Designated critical habitat in this region includes the major rookeries, major haulouts, adjacent land and air zones within 3000 ft of the major rookeries and haulouts, 20nm aquatic zones around major rookeries and haulouts, and the Shelikof Strait aquatic foraging area (50 CFR § 226.202).

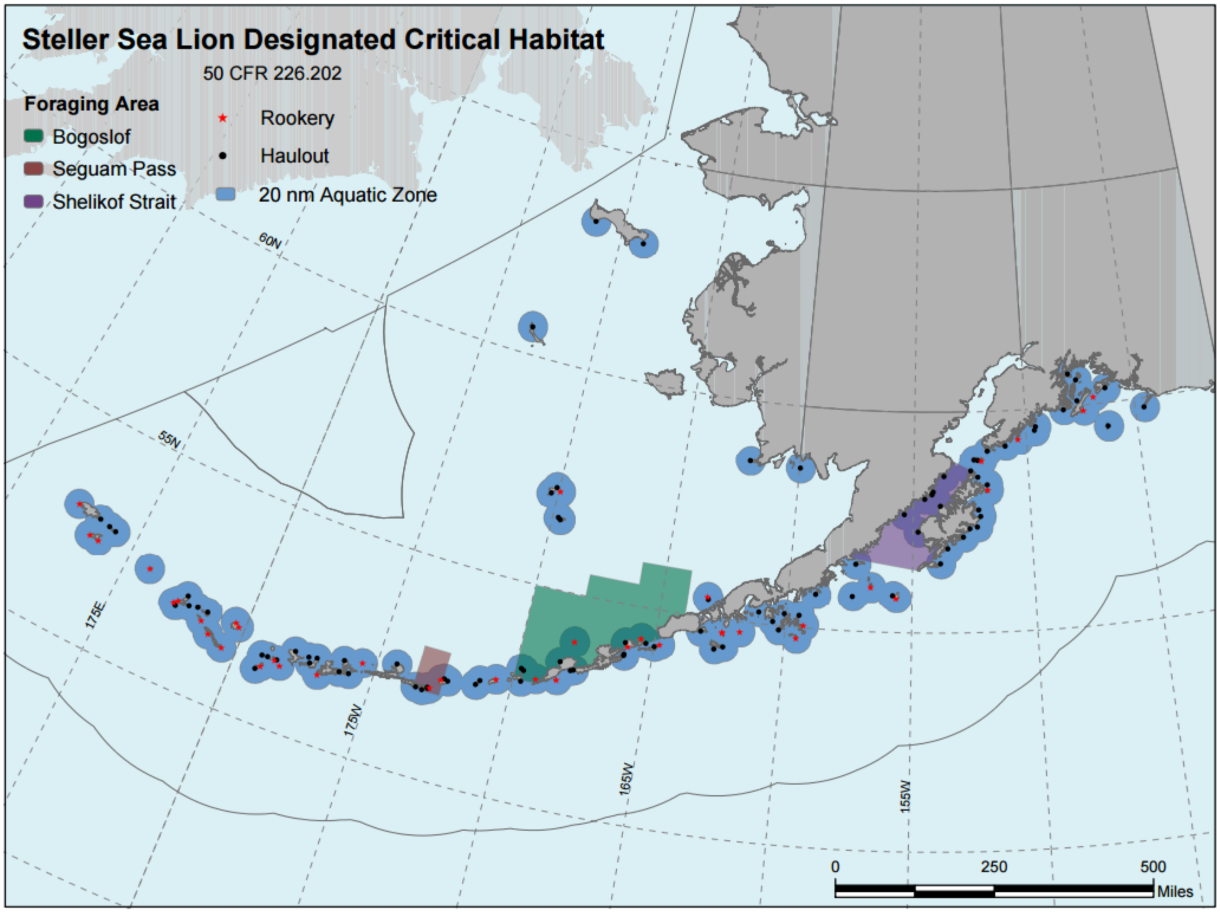

Figure 17. Steller sea lion designated critical habitat.

Steller sea lions are not commonly seen in the mid and upper Inlet. Sightings during NMFS aerial survey for belugas in Cook Inlet indicate that the majority of all Steller sea lions are expected to be found south of the Forelands (Rugh et al. 2005; Shelden et al. 2015b). Sightings of Steller sea lions in the middle and upper areas of Cook Inlet are rare (Jacobs Engineering Group 2017). Steller sea lions occupy rookeries during their pupping and breeding season (late May to early July), however, there have been sightings of small numbers of Steller sea lions during oil and gas projects and at the Port of Alaska in recent years. In 2012, during Apache's 3D Seismic surveys, there were three sightings of approximately four individuals in upper Cook Inlet (Lomac-MacNair et al. 2013). Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof observed seven Steller sea lions during the summer of 2013 (Owl Ridge 2014). During SAExploration's 3D Seismic Program in 2015, four Steller sea lions were observed in Cook Inlet. One sighting occurred between the West and East Forelands, one near Nikiski, and one northeast of the North Foreland in the center of Cook Inlet (Kendall et al. 2015). One Steller sea lion was observed near Ladd Landing for the Harvest Alaska Cook Inlet Pipeline Cross-Inlet Extension (CIPL) project during the summer (Sitkiewicz et al. 2018). Hilcorp recorded 5 Steller sea lions during seismic operations in 2019 (Fairweather Science 2020). During the POA Petroleum and Cement Terminal Project in 2020 and 2021, observers documented 6 and 8 Steller sea lions, respectively (61 North Environmental 2021; 61 North Environmental 2022). An additional on Steller sea lion was seen during NMFS monitoring efforts at the POA in 2021 (unpublished data).

Feeding, Diving, Hauling out and Social Behavior

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

During summer Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 20 nm of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites.

Steller sea lions tend to make shallow dives of less than 250 m (820 ft) but are capable of deeper dives (NMFS 2008b). Female foraging trips during winter tend to be longer in duration and farther from shore (130 km), during which foraging 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 to 250 m) (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.

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 in large groups of up to 45 individuals (Keple 2002), and rafts of several hundred Steller sea lions are often seen adjacent to haulouts. Individual rookeries and haulouts may be comprised of hundreds of animals. At sea, groups usually consist of females and subadult males as adult males are usually solitary (Loughlin 2002).

Hearing, Vocalizations, and Other Sensory Capabilities

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 2018e). Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 and 25 kHz (Kastelein et al. 2005), and in air between 250 Hz and 30 kHz (Mulsow and Reichmuth 2010). Sound signals from vessels are typically within the hearing range of Steller sea lions, whether the animals are in the water or hauled out.

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 process. (50 CFR § 402.02).

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

The listed species, as well as other resident marine mammal species, may be impacted by a number of anthropogenic activities present in Cook Inlet. Over 65 percent of Alaska's human population (734,323) resides within southcentral Alaska or the Cook Inlet region[9]. 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, oil and gas development, fisheries, ship strikes, sound pollution, water pollution, prey reduction, direct mortalities, and research, in addition to factors operating on a larger scale such as predation, and environmental change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. Anthropogenic risk factors are discussed individually below.

5.1 Coastal & Off-shore Development

Cook Inlet beluga whales and Steller sea lions use nearshore environments to rest, feed, give birth, and breed, and thus could be affected by any coastal development that impacts these activities. Humpback and fin whales mostly occupy areas offshore and are less likely affected by coastal development.

If the populations of Anchorage/Mat-Su and the Kenai Borough continue to grow, coastal development will continue to result in the loss of habitat, increased vessel traffic, increased pollutants, and increased sound associated with construction and maintenance activities. Any projects requiring Federal authorization or funding will undergo section 7 consultation. However, as the human population in the area increases, coastal development with impacts to Cook Inlet are likely to occur.

Some development has resulted in both the direct loss of habitat from construction of roads, housing or other shoreline developments, and indirect loss associated with bridges, boat traffic, in-water sound, and discharges that affect water quality. There is concern that increased

[9] Alaska Department of Labor and Workforce Development Research and Analysis webpage. 2021 Population estimates by borough, census area, and economic region. Available from https://live.laborstats.alaska.gov/pop/, accessed February 15, 2022.

development may prevent beluga whales and Western DPS Steller sea lions from reaching important feeding and breeding areas. Frequent use of shallow, nearshore, and estuarine habitats makes beluga whales and Western DPS Steller sea lions particularly prone to regular interaction with human activities (Perrin 1999), and thus the animals are likely to be affected by those activities.

While the majority of the Cook Inlet shoreline is undeveloped, there are municipalities, port facilities, airports, wastewater treatment plants, roads, mixing zones, and railroads that occur along or close to the shoreline. Knik Arm supports the largest port and military base in the state. Construction in Cook Inlet associated with coastal development includes dredging (e.g., at the Port of Alaska), pile driving (e.g., at the Port of Alaska, Ship Creek boat launch, Port MacKenzie, several small projects in the Kachemak Bay area), and oil and gas development.

Anthropogenic activities related to coastal development may detrimentally affect Cook Inlet beluga habitat through loss or degradation of habitat and alterations in the availability of prey in habitat areas. Anthropogenic activities in the vicinity of Cook Inlet beluga habitat broadly include dredging; oil or gas activities; hard rock quarrying; laying of electrical, communication, or fluid lines; construction of docks, bridges, breakwaters or other structures; and other activities. These activities may cause avoidance or destruction of an area used by prey as a result of anthropogenic disturbance. Permanent structures, such as docks, platforms, or bridges, can alter the habitat by altering local tidal flow. However, because anthropogenic structures may repel some species, but attract others, the net effect on prey species remains unknown (NMFS 2010d).

Cities, villages, ports, airports, wastewater treatment plants, refineries, highways, and railroads are situated adjacent to areas of Cook Inlet beluga whale habitat. This development has resulted in the alteration of near shore beluga habitat and changes in habitat quality due to vessel traffic, noise, and pollution (NMFS 2008a; NMFS 2016).

5.1.1 Road Construction

The Alaska Department of Transportation began Seward Highway improvements from Mile 75 to 107 (along Turnagain Arm) in 2015. These activities include geophysical and geotechnical testing, on-shore blasting, pile removal, installation at stream crossings, fill placement in Turnagain Arm to facilitate roadway straightening, and construction of a boat ramp at Windy Point. The planned improvements also include resurfacing 15 miles of roadway, straightening curves, installing new passing lanes and parking areas, and replacing 8 existing bridges along the Seward Highway between mileposts 75 and 90. NMFS concurred that, with mitigation measures, the Seward Highway Milepost 75 to 90 Bridge Replacement project and the Seward Highway Milepost 105-107 Windy Corner project are not likely to adversely affect Cook Inlet beluga whales.

During geotechnical activities, beluga whales were observed on 15 of the 16 days of monitoring at Twentymile Bridge from April 6 to April 23, 2015. Roadway flaggers also heard beluga whales at the bridge site during nighttime hours, when no project activities were occurring. During the 2015 season, there were 18 observations of beluga whale groups, ranging in size from 3-30 animals. Shutdowns were typically implemented when beluga whales were at the mouth of the Twentymile River in order to prevent the animals from entering the harassment zone during in-water activities (HDR 2015). Beluga sightings at the mouth of the Twentymile River have been documented regularly by the Beluga Whale Alliance, Alaska Beluga Monitoring Partnership, and Cook Inlet Beluga Whale Photo-ID Project. The Cook Inlet Beluga Whale Photo-ID Project, including sightings data from the Beluga Whale Alliance and the Alaska Beluga Monitoring Partnership, reported: 14 sightings that totaled over 110 whales during the months of April, September, and October in 2018; 14 sightings that totaled over 100 whales during the months of April, August and September in 2019; 10 sightings that totaled 77 whales during the months of April, September, and October in 2020; and, 4 sightings that totaled 17 whales in April 2021 at the Twentymile River mouth[10].

The Seward Highway Milepost 75 to 90 Bridge Replacement project completed three bridge replacements by the end of 2019 during Phase 1. Phase 2 began in June 2021 and bridge work at Portage Creek #1 and the Placer River is expected to be completed this fall/winter. Bridge work at TwentyMile River is scheduled to begin in the winter of 2022/23 and is expected to be completed by October 2023. To avoid harassment of Cook Inlet beluga whales during the eulachon run, in-water work, including vibratory and impact pile installation and removal, will cease from May 15 to June 15, and any work conducted below mean high water (MHW) will require marine mammal monitoring.

The Seward Highway Milepost 105-107 Windy Corner project will realign a 3.2 km (2 mile) segment of the highway and railroad. In-water work includes land-based blasting and non-impulsive sound from fill placement. The project start has been delayed since the consultation was completed in 2015. According to the Alaska Department of Transportation website, this project is expected to occur between 2022 and 2023. In 2020, NMFS completed consultation for a mitigation project in Portage Creek #2 to compensate for impacts expected to occur from the Windy Corner Seward Highway project. Forty deteriorating timber piles that once supported the Alaska Railroad bridge over Portage Creek #2 will be removed to provide beluga whales unrestricted access to this salmon bearing creek. Project activities are restricted by seasonal timing to avoid the peak eulachon and salmon runs, and by daily tidal cycle to minimize potential interaction with belugas. Work is scheduled to begin in the late fall or early winter of 2022 and is expected to be completed by October 2023.

5.1.2 Port Facilities

Cook Inlet is home to port facilities at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham; barge landings are present at Tyonek and Anchor Point. Anchorage has a small boat ramp near Ship Creek, which was renovated in 2017, and is the only hardened public access boat ramp in Upper Cook Inlet. However, numerous other boat launch sites (e.g., beach launch at Tyonek, Captain Cook 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) provide small boats access to Cook Inlet.

[10] Cook Inlet Beluga Whale Photo-ID Project webpage. CIBW Sightings Page. Available at https://www.cookinletbelugas.com/cibw-sightings, accessed February 28, 2022.

Port of Alaska

The Port of Alaska (POA, previously referred to as the Port of Anchorage) is Alaska's largest seaport. The POA handles half of all Alaska inbound fuel and freight, moving more than four million tons of material across its docks annually, which is distributed statewide and consumed by 90 percent of Alaska's population. Operations began in 1961 with a single berth, and have since expanded to include three cargo terminals, two petroleum terminals, one dry barge berth, two miles of rail-spur connected to Alaska Railroad, and two floating, small-vessel docks, plus 220 acres of land facility located in Anchorage[11].

The POA Expansion Project included pile driving and dredging from 2008 and 2011 (USACE 2009). Between 2009 and 2011, 40 beluga whales were observed within the designated 160 dB disturbance zones, and a single Steller sea lion was sighted at the facility. A test-pile program to evaluate sound attenuation devices for potential use during future port expansion efforts was conducted in 2016. Belugas were observed within the disturbance zones nine times: one four-minute delay of start of operations was implemented, and one authorized instance of harassment of a single whale occurred (Cornick and Seagars 2016). Construction of a new Petroleum and Cement Terminal (PCT) began in 2020 and was completed in 2021. In total, 61 beluga groups were present during or very near in time to in-water pile installation or removal, and 19 of those groups were exposed to sounds levels considered to meet the harassment threshold (61 North Environmental 2021; 61 North Environmental 2022).

Maintenance dredging at the POA began in 1965, and is an ongoing activity from April through October in most years, affecting about 100 acres of substrate per year. The POA is dredged to the depth of minus 35 ft below mean lower low water (MLLW) and dredged materials are dumped 3,000 ft abeam of the POA dock face at the Anchorage in-water disposal site. To accommodate vessels berthing at the PCT location, transitional dredging to a depth of minus 40 ft MLLW began in 2018, and dredged material is deposited in a designated offshore disposal area (NMFS 2018c). Dredging at the POA does not seem to be a source of re-suspended contaminants (USACE 2009), and belugas often pass near the dredge (USACE 2008; ICRC 2012; POA 2019; USACE 2019). NMFS continues to analyze recently acquired data that may suggest belugas react to dredging operations.

Dredging operations occur annually at the Ship Creek Boat Ramp, located approximately 1.4 km (0.8 mi) southwest of the POA. "Dredging" at this site is done over a three to four day period during minus 3-foot tides when the area is dewatered. At this location, dredging consists of heavy machinery pushing sediment that has accumulated on the ramp within the intertidal zone back into the inlet from whence it came. Informal consultation for this project was completed in May 2020.

[11] Port of Alaska in Anchorage webpage. About Port of Alaska. Available at https://www.portofalaska.com/about-us/, accessed February 23, 2022.

Port MacKenzie

Port MacKenzie is along western lower Knik Arm. Coastal development at this site began in 2000 with the construction of a barge dock. Additional construction and bulkhead repair activity has occurred since then; 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 may include dry bulk cargo movement and storage, depending on the current state of the port and existing demand for its facilities. 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 was completed. However, marine mammal monitoring occurred on-site during pile driving operations in April 2016. Observers recorded belugas in or near the pile driving exclusion zone on 12 occasions from April 18-26. Pile driving was not occurring during these close approaches and there were no takes or no shut-downs recorded (Nuka Research and Planning Group 2016). Multiple groups of belugas were observed in this area between April and September 2020 and 2021 during marine mammal monitoring for the POA PCT construction (61 North Environmental 2021; 61 North Environmental 2022).

Other Ports

Nikiski is home to several privately owned docks including the Offshore Systems Kenai (OSK) dock. 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. The Arctic Slope Regional Corporation expanded and updated its Rig Tenders Dock in Nikiski in 2014 in anticipation of increased oil and gas activity.

Ladd Landing Beach, located near Tyonek, serves as public access to the Three Mile subdivision and a staging area for various commercial fishing sites in the area.

5.1.3 Oil and Gas Development

Cook Inlet is estimated to have 500 million barrels of oil and over 19 trillion cubic ft of natural gas that are undiscovered and technically recoverable (Wiggin 2017). Schenk (2015) determined that there may also be unconventional oil and gas accumulations in Cook Inlet of up to 637 billion cubic ft of gas and 9 million barrels of natural gas liquids.

Lease sales for oil and gas development in Cook Inlet began in 1959 (Alaska Department of Natural Resources 2014), and prior to that 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; today there are 17 offshore oil and gas platforms. Figure 18 shows the ongoing oil and gas activities in state waters as of January 2022. Active oil and gas leases in Cook Inlet total 205 leases encompassing approximately 418,974 acres of State leased land of which 324,292 acres are offshore[12] (Figure 19).

[12] Alaska Department of Natural Resources webpage. Active oil and gas lease inventory. Available at https://dog.dnr.alaska.gov/Documents/Leasing/PeriodicReports/Lease_LASActiveLeaseInventory.pdf, accessed

In 2017, BOEM held Lease Sale #244 (NMFS 2017b) in Cook Inlet (Figure 20). Hilcorp was the only responding company and submitted bids on 14 of 224 tracts/Blocks offered; their successful bids encompass 31,005 acres. In 2019, NMFS issued Incidental Take Regulations for Hilcorp's oil and gas activities in Cook Inlet (NMFS 2019b), including seismic surveys, and other exploration and development activities within these blocks (Figure 20). Hilcorp's seismic surveys, as well as other activities under the 2019 ITR, are discussed further below. BOEM was preparing the final EIS for Lease Sale #258 in Cook Inlet; however, the sale was cancelled in May 2022 due to lack of industry interest. Approximately 3.3 million acres were up for bid in the state-owned lease sale in June 2021, and HEX Group and Strong Energy Resources successfully bid on nearly 21,000 acres of oil and gas tracts in Cook Inlet.

Based on existing active leases and estimates of undeveloped oil and gas resources, oil and gas development will likely continue in Cook Inlet; however, the overall effects on listed marine mammals are unknown (!!! INVALID CITATION !!! (NMFS 2008a; NMFS 2016)). The Cook Inlet Beluga Recovery Plan identified potential impacts from oil and gas development, including increased sound from seismic activity, vessel traffic, air traffic, and drilling; discharge of wastewater and drilling muds; habitat loss from the construction of oil and gas facilities; and, contaminated food sources and/or injury resulting from an oil spill or natural gas blowout.

Kenai LNG Plant

The Kenai liquefied natural gas (LNG) liquefaction and terminal complex began operating in 1969 and, until 2012, was the only facility in the United States authorized to export LNG produced from domestic natural gas. LNG shipments from the terminal began declining and the plant has been in a warm-idle state since 2015. In early 2019, NMFS was informed that there were plans to bring the plant back into operation in the next few years. The Federal Energy Regulatory Commission approved Trans-Foreland's request to convert the facility to an importing plant in December 2020 and gave the company until December 2022 to place it into service. The Federal Energy Regulatory Commission received noticed from Trans-Foreland in July 2022 requesting an extension until December 2025 to complete the facility.[13]

March 1, 2022.

[13] https://www.reuters.com/business/energy/marathon-seeks-more-time-build-lng-import-project-alaska-2022-07-11/. Accessed August 29, 2022

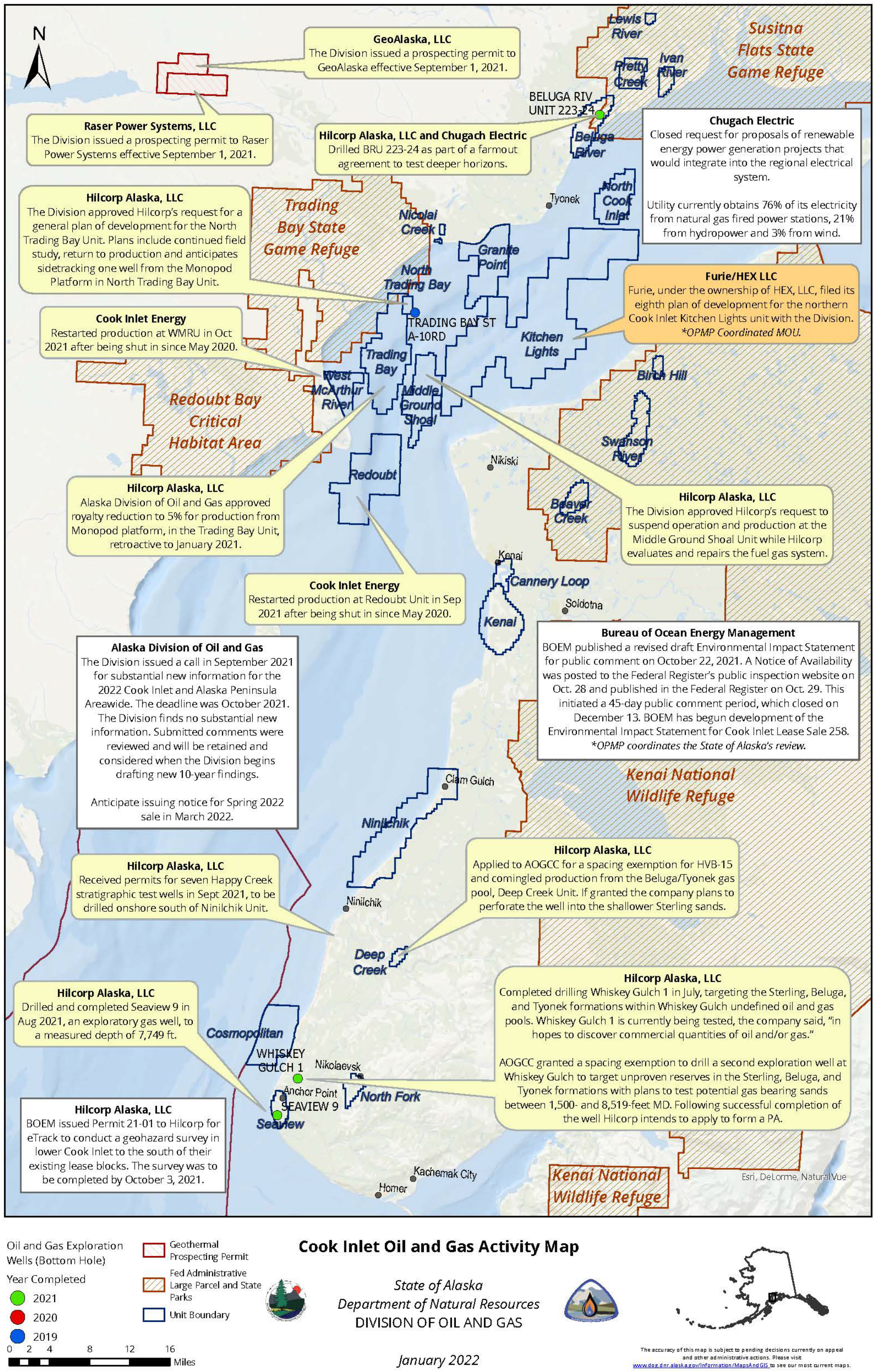

Figure 18. Oil and gas activity in Cook Inlet as of January 2022.

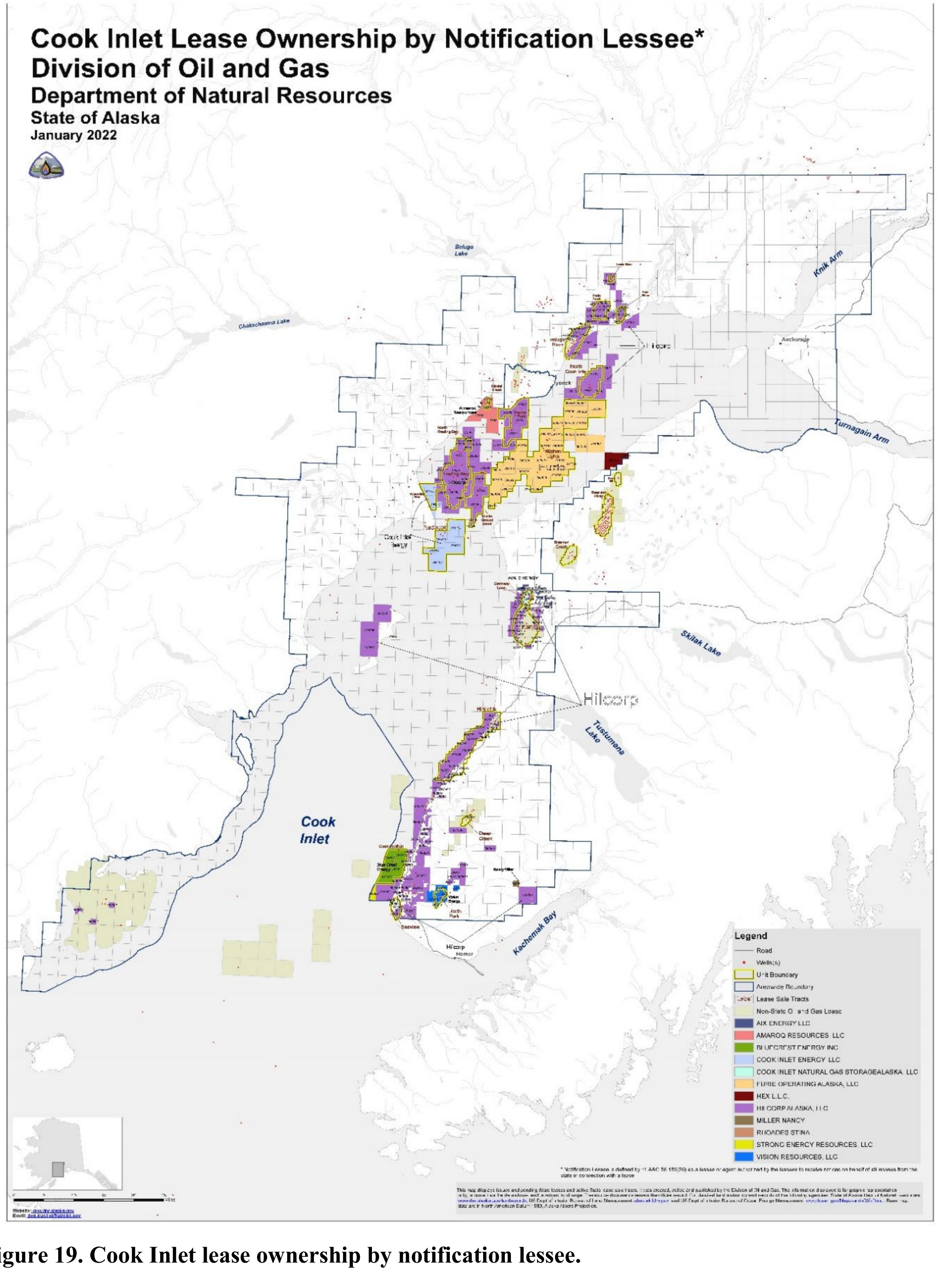

Figure 19. Cook Inlet lease ownership by notification lessee.

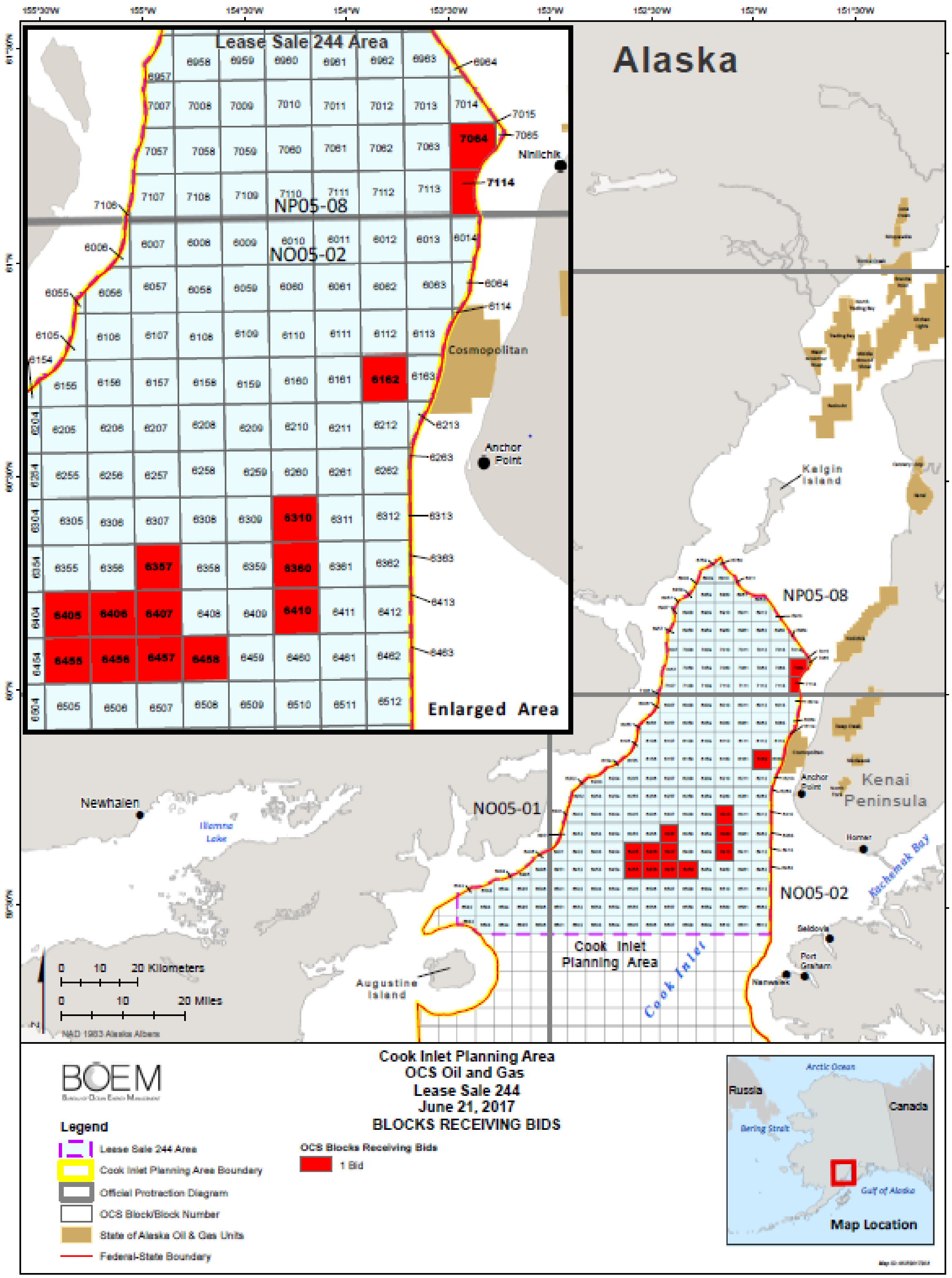

Figure 20. Lease Sale 244 blocks receiving bids.

5.1.4 Underwater Installations

The majority of underwater installations in Cook Inlet are oil and gas pipelines, which are an essential part of oil and gas activities in Cook Inlet. The Cook Inlet basin is the source for all natural gas used in south-central Alaska (Figure 21). Communication cables have also been laid and a project to harness tidal energy is in the initial stages of development.

Installation of pipelines involves multiple vessels. After the trench is dug, pipe is welded together and laid over the back of a non-motorized barge into the trench. Anchors are used to hold the barge in place and anchor-handling tugs use their bow-thrusters to reposition the anchors as the barge is moved along. These projects involve disturbance to the substrate, increased turbidity in the vicinity of the trenching, and increased sound from the tugboats and pipe-laying equipment.

There is always a possibility of pipeline failures associated with oil and gas development, with resultant oil spills, gas leaks, or other sources of marine petrochemical contamination. Spills and contaminants are discussed below.

Telecommunications

Alaska Communications Systems Group, Inc. (ACS) installed a fiber optic cable from Florence, Oregon to Anchorage, Alaska in 2019 to improve communication. A submarine cable extending from Nikiski on the Kenai Peninsula to Point Woronzof in Anchorage was installed. There was likely increased vessel traffic and sound during the installation; however the fiber optic cable now rests along the seafloor with a minimal footprint.

Hilcorp Cook Inlet Pipeline Cross Inlet Extension

Harvest, Alaska LLC, a subsidiary of Hilcorp Alaska, extended the existing undersea pipeline network in Cook Inlet and connected the Tyonek platform to the land-based pipeline located about 6.4 km (4 mi) north of the village of Tyonek in 2018. The cross-inlet extension included two steel subsea pipelines 25 cm (10 in) and 20 cm (8 in) in diameter, and 8.9 km (5.5 mi) in length. The existing 25 cm (10 in) subsea pipeline that crosses Cook Inlet between Kaloa Junction and the East Forelands Facility was also converted from natural gas service to oil service. The IHA authorized Hilcorp to incidentally take, by Level B harassment, 40 Cook Inlet beluga whales, 6 Steller sea lions, and 5 humpback whales (NMFS 2018d). Between May 9 and September 15, 2018, PSOs observed 814 beluga whales, 3 humpback whales, and 2 Steller sea lions; however, of the 819 listed species observed, only 1 humpback was considered exposed to Level B harassment (Sitkiewicz et al. 2018).

Trans-Foreland Pipeline

The Trans-Foreland Pipeline Co. LLC received approval from Federal, state, and regional agencies in 2014 to build the Trans-Foreland Pipeline, a crude oil pipeline from Kustatan Point on West Foreland to Nikiski on the east side of Cook Inlet. Multiple oil producers in western Cook Inlet were expected to use the pipeline to transport oil from the Drift River Tank farm, which is now closed (NMFS 2014b). This project is not expected to occur.

Alaska LNG Project

The Alaska LNG Project proposes to carry natural gas from the North Slope to southcentral Alaska for export internationally, eventually shipping up to 2.4 billion cubic ft of LNG per day. Proposed infrastructure includes an approximately 1,290 km (800 mi) long, large diameter pipeline from the North Slope that would cross Cook Inlet north of the Forelands and terminate at a proposed liquefaction facility in the Nikiski area on the Kenai Peninsula. Five years of construction are anticipated for the Cook Inlet portion of the project. ESA consultation was completed in June 2020; the project is expected to result in harassment of 61 Cook Inlet beluga whales, 1 Western North Pacific DPS humpback whale, and 1 Mexico DPS humpback whale over 5-years. One Mexico DPS humpback whale may also be exposed to sound levels exceeding the injury threshold. No effects to Steller sea lions are anticipated. As of yet, there is no planned project start date.

Tidal Energy Project

Ocean Renewable Power Company (ORPC), a developer of renewable power systems that harness energy from free-flowing rivers and tidal currents, submitted a preliminary permit application to the Federal Energy Regulatory Commission in May 2021. ORPC previously conducted site characterization and environmental studies in the region, and intends to develop a 5 MW pilot project near East Foreland to verify the technical performance and environmental compatibility of its proposed project. Project results will assist in planning a phased build-out of up to a 100 MW commercial-scale project[14]. ORPC will collaborate with Homer Electric Association, Inc. to sell the tidal energy produced.

[14] Renewable Energy Magazine webpage. ORPC plans to advance tidal energy in Cook Inlet. Available at https://www.renewableenergymagazine.com/ocean_energy/orpc-plans-to-advance-tidal-energy-in-20210526, accessed March 15, 2022.

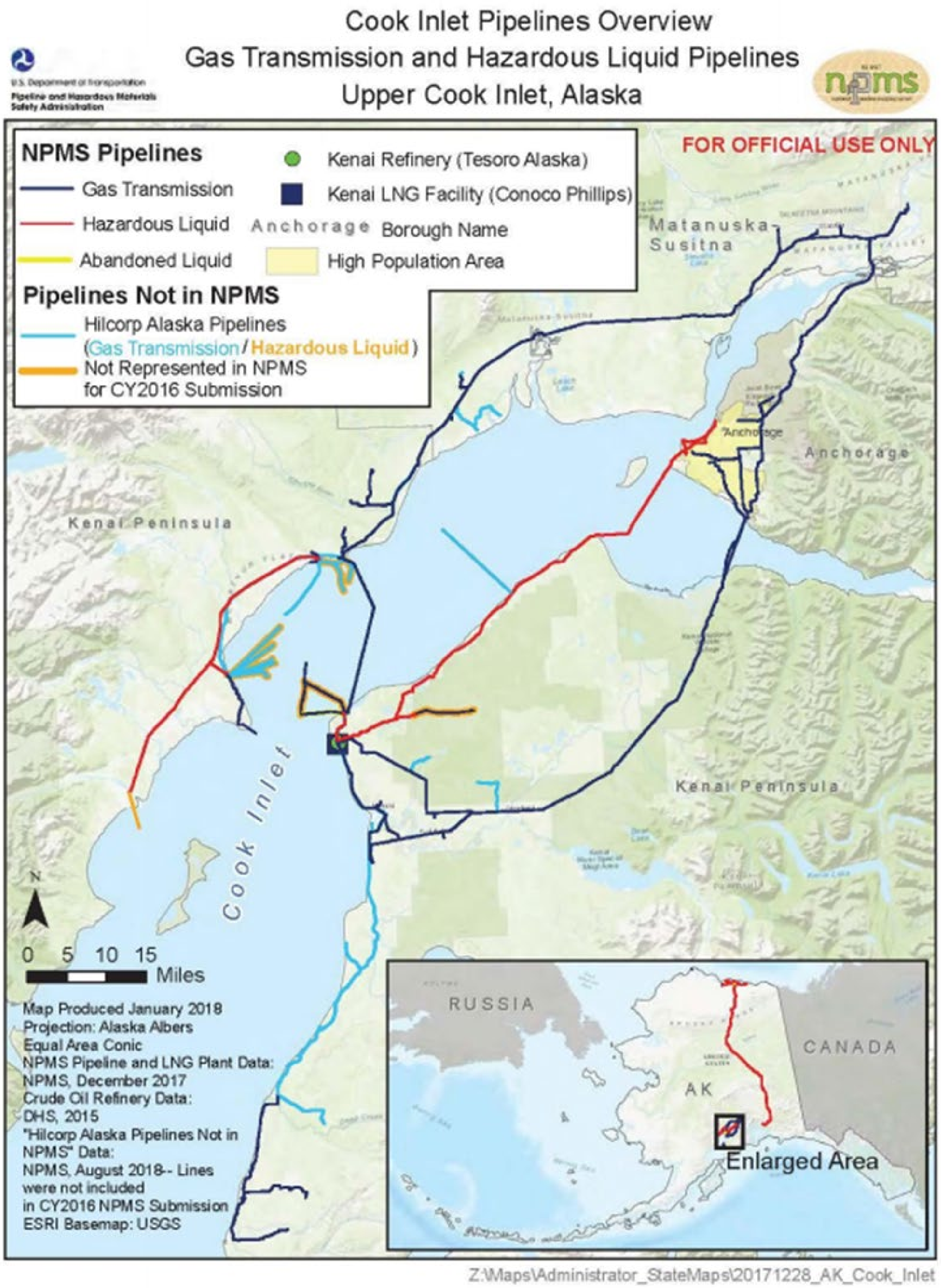

Figure 21. Pipelines in Cook Inlet.

In summary, coastal and off-shore development may affect Cook Inlet beluga whales, humpback whales, fin whales, and Steller sea lions directly or indirectly when new construction occurs (loss of habitat, sound), as a result of increased vessel traffic from port improvements and expansion (ship strike, sound), or from the increased likelihood of contaminants entering Cook Inlet as a consequence of expanded commercial and industrial activities adjacent to the marine environment.

5.2 Natural and Anthropogenic Sound

Because sound is a primary source of disturbance to marine mammals, this opinion considers it as a separate category of the Environmental Baseline, although it is generally attributable to other factors in the Baseline, such as coastal and off-shore development.

Underwater sound in Cook Inlet is categorized as physical sound, biological sound, and human-caused sound. Natural physical sound originates from wind, waves at the surface, currents, earthquakes, ice movement, tidal currents, and atmospheric sound (Richardson et al. 1995). Tidal influences in Cook Inlet are a predominant contributor of physical sound to the acoustic environment (Burgess 2014; BOEM 2016).

Biological sound includes sounds produced by marine mammals (particularly whales and dolphins, but also pinnipeds), fish (Maruska and Mensinger 2009), and invertebrates (Chitre et al. 2005). Human-caused sound includes vessel motor sounds, oil and gas operations, maintenance dredging, aircraft overflights, construction noise, and infrastructure maintenance noise. In general, ambient and background noise levels within the action area in Cook Inlet are assumed to be less than 120 dB whenever conditions are calm, and exceed 120 dB during environmental events such as high winds and peak tidal fluctuations (Blackwell and Greene 2003; Illingworth & Rodkin 2014).

5.2.1 Seismic Surveys in Cook Inlet

Cook Inlet has a long history of oil and gas activities including seismic exploration, geophysical and geological (G&G) surveys, exploratory drilling, increased vessel and air traffic, and platform production operation. Seismic surveys use high energy, low frequency sound in short pulse durations to characterize subsurface geology, often to determine the location of oil and gas reserves. Geophysical seismic activity has the potential to harass or harm marine mammals (Nowacek et al. 2015), including beluga whales.

Large airgun arrays of greater than 3,000 in^3, which can produce sound source levels exceeding 240 dB re 1 μPa rms, were previously used for seismic exploration in Cook Inlet. Smaller arrays are now being used because of the generally shallow water environment and the increased use of ocean-bottom cable and ocean-bottom node technology (Rigzone 2012). Shallow water surveys have employed 440, 620, and 880 in^3 arrays with source sound pressure levels less than 230 dB re 1 μPa_{RMS}. Measured radii to the 160 dB harassment isopleths have ranged from 3 to 9.5 km (1.8-5.9 mi).

Apache Seismic Exploration (2012-2014)

Apache Alaska Corporation (Apache) conducted over 1,800 hours of seismic activity in 2012 and reported zero takes of beluga whales and Steller sea lions; however, protected marine mammal sightings occurred within zones ensonified to greater than 120 and 160 dB prior to equipment power-down or shutdown (Lomac-MacNair et al. 2013).

In 2014, observers recorded a total of 29 takes (12 beluga whales, 6 harbor porpoise, 9 harbor seals, and 2 humpback whales) from sound exposures (25 at ≥160 dB_{RMS} and 4 at ≥180 dB_{RMS}) during 3,029 hours of observation effort. Additionally, four beluga whale groups were recorded less than 500 m from the source vessel during seismic operations (Lomac-MacNair et al. 2014). The monitoring report is ambiguous, and it is unclear if the seismic guns were firing while those four beluga groups were within 500 m of the source vessel. If the 1,760 in^3 airgun array was operating during these sightings, the groups were well within the MMPA Level A isopleth and Level A take occurred. On April 25, 2014, the M/V *Peregrine Falcon* was operating the 1,760 in^3 airgun array at full volume when a humpback whale was observed 1.5 km (0.9 mi) from the sound source. Seismic operations were shut down immediately; however, it is estimated that the whale was exposed to at least 19 shots exceeding the 180 dB threshold (at the time) for Level A take[15] as the animal transited from the edge of the Level A isopleth (1.84 km; 1.1 mi) to the initial sighting location. Regardless of immediate power-down or shutdown actions, an animal is considered exposed if it enters the respective Level A or Level B isopleths while sound is occurring.

SAE 3D Seismic Exploration (2015)

Eight vessels, including two seismic source vessels and one mitigation vessel, conducted seismic operations in upper Cook Inlet from May 15 to September 27, 2015. Seven PSOs, stationed on the source and mitigation vessels, monitored during all daylight hours when seismic operations were occurring and throughout most of non-seismic activities. A trained passive acoustic monitoring (PAM) operator monitored during nighttime hours from 1 July through 27 September using a dipping or over-the-side hydrophone.

Of the total number of visual observations and acoustic detections, 207 marine mammals were confirmed within the MMPA Level B (160 dB) or Level A (190 and 180 dB) isopleths; 194 animals were exposed to sounds exceeding the harassment threshold and 13 animals were exposed to sounds exceeding the injury threshold (Kendall et al. 2015) . Species exposed to sounds exceeding the harassment threshold included an unidentified large cetacean, two belugas, harbor porpoises, an unidentified porpoise, harbor seals, and a Steller sea lion. Harbor porpoises, harbor seals, and a Steller sea lion were exposed to sounds exceeding the injury threshold. Mitigation measures (clearance, ramp-up, and shut down procedures) prevented take during an additional 70 sightings (Kendall et al. 2015).

[15] This project occurred prior to the issuance of the new Level A guidance: NMFS. 2018e. Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA, NMFS, Office of Protected Resources, Silver Spring, MD. NOAA Tech. Memo. NMFS-OPR-55, 178 p., and references the old 180/190 Level A thresholds.

Hilcorp 3D Seismic – Lower Cook Inlet, OCS (2019)

Hilcorp conducted a 3D seismic survey of approximately 790 km^2 (305 mi^2) over 8 Outer Continental Shelf (OCS) lease blocks in Lower Cook Inlet from September 10 to October 17, 2019. One source, two support, and one marine mammal mitigation vessel were deployed, and PSOs were stationed on the source and mitigation vessels. Daily aerial surveys were conducted to ensure that no marine mammals were seen within the project area. Table 9 shows vessel sightings and estimated numbers of animals (including extrapolation) observed within the MMPA Level B isopleth during the project (Fairweather Science 2020). A Steller sea lion and a fin whale were observed in the Level A zone during seismic activity, however, permanent threshold shift or MMPA Level A take was unlikely because shut downs were implemented within a one-shot period. Level A thresholds are calculated with the assumption that an animal remains within the zone for 24 hours before an animal has a permanent threshold shift. Given the short duration of exposure it is unlikely that either animal had a permanent threshold shift.

Table 9. Sightings of ESA-listed marine mammals during 2019 Hilcorp seismic surveys.

ESA-listed species	# of sightings	Estimated # of Individuals	MMPA Level B Exposures
Fin whale	8	23	10.9
Humpback whale (Western North Pacific and Mexico DPS)	14	38	31.5
Beluga whale	2	2	0
Steller sea lion	5	5	4.9
(Fairweather Science 2020)			

5.2.2 Oil and Gas Exploration, Drilling, and Production Noise

With frequencies generally below 10 kHz, operating sounds from the oil platform itself are louder than the sound generated by drilling. Noise from the platform is thought to be weak due to the small surface area (the four legs) in contact with the water (Richardson et al. 1995), and that the majority of the machinery is on the deck of the platform above the water surface. Blackwell and Greene (2003) recorded underwater sound produced at Phillips A oil platform (now the Tyonek platform) at distances ranging from 0.3 to 19 km (0.2 to 12 mi) from the source. The highest recorded sound level was 119 dB at a distance of 1.2 km (0.75 mi). Sound between 2 and 10 kHz was measured as high as 85 dB as far out as 19 km from the source. This noise is audible to beluga, humpback, and fin whales, and Steller sea lions.

EMALL (2016)

In 2016, ExxonMobil Alaska LNG LCC (EMALL) conducted geophysical and geotechnical (G&G) surveys in Upper Cook Inlet within the Susitna Delta Exclusion Zone (SUDEX). PSOs monitored for marine mammals prior to and during all vessel movements in the area, and G&G surveys did not occur within the SUDEX between April 15 and October 15. Three marine mammal sightings of five individuals were observed within the SUDEX, including two sightings of beluga whales (four individuals), and one sighting of a harbor seal. The sightings in the SUDEX occurred during non-operational periods (e.g., when no vibracore operations were occurring), and both beluga sightings were observed outside of the harassment zone (Smultea Environmental Sciences 2016).

Furie Exploration Drilling (2018)

NMFS completed formal consultation in 2017 for oil and gas exploratory drilling operations in the Kitchen Lights Unit (KLU) in upper Cook Inlet between June 2017 and December 2021 (NMFS 2017a). Actions included transport of a jack-up rig from winter storage locations in lower Cook Inlet to the drilling sites by up to three tugs, high-resolution geophysical surveys, pile driving at the drilling locations, drilling operations, vessel and air traffic associated with rig operations, fuel storage, and well completion activities.

Furie did not conduct exploratory drilling in 2017 and requested reinitiation in late 2017 after modifying the proposed actions; the jack-up rig would be stored in Nikiski during the winter, eliminating many of the potential impacts to listed species resulting from towing the rig from lower Cook Inlet to the KLU. Based on modifications to the proposed action and with implementation of revised mitigation measures, NMFS determined that the project may affect, but is not likely to adversely affect, ESA-listed species (NMFS 2018b). Continuous monitoring during drilling and well construction was not required after the initial start-up period; however, PSOs were required to monitor continuously during pile driving activities. PSOs monitored for approximately 23 hours between June 25 and 29, 2018 during pile driving, and observed 1 harbor seal, 2 harbor porpoises, and 1 dead beluga whale. The beluga carcass was unrelated to project activities, and was immediately reported to the NMFS Marine Mammal Stranding Network (Jacobs Engineering Group 2019). The KLU was purchased by HEX LLC at a December 2019 bankruptcy auction.

Hilcorp Oil and Gas (2019 - 2022)

The Hilcorp Incidental Take Regulations issued in 2019 included oil and gas exploration, development, production, and decommissioning activities in Cook Inlet, Alaska between July 30, 2019 and July 30, 2024. As discussed above, Hilcorp completed seismic operations in 2019. On September 17, 2019, Cook Inletkeeper and the Center for Biological Diversity filed suit in the U.S. District Court for the District of Alaska challenging NMFS's issuance of the ITRs and LOAs and supporting documents, including the ESA Biological Opinion. In a decision issued on March 30, 2021, the court ruled largely in NMFS's favor but found a lack of adequate support in NMFS's record for the agency's determination that tug towing of drill rigs will not cause take of beluga whales. The court issued its judgment and order on remedy on May 27, 2021, partially vacating and remanding the ITRs, environmental assessment, and biological opinion to NMFS for further analysis of tug use under the MMPA, ESA, and National Environmental Policy Act (NEPA). The court vacated Hilcorp's use of tugs towing a drill rig in connection with exploratory well drilling and in connection with all other production well drilling. The court remanded without vacatur Hilcorp's use of tugs towing a drill rig for production drilling in 2021 at the Tyonek platform and for well decommissioning (which partially occurred in 2021). All other activities under the Biological Opinion were allowed to continue.

In 2020, Hilcorp completed routine pipeline maintenance operations but did not observe any marine mammals. In 2021, Hilcorp transported the *Spartan 151* jack-up rig once in June from the Rig Tenders Dock in Nikiski to Well 17589 for plug and abandonment (P&A) activities and once in July from Well 17589 to the Tyonek platform for production drilling (this activity was analyzed in the 2019 biological opinion, and the court did not vacate that particular activity for 2021). P&A of Well 17589 began in 2021 but was not finished due to equipment sourcing issues. Hilcorp has since resolved the issue and intends to finish P&A activities in accordance with Alaska Oil and Gas Conservation Commission regulations. Also in 2021, Hilcorp completed a shallow hazard survey over lower Cook Inlet OCS leases to evaluate potential hazards; document any potential cultural resources; identify shallow hazards such as old pipelines or wrecks; obtain engineering data for placement of structures (e.g., proposed platform locations); and detect subsurface geologic hazards (e.g., faults and gas pockets; this activity was analyzed in the 2019 biological opinion, and in the court's order on remedy, the court did not vacate other Hilcorp activities not associated with the use of tugs towing drill rigs). The survey was conducted from 11 September 2021 to 24 October 2021; however, the geohazard portion of the survey that required use of the sound source concluded on 9 October 2021.

On April 28, 2022, Hilcorp notified NMFS that Hilcorp needed to begin tugging of a drill rig in May due to depleted energy reserves for the Southcentral Alaska region. NMFS concurred with Hilcorp's assessment that take of marine mammals by Level B harassment was unlikely to occur for the transport of the jack-up rig from the Rig Tender's Dock in Nikiski to the Tyonek platform in middle Cook Inlet. The letter did not authorize any take of marine mammals under the MMPA and was not subject to ESA section 7 consultation. Hilcorp moved the jack up rig from Nikiski to the Tyonek platform on June 2022. For more information on the marine mammals Hilcorp documented and their behaviors during project activities from 2021 and 2022 see Section 6.2.2.6

Also in 2022, Hilcorp and Harvest requested informal consultation from the Alaska Region for routine oil and gas pipeline and infrastructure maintenance. Routine maintenance activities include: subsea pipeline inspections, pipeline stabilization, and repair and replacement; platform leg inspections and repairs; and anode sled installations. Work under the informal consultation will occur over a 5 year period from 2022 – 2027, the consultation process was completed on August 12, 2022.

5.2.3 Construction and Dredging Sound

Pile driving and dredging are the primary sources of construction sound in Cook Inlet. The Port of Alaska located outside of the action area, is dredged annually and extensive renovations, including significant amounts of pile driving, occurred in 2020 and 2021. Port MacKenzie, located two miles across Cook Inlet from the POA, has also undergone recent renovations and multiple emergency repairs requiring pile driving, including removal and installation of sheet piles (NMFS 2017c).

The majority of construction activities in upper Cook Inlet have taken place near Anchorage and most of the studies documenting construction sound in Cook Inlet have occurred in this area. These studies have focused almost exclusively on pile driving in order to evaluate potential harassment to beluga whales. A few studies have recorded dredging sound near the POA (Dickerson et al. 2001; URS 2007).

5.2.4 Vessel Traffic Sound

Cook Inlet is a regional hub of marine transportation throughout the year, and is used by various classes of vessels, including containerships, bulk cargo freighters, tankers, commercial and sport-fishing vessels, and recreational vessels. Vessel traffic in Cook Inlet transits through the Ports of Kodiak, Homer, and Anchorage. Off-shore vessels, tug vessels, and tour boats represent 86 percent of the total operating days for vessels in Cook Inlet (BOEM 2016). Vessel traffic density is concentrated along the eastern margin of the Inlet between the southern end of the Kenai Peninsula north to Anchorage (Figure 22). Eighty percent of large ship operations were made by only 15 vessels that regularly called at Homer, Nikiski, or Anchorage. Vessel traffic was very consistent throughout the year along the Forelands. Kachemak Bay had the highest level of traffic activity in Cook Inlet with most large ships entering the mouth of the bay to pick up a marine pilot or await U.S. Coast Guard inspection. The bay was also a frequent and preferred port of refuge for ships and tugs while waiting out bad weather (Cape International 2012). The Drift River Terminal was decommissioned, which eliminated a substantial source of tanker traffic in Cook Inlet.

Blackwell and Greene (2003) recorded underwater sound 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). Continuous sound from ships generally exceeds 120 dB re 1 μPa_{RMS} to distances between 500 and 2,000 m (1,640 and 6,562 ft; Jacobs Engineering Group 2017); however, sound effects from transiting vessels are short term (BOEM 2017). There are anecdotal reports of belugas with varying levels of reactions from vessel traffic. Observers noted that belugas sometimes seem habituated to vessels while other times they would dive, split up from their groups, and/or change direction when vessels crossed in front of or over the top of them (HDR 2015 unpublished data). Belugas may decrease or cease vocalizations in response to sounds from ships and other activities, or their vocalizations may be masked (Castellote et al. 2016b).

Cook Inlet belugas may be affected by the sound associated with shipping and transportation. Beluga prey species could be displaced from preferred habitat areas that contain features essential for the species, or that alter the quantity and/or quality of these essential features (NMFS 2014a; NMFS 2016). Vessel traffic and tourism encroachment in areas could disturb and displace belugas and/or their prey species.

Steller sea lions, humpback whales, and fin whales may exhibit varying reactions to the presence of vessels, ranging from avoidance to attraction (especially if animals are habituated to vessels as a source of food). We lack information characterizing the reactions of these species to vessels within the action area, or the number of interactions between marine mammals and vessels that cause behavioral changes.

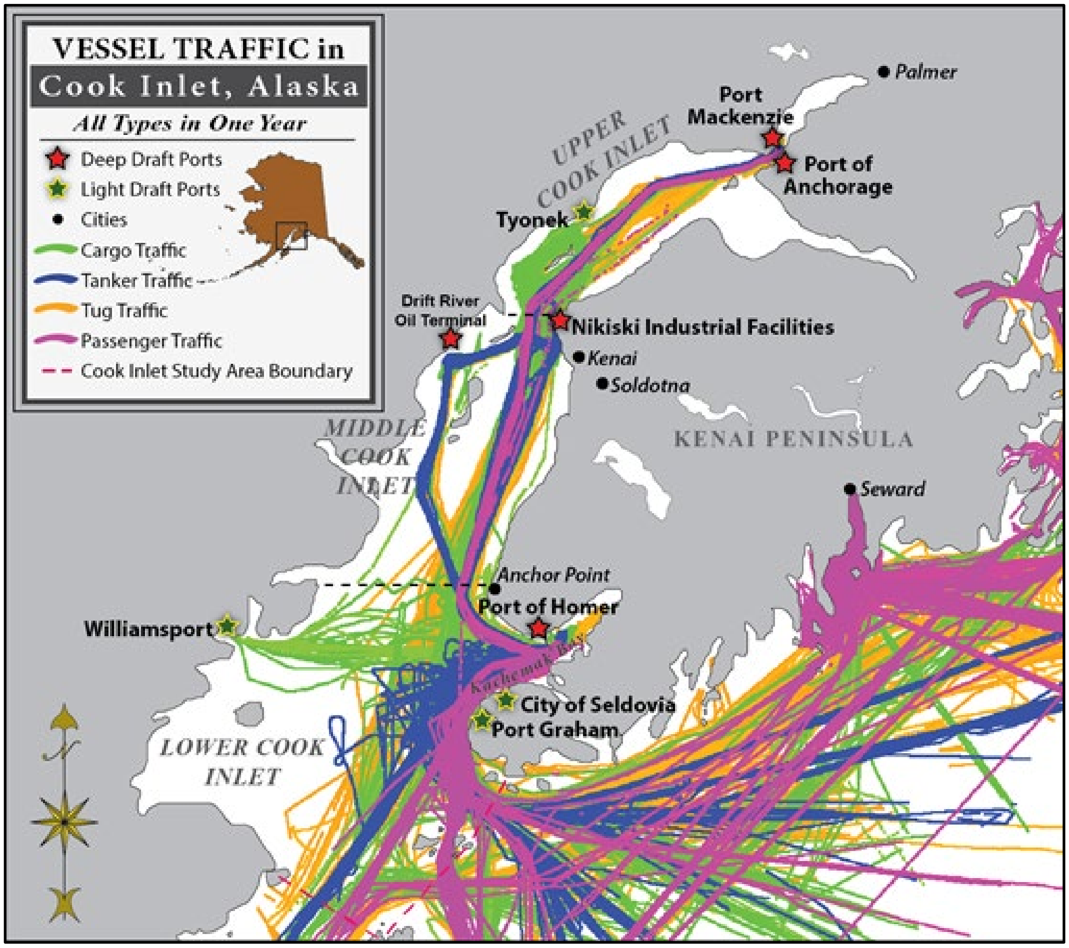

Figure 22. Summary of Cook Inlet vessel traffic by vessel type (Eley 2012). Only vessels more than 300 gross tons are shown.

5.2.5 Aircraft Sound

The Cook Inlet airspace has significant aircraft traffic. Ted Stevens Anchorage International Airport, located directly adjacent to lower Knik Arm, is the second largest air cargo hub in the U.S. and receives high volumes of commercial air traffic. Joint Base Elmendorf-Richardson also has a runway and airspace directly over Knik Arm. Lake Hood in Anchorage is the largest and busiest seaplane base in the world, and the only seaplane base in the U.S. with primary airport status (Federal Aviation Administration 2016). Small public runways are located in Birchwood, Goose Bay, Merrill Field, Girdwood, the Kenai Municipal Airport, Ninilchik, Homer, and Seldovia. Oil and gas operators frequently utilize helicopters and fixed-winged aircraft for transport of personnel and goods, as well as for surveys.

Airborne sounds do not transfer well to water as much of the sound is attenuated at the surface or reflected where angles of incidence are greater than 13°; however, loud aircraft sound can be heard underwater when aircraft are within or near the 13º overhead cone and surface conditions are calm (Richardson et al. 1995). The sound and visual presence of aircraft may result in behavioral changes in whales, including diving, altering course, vigorous swimming, and breaching (Patenaude et al. 2002). Richardson et al. (1995) observed beluga whales in the

Beaufort Sea dive or swim away when low-flying (500 m (1640 ft)) aircraft passed above. During beluga aerial surveys in Cook Inlet, observers reported little or no change in swimming direction of the whales in response to the survey aircraft flying at approximately 244 m (800 ft; Rugh et al. 2000). Individual responses of belugas may vary depending on previous experiences, beluga activity at the time of the sound, and sound characteristics.

The responsiveness of baleen whales (humpbacks and fin whales) to aircraft is variable and may depend on behavioral state, habitat, and age class. Responses vary from no observed reaction to diving, turns, and other changes in behavior. Whales actively engaged in feeding or social behavior often appear insensitive. Whales with calves or in confined waters may be more sensitive. Single or occasional aircraft overflights do not seem to cause long-term displacement or abandonment by whales (Richardson et al. 1995). .

Aircraft may also disturb Steller sea lions, especially if hauled out. Disturbance of a rookery or haulout has the potential to result in serious injury or death, predominantly from trampling. Over 1,000 sea lions were observed stampeding off a beach in response to a large helicopter over a mile away (Withrow 1982).

5.2.6 Sound and Habitat

A wide variety of anthropogenic sound sources are present in and around Cook Inlet beluga habitat. While anthropogenic sound occurs year-round, many of the sources are seasonal and only present during the ice-free months. Sound sources include tugs, tankers, cargo ships, fishing vessels, small recreational vessels, dredging, pile-driving, military detonations, and seismic surveys (NMFS 2016).

Little is known about the effects of sound on fish, but the limited scientific literature on the subject indicates that sound can evoke a variety of responses from fish. Pile driving can induce a startle response and/or avoidance response, and can cause injury or death to fish close to the sound source (McCauley et al. 2003; Slabbekoorn et al. 2010; Casper et al. 2012; Halvorsen et al. 2012). Fish will likely avoid sound sources within ranges that may be harmful (McCauley et al. 2003).

Coho salmon (*Oncorhynchus kisutch*), a Cook Inlet beluga and Steller sea lion prey species, were exposed to pile driving sound in a laboratory environment and potential effects were evaluated (Casper et al. 2012; Halvorsen et al. 2012). Very high sound level exposures (210 dB re 1µPa_{rms}) were required to meet the threshold for onset of injury, suggesting that one or two mild injuries resulting from pile driving exposure at these or higher levels were unlikely to affect the survival of the exposed animals. Rodkin (2009) studied the effects of pile driving sheet piles on juvenile coho salmon at the Port of Anchorage in Knik Arm of Cook Inlet. The fish were exposed to in-situ sound from vibratory or impact pile driving at distances ranging from less than 1 meter to over 30 meters. There was no mortality of any test fish within 48 hours of exposure to the pile driving activities, and subsequent necropsies found no effects or injuries. The effects of sound on other Cook Inlet beluga and Steller sea lion prey species, such as eulachon, gadids, and flounder species, is unknown (NMFS 2008b; NMFS 2016).

5.3 Water Quality and Water Pollution

The Cook Inlet region is the most populated and industrialized region of the state. Its waters receive various pollutant loads through activities that include urban runoff, oil and gas activities (e.g., discharges of drilling muds and cuttings, production waters, treated sewage effluent discharge, deck drainage), municipal sewage treatment effluents, oil and other chemical spills, fish processing, and other regulated discharges. The main sources of pollutants likely include the 10 wastewater treatment facilities, stormwater runoff, airport de-icing, military training at Eagle Bay, and discharge from oil and gas development (Moore et al. 2000; NMFS 2008a). Many pollutants are regulated by either the Environmental Protection Agency (EPA) or the ADEC, who may authorize certain discharges under the National (or Alaska) Pollution Discharge Elimination System (NPDES/APDES; section 402 of the CWA of 1972). It is necessary to manage pollutants and toxins to protect and maintain the biological, ecological, and aesthetic integrity of these waters.

Chemical analyses of water and dredging sediments from Cook Inlet found that contaminants analyzed were below management levels, and some were below detection limits. Cook Inlet beluga whales also generally have lower contaminant loads than belugas from other populations (NMFS 2016). The comparatively low levels of contaminants documented in the Cook Inlet water and sediment samples, as well as in the belugas themselves suggests that the magnitude of the pollution threat appears low.

5.3.1 Petrochemical spills

According to the Alaska Department of Environmental Conservation (ADEC), oil spills in marine waters consist mostly of harbor and vessel spills, and spills from platform and processing facilities. A spill baseline study conducted as part of the Cook Inlet Risk Assessment estimated a historical vessel spill rate of 3.4 spills (regardless of size) per year, with rates ranging from 0.7 spills per year for tank ships to 1.3 spills per year for non-tank/non-workboat vessels (Nuka Research and Planning and Pearson Consulting LLC 2015). Between 1966 and 2015, eight large spills (≥ 1,000 bbl) from vessels (tankers and, in one case, a tug) were documented in Cook Inlet (BOEM 2016).

In February 2017, a natural gas leak was discovered in an eight-inch pipeline in Cook Inlet belonging to Hilcorp. A large rock caused the breach at a depth of 80 ft. The leak began in late December 2016, and the initial estimated leak rate was between 225,000 to 325,000 cubic ft per day from (Hilcorp 2017b). A permanent repair was completed by mid-May 2017. Limited aerial wildlife surveys in the area did not detect marine mammals near the leak (Hilcorp unpublished data). The Anna Platform experienced a diesel tank spill of 441 gallons in January 2018; all of the diesel was recovered and recycled. The Hilcorp King Salmon Platform spilled 588 gallons of ethylene glycol in mid-April 2019; the glycol was recovered and recycled. The Hilcorp Platform A spilled 180 gallons of ethylene glycol in mid-June 2020; the glycol was recovered and recycled. The Hilcorp subsea pipeline that leaked in 2017 was again discovered to be leaking natural gas in early April 2021. The line was shutdown to stop the leak; however, 175,000 pounds were released. Federal regulators ordered Hilcorp to replace the 7-mile long aging pipeline.

In August 2022, a 645-ft container ship the Maunalei traveling to the Port of Alaska in Anchorage had a lubricant leak and was actively discharging hydraulic oil into Cook Inlet. The lubricant was considered to have minimal impacts to wildlife given the low toxicity of the biodegradable lubricant, the strong tidal currents, and slow release rate (six gallons per hour)[16]. A boom was deployed once the container ship was docked. The ship stayed at the Port for no more than 48 hours prior to leaving to receive repairs in the lower 48.

The ADEC Statewide Oil Spills Database[17] provides public access to data on all the spills reported in Cook Inlet or in tributaries to Cook Inlet. The types of spills recorded include jet fuel, crude oil, ethylene glycol, and produced water. Spills of as little as one gallon are reported and it is often reported that they are contained and disposed of properly. Two spills have been recorded so far in 2022, 21 in 2021, 12 in 2020, and 18 in 2019. Marine mammals and their prey are exposed to a range of contaminants in varying concentrations, and the long-term consequences of this exposure remain unknown.

Oil spills that occur in or upstream of Cook Inlet could result in marine mammals experiencing direct contact with the oil, with possible effects to skin and/or respiratory systems. Research indicates cetaceans are capable of detecting oil, but they do not seem to avoid it (Geraci and St. Aubin 1990), and oil has been implicated in the deaths of pinnipeds, including Steller sea lions (St. Aubin 1990). An oil spill in Cook Inlet could also result in widespread habitat degradation, impacting beluga whales and putting the population at risk. Population level effects to the Western DPS of Steller sea lions and listed humpback and fin whales within Cook Inlet would be far less likely; however, individual animals may also be put at risk from a spill. Given the amount of oil and gas production and vessel traffic, spills of petroleum products are a threat to marine mammals inhabiting Cook Inlet.

Cook Inlet beluga whales could be affected through residual oil from a spill, even if they were not present during the oil spill, due to the highly mobile nature of oil in water and the extreme tidal fluctuations in Cook Inlet (NMFS 2008a). Prey contamination is also likely, but the effect of contaminated prey on belugas remains unknown. Polycyclic aromatic hydrocarbons (PAHs), a group of contaminants found in petroleum products, combined with other contaminants, may cause cancer in beluga whales (Kingsley 2002). Cook Inlet belugas appear to be bioaccumulating PAHs from the environment and prey (Norman et al. 2015). Spill clean-up efforts could also result in displacement of whales from essential feeding areas.

Pinnipeds exposed to oil at sea through incidental ingestion, inhalation, or limited surface contact do not appear greatly harmed by the oil; however, pinnipeds found close to the source or who must emerge directly in oil appear substantially more affected. Sea lions exposed to oil through inhalation, dermal contact and absorption, direct ingestion, or through the ingestion of prey may become heavily contaminated with PAHs. Toxic substances, such as oil, may be a contributing factor in the decline of the Western DPS Steller sea lion population (NMFS 2008b). While the Exxon Valdez oil spill occurred after the current Steller sea lion population decline began, the

[16] https://coastguardnews.com/coast-guard-monitors-container-ship-lubricant-leak-in-anchorage/, accessed August 15, 2022

[17] Alaska Department of Environmental Conservation webpage. PPR spills database search. Available at https://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch, accessed March 15, 2022.

spill almost certainly exacerbated the decline. Mortalities from toxic contamination are strongly linked to this spill; 12 sea lion carcasses were found in Prince William Sound, and 16 carcasses were found near Prince William Sound, along the Kenai coast, and at the Barren Islands. Elevated PAH levels were present in the animals found dead shortly after the spill (NMFS 2008b).

It is not known whether humpback whales or fin whales avoid oil spills; however, humpbacks have been observed feeding in a small oil spill on Georges Bank (NMFS 1991). The greatest impacts of oil spills on humpbacks and fin whales could occur indirectly. Local depletion of food resources may occur as a result of displacement and mortality of their food resources, many of which are highly susceptible to the toxic effects of oil and are essentially unable to move away from the site of a spill. Other, more mobile, prey species may suffer from mortality of eggs and immature life stages (NMFS 1991), possibly reducing future availability of prey.

5.3.2 Wastewater Discharge

Wastewaters entering treatment facilities may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern; and undergo primary, secondary, or tertiary treatment prior to being discharged into a body of water. Primary treatment involves sedimentation. In general, this includes removing 50 to 70 percent of the solid particulate from the wastewater prior to discharge (Sonune and Ghate 2004). In addition to sedimentation, secondary treatment involves adding a biological component to remove the remaining organic matter. Tertiary treatment involves both primary and secondary treatment as well as additional processes to increase the water quality of the discharge (Sonune and Ghate 2004).

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewater from the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive primary treatment, wastewaters from Homer, Kenai, and Palmer receive secondary treatment, and wastewaters from Eagle River and Girdwood receive tertiary treatment.

The Anchorage John M. Asplund Wastewater Treatment Facility (AWTF) is the largest wastewater facility in Alaska and is located in upper Cook Inlet. AWTF provides primary treatment only; it removes approximately 80 percent of solids prior to discharge. The facility was built in 1972, upgraded in 1982 (increasing treatment capacity to 28 million gallons per day [mgd]), and then upgraded again in 1989 (to 58 mgd). The EPA issues AWTF a waiver for secondary treatment because of the levels of sediment they are able to extract and the extreme tides and currents of Cook Inlet (Kinnetic Laboratories Incorporated 2017). Once the sediment is removed from the wastewater, the sludge is incinerated. The effluent is tested regularly, including bioassays on fish and invertebrates, and has shown very low levels of contaminants (Jokela et al. 2010).

The Village of Tyonek wastewater treatment facility operates on a gravity fed sewer that drains into a community septic tank. The solids are transferred to a sludge lagoon for dewatering twice a year and the liquid effluent is then discharged into Cook Inlet near an area heavily used by feeding Cook Inlet beluga whales. The City of Kenai wastewater facility is one of the larger plants and is located near the largest runs of salmon in Cook Inlet. Secondary-treated wastewater is discharged directly into Cook Inlet, and the sludge is taken to the Soldotna landfill.

Wastewater discharge from oil and gas development could also increase pollutants in Cook Inlet (NMFS 2008a.) Discharge includes, but is not limited to, drilling fluids (muds and cuttings), produced water (water phase of liquid pumped from oil wells), and domestic and sanitary waste (NMFS 2008a; EPA 2015). Oil and gas facilities are required to monitor effluent for pollutants and meet specific standards stipulated in their EPA-issued NPDES permit before wastewater is discharged into Cook Inlet (EPA 2015).

5.3.3 Mixing Zones

In 2010, EPA consulted with NMFS on the approval of ADEC's Mixing Zone Regulation section [18 AAC 70.240], including the most recent revisions of the Alaska Water Quality Standards [18 AAC 70; WQS], relative to the endangered Cook Inlet beluga whale (NMFS 2010b). The biological opinion concluded that there was insufficient information to determine 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. The effects of EPA approval of the Mixing Zone Regulation to beluga whale habitat were addressed in a 2019 biological opinion.

5.3.4 Stormwater Runoff

Stormwater pollutants may include street and aircraft de-icer, oil, pesticides and fertilizers, heavy metals, and fecal coliform bacteria. Public Works and the Alaska Department of Transportation and Public Facilities (ADOT&PF) are responsible for identifying, monitoring, and controlling pollutants in stormwater. The effects of stormwater on the Cook Inlet beluga whale have not been studied and are unknown (NMFS 2008a).

5.3.5 Aircraft De-icing

The Federal Aviation Administration requires de-icing and anti-icing of aircraft and airfield surfaces, when necessary, to ensure passenger safety. De-icing and anti-icing chemicals are used from October through May and may be used on aircraft, tarmacs, and runways. De-icing material is comprised of different chemicals depending on the application; ethylene glycol and propylene glycol are used on aircraft for anti-icing and de-icing purposes, whereas potassium acetate and urea are used to de-ice tarmacs and runways.

The Ted Stevens Anchorage International Airport and Joint Base Elmendorf-Richardson airport are the largest airports in the Cook Inlet region. Other smaller airports exist throughout the Cook Inlet watershed, including Merrill Field, Lake Hood, Kenai, and Homer (NMFS 2008a). Much of the de-icing material or their breakdown products eventually enter Cook Inlet, contributing to pollutant levels.

The current permit, issued in 2020, for the Ted Stevens Anchorage airport, requires monthly sampling and reporting of several water quality standards and an annual report for the outfall entering Knik Arm. When assessing impact to CI beluga whales, the ADEC determined that the waters near the outfall were used by belugas primarily as a transit corridor, to travel in and out of

Knik Arm, and that their exposure to elevated levels of contaminants in April and May when the majority of runoff occurs would be extremely limited[18]. We are unaware of information that would lead us to either affirm or refute ADEC's conclusion.

5.3.6 Ballast Water Discharges

Ships can potentially release pollutants and non-indigenous organisms into Cook Inlet through the discharge of ballast water. Marine organisms picked up in ship ballast water and released into non-native habitats are responsible for significant ecological and economic perturbations costing billions of dollars; this is a recognized worldwide problem. Discharges of wastes from vessels are regulated by the United States Coast Guard and, by law, no discharges of any kind are allowed within three miles of land.

An estimated 2.2 million metric tons of non-indigenous ballast water discharges were released in Cook Inlet each year between 1997 and 2001. A large portion of these discharges originated in Japan and the west coast of the United States; however, the origin of most of the discharges remains unknown (Robertson and Crews 2003). The National Ballast Information Clearinghouse reported that more than five million metric tons of ballast water was released in Cook Inlet, from Homer to Anchorage, between 1999 and 2003. Invasive species were found just off the POA in a 2004 survey by the Smithsonian Environmental Center. ADFG developed an Aquatic Nuisance Species Management Plan (Fay 2002) in order to protect Alaska’s waters. The effects of discharged ballast water and the possible introduction of invasive species on fin whales, humpback whales, and Cook Inlet beluga whales and Western DPS Steller sea lions are unknown.

5.3.7 Contaminants Found in Listed Species

Studies conducted in upper Cook Inlet found polychlorinated biphenyls (PCB), pesticide, and petroleum hydrocarbon levels below detectable limits in the water column and sediment, and heavy metals were below management levels (KABATA 2004; NMFS 2008a; USACE 2008).

Becker et al. (2000) compared levels of PCBs, chlorinated pesticides, heavy metals, and other elements between beluga populations in Greenland, Arctic Canada, and the St. Lawrence Estuary, and Cook Inlet, Point Hope, and Point Lay, Alaska. The Cook Inlet population had the lowest concentrations of PCBs, pesticides, cadmium, and mercury of all these populations, but had higher concentrations of copper than the other two Alaska populations. The lower levels might be related to differences in contaminant sources, food web differences, or different age distributions of the animals sampled. Concentration values of previously reported legacy organic contaminants in the Cook Inlet beluga whale population did not significantly change with the analysis of more recent samples; however, chemicals of emerging concern (e.g., polybrominated diphenyl ether, hexabromocyclododecane, and perfluorinated compounds) were identified. While the contaminant levels found in the Cook Inlet beluga whale population are lower than the levels in other populations, the effects of these contaminants on this population are unknown (Becker et

[18] ADEC.2019. Alaska Pollutant Discharge Elimination System Permit Fact Sheet Permit Number AKG315200. https://dec.alaska.gov/media/25419/ak0020648-prpsdfnlfs.pdf

al. 2000; NMFS 2008a).

O'Shea and R. L. Brownell (1994) state that concentrations of organochlorine and metal contaminants in tissues of baleen whales are low, and lower than other marine mammal species. They further state that there is no firm evidence that levels of organochlorines, organotins, or heavy metals in baleen whales generally are high enough to cause toxic or other damaging effects. Baleen whales can accumulate lipophilic compounds (e.g., halogenated hydrocarbons) and pesticides (e.g., DDT) in their blubber, as a result of feeding on contaminated prey (bioaccumulation) or inhalation in areas of high contaminant concentrations (e.g., regions of atmospheric deposition; (e.g., regions of atmospheric deposition; Barrie et al. 1992; Wania and Mackay 1993). Some contaminants (e.g., DDT) may be passed on maternally to young during gestation and lactation (e.g., fin whales, Aguilar and Borell 1994). The health effects of different doses of contaminants are currently unknown. There is evidence of detrimental health effects from these compounds in other mammals, including disease susceptibility, neurotoxicity, and reproductive and immune system impairment (Reijnders 1986; de Swart et al. 1996; Eriksson et al. 1998). Although there has been substantial research on the identification and quantification of such contaminants on individual whales, no detectable effect from contaminants has been identified in baleen whales. There may be chronic, sub-lethal impacts that are currently unknown.

Steller sea lions are exposed to local and system-wide contaminants and pollutants as they traverse the North Pacific basin. Effects on other pinnipeds have included acute mortality, reduced pregnancy rates, immuno-suppression, and reduced survival of first born pups (Section III of NMFS 2008b). There are no published reports of contaminants or pollutants (other than spilled oil) resulting in mortality of Steller sea lions (NMFS 2008b).

5.4 Fisheries

Cook Inlet supports several commercial fisheries, all of which require permits. Commercial fisheries are divided into the upper and lower Cook Inlet regions[19]. The upper region contains all waters north of Anchor Point and is further divided into the Northern (north of the West and East Foreland) and Central Districts (south of the Forelands to Anchor Point Light). Species commercially harvested in upper Cook Inlet include all five Pacific salmon species (drift and set gillnet), eulachon or smelt (dipnet), Pacific herring (gillnet), and razor clams (hand-digging); however, sockeye salmon are the most economically valuable[20].

Amendment 14 to the Fishery Management Plan for the Salmon Fisheries in the Exclusive Economic Zone off Alaska closed Federal waters of Cook Inlet to commercial salmon fishing. However, in June 2022, the district court overturned the closure of Federal waters to commercial driftnet fishing. In the absence of any Federal regulations, the State of Alaska manages commercial salmon fishing in both the State and Federal waters of Cook Inlet.

Recreational fisheries exist in the river systems on the western Kenai Peninsula for salmon

[19] Alaska Department of Fish and Game webpage. Commercial fisheries overview, Cook Inlet management area. Available http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareacookinlet.main, accessed April 11, 2022.
[20] Alaska Department of Fish and Game webpage. Commercial fisheries overview, Upper Cook Inlet management area. Available at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareauci.main, accessed April 11, 2022.

(Chinook, sockeye, pink, and coho), both freshwater and marine Dolly Varden char, and rainbow trout/steelhead trout. In the marine waters throughout Cook Inlet, recreational fishing occurs for salmon (Chinook and coho), Pacific cod, and halibut. Many of the charter fishing vessels targeting salmon and halibut operate out of Homer, in lower Cook Inlet. A new recreational dipnet fishery began in 2020 on the Susitna River from July 10 to July 31 on Wednesdays and Saturdays for all species other than Chinook salmon.

NMFS assumes that ADFG will continue to manage fish stocks and monitor and regulate fishing in Cook Inlet to maintain sustainable stocks. An important remaining unknown is the extent to which Cook Inlet marine mammal prey is made less available due to commercial, subsistence, personal use, and sport fishing either by direct removal of the prey or by human-caused habitat avoidance. Gathering data on this threat near the mouths of salmon and eulachon spawning streams is especially important. Other potential impacts from commercial fishing include ship strikes, harassment, and gear entanglement.

5.4.1 Entanglement

Reports of fatal takes of Cook Inlet belugas incidental to entanglement in fishing gear prior to the mid-1980s are documented in the literature (Murray and Fay 1979; Burns and Seaman 1986). There have been sporadic reports since the mid-1980s of single belugas becoming entangled in fishing nets; however, the only confirmed entanglement mortality was a young Cook Inlet beluga carcass recovered from a subsistence set net in 2012. Overall, the current rate of direct mortality from fisheries in Cook Inlet appears to be insignificant. Non-lethal entanglements have been documented; in 2005, a beluga entangled in an unknown object, perhaps a tire rim or a culvert liner, was photographed in Eagle Bay (McGuire et al. 2014), and another Cook Inlet beluga was repeatedly photographed in 2010–2013 with what appeared to be a rope entangled around the upper portion of its body near the pectoral flippers (McGuire et al. 2014). It is not known if these animals were able to disentangle themselves or if they died as a result of the entanglements (NMFS 2016).

Humpback whales have been killed and injured during interactions with commercial fishing gear; however, the frequency of these interactions does not appear to have a significant adverse consequence for humpback whale populations. Most humpbacks become entangled with gear between early June and early September, while foraging in nearshore Alaska waters. A photographic study of humpback whales in southeastern Alaska found at least 53 percent of individuals showed some kind of scarring from fishing gear entanglement (Neilson et al. 2005). Fishing gear involved in humpback entanglements between 1990 and 2016 included gillnet gear (37 percent), pot gear (29 percent), and longline gear (1-2 percent). In 2015, a humpback whale was entangled in a salmon purse seine net in Cook Inlet but was cut free by the fisherman and was assumed to be unharmed (Delean et al. 2020). In 2017, a minke whale or small humpback whale was reported entangled near the Lands End hotel in Homer. In 2019 a humpback whale was reported entangled near the Homer Spit (NMFS unpublished data). These are the only known incident of interactions of humpback whales and fisheries in Cook Inlet.

One incidental mortality of a fin whale entangled in ground tackle of a commercial mechanical jig fishing vessel was reported to NMFS in Alaska, resulting in an estimated annual mortality of 0.2 fin whales per year between 2010 and 2014 (Muto et al. 2018).

The minimum estimated mean annual mortality and serious injury rate in U.S. commercial fisheries between 2014 and 2018 was 37 Western DPS Steller sea lions, and this is likely an underestimate of the actual level (Muto et al. 2021). The NMFS Alaska Region marine mammal stranding network received three reports of Steller sea lion interactions with salmon hook and line gear and one report of an animal that was entangled in unidentified hook and line gear from 2014 to 2018 in Alaska. The mean annual mortality and serious injury rate was 0.8 sea lions in these unknown (commercial, recreational, or subsistence) fisheries (Muto et al. 2021). This mortality and serious injury estimate results from an actual count of verified human-caused deaths and serious injuries and is a minimum because not all entangled animals strand nor are all stranded animals found, reported, or have the cause of death determined. Overall, the relative impact on the recovery of the WDPS of Steller sea lion due to entanglement is ranked as low (NMFS 2008b).

Approximately 400 observations of Steller sea lion entanglements and fishery gear interactions, many of which were repeat sightings, were documented and reviewed by ADFG based on standardized annual summer surveys conducted at nearly every sea lion haulout and rookery in Southeast Alaska, Prince William Sound, the Barren Islands, and Bristol Bay from 2013-2017 (Delean et al. 2020). From these observations, 228 incidents of seriously injured Steller sea lions were determined to be unique animals. Among these records, hooking and/or ingestion of fishing gear (n = 114) and entanglement/entrapment in fishing gear and marine debris (n = 107) were most prevalent; the remainder (n = 7) were dependent pups with seriously injured mothers (Delean et al. 2020). No incidents were documented in Cook Inlet during this time, where both observation effort and sea lion density are low.

5.4.2 Competition for Prey

Fisheries in Cook Inlet, depending on gear type, species fished, timing, and fisheries location and intensity, have varying likelihoods of competing with marine mammals for fish. Cook Inlet beluga whales may experience reduced prey availability and/or habitat displacement due to commercial and recreational fishing activity. Cook Inlet belugas are dependent on access to relatively dense concentrations of high value prey species, particularly in the spring and throughout the summer months.

Norman (2011) estimated that 350 Cook Inlet beluga whales would consume a total biomass of approximately 1,250 metric tons of fish during the summer, and chum, coho, and other salmonid species constitute >54 percent of their summer diet (Hobbs and Shelden 2008). The 2020 Upper Cook Inlet commercial harvest of approximately 1.2 million salmon was 65 percent less than the recent 10-year average harvest of 3.2 million fish, and sockeye salmon returns were approximately 73 percent less than the 2010-2019 average annual harvest (Brenner et al. 2021). The 2020 upper Cook Inlet commercial harvest of all Chinook salmon stocks was 3,008 fish, which was 56 percent less than the previous 10-year average (2010–2019) annual harvest of 6,848 fish, and the second lowest harvest on record (Brenner et al. 2021). At this point, it is hard to know if these results are a short-term reflection of natural variation or are an indicator of a more systematic shift and downward trend. However, because salmon are the primary prey item for Cook Inlet beluga whales, these numbers may be a cause for concern. At best, they indicate there are fewer salmon available for commercial fisheries, recreational, personal and subsistence use, and beluga whales. A significant reduction in the amount of available prey could impact

Cook Inlet beluga whale energetics and delay recovery.

The operation of watercraft near the mouths and deltas of rivers entering Cook Inlet, Turnagain Arm, and Knik Arm may result in beluga whale habitat displacement, if pursuit of eulachon and salmon prey in these waters is impeded. NMFS has numerous reports of beluga whales in the Kenai River prior to and after the summer salmon fishing season; however, the whales have not been observed in or near the river in recent times when salmon runs are strong and fishing activity is high (Castellote et al. 2015; Shelden et al. 2015b).

There has been considerable debate among the scientific community as to whether fisheries reduce Steller sea lion prey biomass and quality at local and/or regional spatial scales, which then leads to a reduction in Steller sea lion survival and reproduction (NMFS 2008b). The minimum mean annual mortality and serious injury rate for all fisheries between 2014 and 2018 is 38 Western DPS Steller sea lions (Muto et al. 2021).

There is no known information summarizing interactions between large cetaceans and fishing in Cook Inlet. Prey competition is unlikely to occur, as the important foraging areas for humpback whales and fin whales are outside of Cook Inlet.

5.5 Tourism

There are no commercial whale-watching companies operating in upper Cook Inlet, nor are we aware of proposals to begin such operations. Other tourism including aerial flights (such as guided hunting trips and aerial tours) may effect Cook Inlet belugas by circling belugas or flying at low altitudes. NMFS has initiated outreach efforts to educate local pilots of the potential consequences of such actions. Pilots are encouraged to maintain altitudes of 1,500 ft over belugas and not to circle over them.

Tourism continues to grow in lower Cook Inlet, with Homer and Kenai as two popular destinations. Fishing in the Kenai River is a major draw, and a number of commercial vessel-based tour companies operate in the marine waters of lower Cook Inlet, primarily out of Homer. The tour vessels range in size and capacity from six to over 100 passengers, and include fishing as well as wildlife viewing (including marine mammal watching) tours.

There are also a number of commercial flight-seeing tour operators out of Homer. Flights occur over land on the Kenai Peninsula, the waters of lower Cook Inlet (Kachemak Bay), and across the Inlet to places such as Katmai National Park and McNeil River State Game refuge. These planes have the potential to disturb marine mammals, including whales, but particularly pinnipeds on haulouts and rookeries.

5.6 Direct Mortality

Within the proposed action area there are several potential sources of direct anthropogenic mortality, including shootings, strandings, fishery/gear/debris interactions, vessel collisions, predation, and research activities. NMFS is not aware of any illegal shootings of listed marine mammals in Cook Inlet (NMFS Alaska Regional Office Stranding Database accessed August 2022).

5.6.1 Subsistence Harvest

The ESA and MMPA allow for the harvest of marine mammal species by Alaska Natives for subsistence purposes and for the creation of traditional handicrafts. Subsistence harvest of Western DPS Steller sea lions occurs under co-management agreements with NMFS, and occurs at or well below sustainable levels of harvest. The best available statewide subsistence harvest estimates for Western DPS Steller sea lions are those from 2004 to 2008; annual statewide data on community subsistence harvest stopped being consistently collected as of 2009. The mean annual subsistence take (harvested plus struck-and-lost) from the Western DPS from 2004 through 2008, combined with the mean annual take between 2014-2018 from St. Paul, St. George, and Atka Island, was 209 sea lions per year (Muto et al. 2021).

Past subsistence harvests of Cook Inlet belugas have had a significant effect on the population. An unknown amount of harvest occurred for decades or longer; however, the subsistence harvest increased substantially to unsustainable levels in the 1980s and 1990s. Harvests during 1994-1998 likely account for the population decline during that interval. Cook Inlet beluga whale subsistence harvest discontinued in 1999 as a result of both a voluntary moratorium by the hunters that spring, and the passage of Public Law 106–31, section 3022 (later made permanent by Public Law 106-553, section 627), requiring any taking of Cook Inlet beluga whales by Alaska Natives to occur pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. A co-management agreement allowed the harvest of two whales in 2005 and one whale in 2006; however, no whales were taken in 2006 due to poor weather and the avoidance of females with calves. In 2008, NMFS issued regulations (73 FR 60976; October 15, 2008) establishing long-term limits on the maximum number of Cook Inlet beluga whales that may be taken for subsistence by Alaska Natives. These long-term harvest limits, developed for five-year intervals, require that the abundance estimates reach a minimum five-year average of 350 belugas (50 CFR 216.23(f)(2)(v)). No hunt has been authorized since 2006.

With the exception of the harvest of bowhead whales by subsistence hunters in the Alaska Eskimo Whaling Commission's 11 member villages, subsistence hunters in Alaska are not authorized to take any species of great whales, which includes humpback and fin whales (Muto et al. 2021; pers comm G. Balogh), under the Whaling Convention Act (16 USC § 916 et seq.), which implements the International Convention for the Regulation of Whaling. However, one humpback whale was illegally harvested in Kotlik in October 2006, and another in Toksook Bay in May 2016.

5.6.2 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. NMFS maintains an enforcement presence in upper Cook Inlet; however, effective enforcement across such a large area is difficult. NMFS Enforcement has investigated several reports of Cook Inlet beluga whale harassment, but there have been no confirmed poaching incidents.

Historically, Steller sea lions have been poached and illegally harvested throughout their range. The NMFS Alaska Marine Mammal Stranding Program documented 60 Steller sea lions with suspected or confirmed firearm injuries in Southeast and Southcentral Alaska from 2000–2019

(Wright 2016; Wright 2021). Western DPS Steller sea lions with gunshot wounds have been found stranded on shore along the outer Copper River Delta in recent years (Wright 2016; Wright 2021), and two men were convicted for illegally shooting sea lions in that area[21]. It was determined that seven of nine pinnipeds stranded in the surveyed area in 2019 were intentionally killed (Wright 2021).

Few illegal harvests of humpback whales have occurred in Alaska (only 2 cases are known); subsistence hunters in western Alaska were under the misperception that they could legally harvest large whales other than bowheads (e.g., humpback, gray, and minke whales). NMFS knows of no instances of illegal harvest of fin whales.

5.6.3 Stranding

Live stranding occurs when a marine mammal is found in waters too shallow to swim. Cook Inlet beluga whales are likely predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet where extreme tidal fluctuations occur. Strandings may be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then becoming trapped by receding tide), or a result of injury, illness, or death. Stranding events that last more than a few hours may result in mortalities. An estimated 876-953 live beluga strandings and 214 dead beluga beachings have been documented in Cook Inlet from 1988 through 2015 (NMFS 2016). Beluga whale stranding events may represent a significant threat to the conservation and recovery of this population.

Live strandings are uncommon among sea lions; however, pinniped strandings and mortality resulting from entanglement in fishing gear have been documented (Loughlin and York 2000) (Raum-Suryan et al. 2009; Muto et al. 2018).

Nearly all known cases of humpback whale and fin whale strandings involve animals that died at sea of various other causes and washed ashore. A young humpback whale live stranded on the mud in Turnagain Arm in April 2019 and, while it freed itself on an incoming tide at one point, the animal later died.

5.6.4 Predation

Killer whales are the only natural predators of beluga whales and Steller sea lions in Cook Inlet (Muto et al. 2018). Killer whale sightings were not well-documented prior to the mid-1980s and were likely rare in the upper Inlet. From 1982 through 2014, 29 killer whale sightings in upper Cook Inlet (north of the East and West Forelands) were reported to NMFS. During this time (1982-2014), between 9 and 12 beluga whale deaths were suspected to be a direct result of killer whale predation (NMFS 2016). In Cook Inlet, an average of one beluga was killed annually by killer whales prior to 2000 (Shelden et al. 2003), three belugas were reported as preyed upon by killer whales between 2001-2012 (NMFS unpublished data), and there were no reports of killer whale sightings in upper Cook Inlet or possible predation attempts from 2011 through 2014.

[21] United States Department of Justice, The United States Attorney's Office, District of Alaska webpage. Two Alaska men charged with harassing, killing Steller sea lions and obstructing the investigation into their illegal activities. Available at https://www.justice.gov/usao-ak/pr/two-alaska-men-charged-harassing-killing-steller-sea-lions-and-obstructing-investigation, accessed April 11, 2022.

Killer whale predation of belugas is likely underestimated, as remains of preyed-upon belugas may sink and go undetected by humans. Predation may potentially have a significant impact on the Cook Inlet beluga whale population (Shelden et al. 2003). 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).

The risk to Western DPS Steller sea lions from killer whale predation is considered potentially high (Muto et al. 2020), and may be one of the causes contributing to population declines.

5.6.5 Vessel Strikes

Beluga whales may be susceptible to strikes from commercial and recreational fishing vessels since both belugas and fishing activities occur where salmon and eulachon congregate. Cargo ships, oil tankers, and barges can also overlap spatially with belugas, creating a risk for vessel strike. A number of beluga whales have been photographed with propeller scars (McGuire et al. 2014), suggesting that small vessel strikes are not rare, but such strikes are often survivable. In an examination of 106 individuals, 37.7 percent had scars classified as either confirmed or from possible anthropogenic origin; 14 percent had signs of confirmed or possible vessel strike (McGuire et al. 2020c). A Cook Inlet beluga whale death in October 2007 was attributed to a potential vessel strike based on bruising consistent with blunt force injuries (NMFS unpublished data) and a beluga necropsy conducted in October 2012 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).

Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated, e.g., near rookeries or haulouts (NMFS 2008b). In 2007, a Steller sea lion was found in Kachemak Bay with two separate wounds consistent with blunt trauma, which may have been due to a boat collision (NMFS Alaska Regional Office Stranding Database accessed May 2022). The risk of vessel strike, however, has not been identified as a significant concern for Steller sea lions.

From 1978-2011, there were at least 108 recorded whale-vessel collisions in Alaska, with the majority occurring in Southeast Alaska (Neilson et al. 2012). Between 2013-2017, Delean et al. (2020) found that 29 humpback whales were struck resulting in 11.92 mortalities or serious injuries in Alaska and the U.S. West Coast. Among larger whales, humpback whales are the most frequent victims of ship strikes in Alaska, accounting for 86 percent of all reported collisions. There have been three documented large cetacean vessel collisions in Cook Inlet since 2001; one humpback whale, one fin whale, and one unidentified large cetacean. In 2001, a humpback whale was discovered on the bulbous bow of a 710 ft container ship as it docked in the Port of Anchorage; where the vessel may have collided with the whale is unknown. In 2005, a 28 ft charter boat hit an unidentified large cetacean (NMFS Alaska Regional Office Stranding Database accessed May 2022). In 2015, a dead fin whale was discovered at the Port of Anchorage on the bulbous bow of a ship traveling from Seattle; it is unknown where the strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2022). The very low number of humpback and fin whales in upper Cook Inlet greatly reduce the probability of vessel strike in this area.

5.6.6 Research

Research is necessary to assist in the recovery of threatened and endangered species; however, research activities may also disturb the studied animal(s). Marine mammal research often requires the use of boats, which add to vessel traffic, sound, and pollution the area. Boat-based surveys, such as photo-identification studies, often require the boat to closely approach whales or whale groups. Aerial surveys may also disturb whales, especially when circling at low-altitudes to obtain accurate group counts.

Section 104 of the MMPA allows for the permitting or authorization of the directed take of marine mammals for research, enhancement, or public display, and as with incidental take authorizations, any such permit or authorization must comply with the ESA. Scientific research and enhancement permits that authorize take of ESA listed marine mammals, including Cook Inlet beluga whales, are issued as joint permits under section 104 of the MMPA and section 10(a)(1)(A) of the ESA. In limited situations, permits may be issued under the MMPA only for endangered species if the permit authorizes Level B harassment and it has been determined that the activities will not likely adversely affect the species under the ESA. From 2017 through 2021, 11 MMPA/ESA research and enhancement permits authorized take of Cook Inlet beluga whales; these permits on average authorized approximately 20,680 takes per year. However, the majority of these takes (99 percent) are for remote, non-invasive methods of research during aerial and vessel surveys to conduct population monitoring (see discussion of takes below). In 2019, to support ESA section 7 consultation, the Office of Protected Resources completed a programmatic biological opinion with an extensive analysis of research impacts on endangered cetaceans (NMFS 2019a). A key conclusion of that biological opinion was that proposed research efforts directed at any cetacean population listed as endangered or threatened under the ESA, including Cook Inlet beluga whales, were unlikely to cause a change in abundance or reproduction.

More invasive research activities include animal capture, collecting blood and tissue samples, and attaching tracking devices such as satellite tags. Between 1999 and 2002, NMFS attached satellite tags to 18 beluga whales in upper Cook Inlet (Hobbs et al. 2005). The satellite tags provided data on dive behavior and movement within Cook Inlet (Shelden et al. 2018); however, of the 18 tags deployed in the summer, only 4 provided data into spring. In 2002, a tagged beluga was found dead 32 hours after being tagged. Another two tagged beluga whales, with similar dive patterns and tagged in the same manner as the deceased whale, transmitted data for less than 48 hours, and it is unknown if these whales also perished or were fitted with defective tags (NMFS, unpublished data). The photo identification project, started in 2005, identified many of the tagged belugas; 5 of the 14 tagged whales in the photo-id catalog had visible signs of tag-site infection, 8 had signs of concavity of the dorsal crest above the tag site, and two showed damage to the left pectoral fins, likely caused by flipper bands applied during tagging (McGuire and Stephens 2016). In 2015, a tagged whale washed up dead with an infection at the tag attachment site, potentially the cause of death.

There are many remaining data gaps on Cook Inlet beluga whale biology and ecology, and research efforts will continue (NMFS 2016). However, managers are cautious and only permit minimally invasive research techniques. Given the consequences of the tagging project and the status of the beluga population, it is unlikely that this type of project will be repeated.

Migura and Bollini (2022), assert that an increase in the authorized number of takes of Cook Inlet belugas projected to occur through 2025 is statistically correlated with the decreasing population size of this population. However, the authors did not evaluate the severity of the potential impacts from the authorized take. For instance, the vast majority of the authorized research takes (which comprise over 99% of the total authorized take in any year) are for remote, non-invasive methods such as photo-identification during aerial and vessel surveys that have the potential to result in only a minor degree of Level B harassment under the MMPA. Further, the programmatic biological opinion (NMFS 2019) prepared for NMFS' cetacean research and enhancement permitting program determined that these methods (aerial and vessel surveys) are not likely to adversely affect any ESA-listed populations or species, including Cook Inlet beluga whales. For example, permitted researchers conducting aerial or vessel-based surveys are directed to count each sighting that is closer than the distances of NMFS wildlife viewing guidelines as a take because the activities have the potential to harass animals, regardless of the likely severity of those takes. Further, for research activities, authorized takes are typically a larger number than the actual takes that occur. For example, 22,090 takes were authorized for Cook Inlet beluga research occurring in 2019 but only 2,405 takes occurred. Given this difference, it is unlikely that the correlation Migura and Bollini (2022) strive to make (between projected future authorized take numbers and the Cook Inlet beluga whale population decline) exists. In addition, long-term trend analysis of authorized take levels is not advisable because there have been changes in how take is interpreted and characterized in research permits. This means that, in some cases, take numbers across permits and across years are not directly comparable and at face value may seem like an increase in authorized take numbers. In recent years, managers have simplified how take numbers in research permits are determined to provide a more consistent approach to counting take across incidental and directed take permitting programs. OPR will continue to closely analyze the number of takes requested and used by researchers each year.

In addition to activities involving free-ranging Cook Inlet belugas, a single individual is currently housed in captivity. "Tyonek," a young calf, live-stranded near Trading Bay in Cook Inlet in 2017. With authorization from NMFS, the Alaska Sealife Center and partners provided rehabilitative care; however, NMFS determined that the animal was non-releasable due to underlying medical problems. Tyonek is now permanently located at Seaworld San Antonio, Texas, pursuant to a scientific research and enhancement permit, which includes an educational component. NMFS considers this to be a unique incident; there are no plans to house additional Cook Inlet beluga whales in captivity in the foreseeable future. Therefore, the long-term holding of Tyonek in captivity does not contribute to the DPS's endangered status.

With the low occurrence of humpbacks, fins, and Steller sea lions in the action area, this area is not a high priority for research of these species. However, they may be indirectly affected or harassed by other non-invasive research projects, such as Cook Inlet beluga aerial surveys. There have been no known instances of research-related deaths of humpback or fin whales in the action area. Aerial surveys have the potential to affect Steller sea lions; aircraft sound may result in stampedes, which can crush young animals and pups. NMFS has no knowledge of any stampedes associated with research in the action area.

5.7 Climate and Environmental Change

Since the 1950s the atmosphere and oceans have warmed, snow and sea ice have diminished, sea levels have risen, and concentrations of greenhouse gases have increased (IPCC 2014). There is little doubt that human influence has been the dominant cause of the observed warming since the mid-20th century (IPCC 2014). The impacts of climate change are especially pronounced at high latitudes and in polar regions. Average temperatures have increased across Alaska at more than twice the rate of the rest of the United States (EPA 2017). In the past 60 years, average air temperatures across Alaska have increased by approximately 3˚F, and winter temperatures have increased by 6˚F (Chapin et al. 2014). Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014). Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton 2001; McCarthy et al. 2001). The impacts of these changes and their interactions on listed species in Alaska are hard to predict.

Cook Inlet beluga whales likely rely on the combined salmon escapement from multiple watersheds. Changes in prey availability to belugas may result from changes in the total availability, quality, species composition, and seasonality of prey. The greatest climate change risks may be potential changes in salmon and eulachon abundance. These changes could occur through regime shifts and changes in ocean ecosystems and/or through changes in these species' freshwater habitat. Temperature and hydrology control several critical stages in the life cycle of salmonids in their freshwater habitats. During periods of rapid climate change, these can have significant effects on anadromous salmonid populations (Bryant 2009).

Indirect threats associated with climate change include increased human activity as a result of regional warming. Less ice could mean increased vessel activity or construction activities with an associated increase in sound, pollution, and risk of ship strike. Human fishing pressure could change the abundance, seasonality, or composition of beluga whale prey. Fisheries in Alaska are managed with the goal of sustainability; however, not all fish stocks are assessed, and it is unknown whether management of fisheries for optimal returns provides sufficient densities in beluga feeding areas for efficient foraging by belugas (NMFS 2016).

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 are other potential indirect threats from climate change. More rapid melting of glaciers might also change the silt deposition in the Susitna Delta, potentially altering habitat for prey (NMFS 2008a). 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.

In summary, the effects of climate change will likely create several challenges to Cook Inlet beluga whales, primarily through impacts to their primary prey species, salmon. Warmer ocean temperatures, warmer stream temperatures, and warmer air temperatures will likely create many challenges and changes to the freshwater and marine ecosystems that salmon depend on. Pre-spawning salmon mortalities, reductions in returns, and shifts in run timing have already been documented. It remains to be seen how adaptable both salmon and belugas can be in the face of rapidly changing conditions.

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. There was no clear trend in the number of humpback whale sightings in lower Cook Inlet between 2004 and 2016. An Unusual Mortality Event (UME) of large cetaceans occurred in Alaskan waters in 2015-2016. Reports of dead whales included 22 dead humpback, 12 fin, 2 gray, 1 sperm, and 6 unidentified whales. The fin whales were observed stranded within a 27-day period around Kodiak Island. This was concurrent with an unusually large number of dead whales found in British Columbia, which included 6 humpback, 5 fin, and 1 sperm whale (NMFS unpublished data). The strandings were concurrent with the arrival of the Pacific marine heatwave. The mortalities were also concurrent with one of the strongest El Nino weather patterns on record, decreasing ice extent in the Bering Sea, and one of the warmest years on record in Alaska in terms of air temperature. While we cannot say with certainty that this UME was caused or exacerbated by climate change, it remains a reasonable hypothesis.

The Pacific marine heatwave, or “the blob”, is also likely responsible for poor growth and survival of Pacific cod, an important prey species for endangered Steller sea lions. The 2018 Pacific cod stock assessment estimated that the female spawning biomass of Pacific cod was at its lowest point in the 41-year time series considered in the assessment. This assessment was conducted following three years of poor recruitment in 2014-2016 and increased natural mortality during the 2014-2016 Gulf of Alaska marine heat wave (NMFS 2018a). Biologists also attribute increases in bird die-offs, whale strandings, toxic algae blooms, and poor salmon survival to warmer water conditions (Bernton 2017).

Cook Inlet beluga whale habitat may be affected by climate change and other large-scale environmental phenomena including Pacific Decadal Oscillation (PDO) (a long-lived El Nino-like climate variability that may persist for decades) and ecological regime shifts. Climate change can potentially affect prey availability, glacial output and siltation, and salinity and acidity in downstream estuarine environments (NMFS 2010a; NMFS 2016). PDO may influence rainfall, freshwater runoff, water temperature, and water column stability. Ecological regime shifts, in which species composition is restructured, have been identified in the North Pacific (Hollowed and Wooster 1992; Anderson and Piatt 1999; Hare and Mantua 2000) and are believed to have affected prey species availability in Cook Inlet and the North Pacific. These events may result in seasonal and spatial changes in prey abundance and distribution and could affect habitat for Cook Inlet beluga whales.

Natural Catastrophic Changes

Cook Inlet beluga whales, humpback whales, fin whales and Steller sea lions inhabit regions of known seismic and volcanic activity and tsunami events. Earthquakes, volcanic eruptions, landslides, and tsunamis can alter the physical environment instantaneously. Catastrophic events are infrequent but have the potential to impact ESA listed species by: decreasing prey abundance as a result of direct mortality; rendering habitat unsuitable for ESA listed species and prey species; directly removing habitat areas (e.g., elevation changes, landslides, and tsunamis could remove haulouts and rookeries or block access to habitat); and, degrading habitat quality (e.g., volcanic ash outfall could affect siltation and water chemistry; NMFS 2016). To date, natural catastrophes are not known to have impacted any of these species.

5.8 Summary of Baseline Environmental Stressors Affecting Listed Species in the Action Area

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

- Coastal development, particularly at the Port of Alaska, has resulted in exposure of beluga whales to sound levels capable of causing harassment.
- Oil and gas development has resulted in 231 spills in the Cook Inlet region in the last 10 years.
- Seismic exploration has introduced anthropogenic sound into the marine environment of Cook Inlet, creating zones as large as 9.5 km-radius in which sound was sufficiently loud to cause harassment. Seismic exploration has resulted in harmful Level A sound exposure to both humpback and beluga whales. It has also resulted in the temporary degradation of Cook Inlet beluga whale habitat.
- Aircraft have been observed to cause behavioral changes to groups of feeding beluga whales when the aircraft flew past at low altitudes or circled the groups.
- Fisheries that co-occur with concentrations of beluga prey may be competing with the whales. Beluga whales no longer avail themselves of abundant but heavily human-exploited salmon runs off the Kenai River during summer as they once did.
- Commercial fisheries may have reduced prey availability.
- Prior to 1999, subsistence whaling for Cook Inlet beluga whales by Alaska Natives represented the largest known anthropogenic mortality for the stock. The population had seriously declined since 1979, from about 1,300 whales to 347 whales at the time of the moratorium (NMFS 1999). The last beluga was harvested in 2005.
- Subsistence harvest of Western DPS Steller sea lions occurs under co-management agreements with NMFS, and occurs at or well below sustainable levels of harvest.
- Vessel traffic in Cook Inlet poses varying levels of threat to the species depending on the type and intensity of the shipping activity and its degree of spatial and temporal overlap with habitats. Strikes have involved cruise ships, recreational cruisers, fishing vessels, and skiffs. The presence, movements, and sound of ships in the vicinity of some species may cause them to abandon breeding or foraging areas.
- Propeller scars observed on belugas may have resulted from collisions with recreational or commercial fishing boats.

- Whether contaminants have resulted in the degradation of Cook Inlet beluga whale habitat remains unknown. Contaminant loads in Cook Inlet beluga whales are low compared to other stocks.
- Wastewater is discharged into Cook Inlet, much of it untreated or undergoing only primary treatment. Effects of this discharge on marine mammals remain unknown.
- One Cook Inlet beluga whale died shortly after attachment of a satellite transmitter in the early 2000s. Another two tagged beluga whales, with similar dive patterns and tagged in the same manner as the deceased whale, transmitted data for less than 48 hours, and it is unknown if these whales also perished or were fitted with defective tags (NMFS, unpublished data). Another died in 2015 with an infection at the tag attachment site. NMFS no longer authorizes invasive research with these tags (or similar tags) of Cook Inlet beluga whales, and no recent mortalities incidental to marine mammal research activities in the action area have been documented.
- There are insufficient data to make reliable estimations of the impact of climate change on marine mammals considered in this Biological Opinion. The feeding range of humpback and fin whales is larger than that of other species and consequently, as feeding generalists, it is likely that these two species may be more resilient to climate change than other species with more restricted foraging habits. Although the effects of climate change and other large scale environmental phenomena on Steller sea lion and Cook Inlet beluga whale habitat cannot be predicted with certainty, impacts to their prey from oceanic regime shifts, or changes in freshwater habitat (hydrologic changes, increased water temperature) are projected to occur.
- The beluga whale has undergone notable summer range restriction in recent years, and whales now occur predominantly in upper Cook Inlet.

The Cook Inlet beluga population continues to decline for unknown reasons, the population trend of Western North Pacific DPS and Mexico DPS of humpback whales is unknown, and the population trend of fin whales is unknown. In contrast, Western DPS Steller sea lions within Southcentral Alaska appear to be stable or increasing. Although we do not have information on other measures of the demographic status of Steller sea lions (for example, age structure, sex ratios, or the distribution of reproductive success) that would facilitate a more robust assessment of the probable impact of factors discussed in the *Environmental Baseline*,[22] we infer from their increasing abundance in the vicinity of Cook Inlet that no factor alone or in combination is preventing this population from increasing in this area.

The main threats to recovery of Western North Pacific and Mexico DPS humpback whales is thought to be entanglement in fishing gear and vessel strike due to increased shipping throughout their range (Muto et al. 2020). These threats are discussed in this *Environmental Baseline*, but do

[22] Increase in a population's abundance is only one piece of evidence that a population is improving in status; however, because populations can increase while experiencing low juvenile survival (e.g., if low juvenile survival is coupled with reduced adult mortality) or when those individuals that are most sensitive to a stress regime die, leaving the most resistant individuals, increases in abundance are not necessarily indicative of the long-term viability of a species.

not appear to be significant stressors in Cook Inlet.

The cause, or causes, of the continued decline of Cook Inlet beluga whales is unknown. The Recovery Plan (NMFS 2016) outlines multiple threats to Cook Inlet beluga whales. Many of the projects and issues discussed in this *Environmental Baseline* are specific examples of these types of threats (e.g., sound, habitat loss or degradation, pollution, cumulative effects, etc.).

6. Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the 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. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. 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 biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS gives the benefit of the doubt to the listed species by minimizing the likelihood of false negative conclusions (concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

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

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

NMFS identified and addressed all potential stressors; and considered all consequences of the proposed action, individually and cumulatively, in developing the analysis and conclusions in this opinion regarding the effects of the proposed action on ESA-listed species. The proposed action (issuance of the IHAs), results in two years of drilling and plugging and abandonment activities in Cook Inlet. The proposed action is not expected to increase Hilcorp's future oil and gas production but rather Hilcorp will continue to operate in a manner similar to production operations prior to the proposed action. Therefore the project is not expected to increase aircraft, support vessels, and other platform operations outside of the drilling season. Effects during the drilling season are analyzed in Section 6, and effects from all past and ongoing activities are analyzed in Section 5. While the IHAs cover only two drilling seasons, we assume a similar level of activities could be ongoing over the life of the drilling platforms.

6.1 Project Stressors

Stressors are any physical, chemical or biological phenomena that can induce an adverse response. The effects section starts with identification of the stressors produced by the constituent parts of the proposed action. Based on our review of the IHA applications, personal communications, and available literature as referenced in this biological opinion, the proposed activities may cause the following stressors to ESA-listed marine mammals:

1. Sound fields produced by non-impulsive sound sources such as: tugs towing the jack-up rig, drilling operations, well plugging and abandonment, water jets, multibeam echosounder, handheld underwater power tools with source levels <167 dB re 1 μPa at 1 m, support vessels, and aircraft;
2. Risk of vessels striking marine mammals;
3. Seafloor disturbance and habitat alteration from P&A of Well 17589 and production drilling;
4. Entanglement and ingestion of trash and debris; and,
5. Pollution.

Below we discuss each stressor's potential to affect ESA-listed species (Cook Inlet beluga whales, humpback whales, fin whales and Steller sea lions).

6.2 Exposure and Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, exposure analyses are designed to identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence. In this step of our analysis, we 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.

As discussed in Section 2.1.2 above, Hilcorp proposed mitigation measures that should avoid or minimize exposure of Cook Inlet beluga whales, humpback whales, fin whales, and Steller sea lions to one or more stressors from the proposed action.

For our exposure analyses, NMFS generally takes under advisement an action agency's estimates of the number of marine mammals that might be "taken" (as per the MMPA) over the duration of the proposed action. Hilcorp provided a two-year quantitative exposure analysis to NMFS Permits Division with its IHA application. Based on these initial qualitative and quantitative analyses, NMFS Permits Division calculated the exposure and "take" estimates for two years of the project.

Following the exposure analysis is the response analysis. The 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.

Each stressor may result in similar or different responses. Possible responses by ESA-listed marine mammals to project activities in this analysis are:

- Auditory threshold shifts
    - Temporary threshold shift (TTS)

  - Permanent threshold shift (PTS)
- Non-auditory physical and physiological effects
  - Stress
  - Distress
- Behavioral responses
  - Change in vocalizations
  - Change in behavioral state
  - Avoidance or Displacement
- Auditory interference
  - Masking

The potential responses to each project stressor are described in Sections 6.2.1 and 6.2.2. This analysis also considers information on the potential effects on prey of ESA-listed species in the action area.

While each activity may result in underwater sound and potential disturbance to marine mammals, not all of the activities are expected to exceed the ESA harassment criteria, and therefore, are not evaluated in estimating exposures. For purposes of ESA Section 7 consultation, NMFS interprets the term "harass," to mean 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). Only those specific activities identified as exceeding MMPA take criteria (i.e. Level B Harassment) were evaluated for potential ESA harassment exposure. Using MMPA take criteria sets a conservative take threshold and ensures that all potential ESA take is considered: any activity that rises to harassment take under the ESA would constitute harassment take under the MMPA.

Activities exceeding the Level B take criteria that were used to estimate ESA exposure include tugs towing the jack-up rig. Other activities and stressors such as support vessels, water jets, impact wrench, and other hand held tools may have impacts to listed species, however impacts maybe minor and undetectable or improbable and would not rise to the level of take under the ESA. Additionally, mitigation measures are expected to reduce the likelihood of exposure for some stressors. For purposes of our analysis, we are considering any anticipated take under the MMPA to be expected take under the ESA.

Threshold Shifts

Exposure of marine mammals to very loud sound can result in physical effects, such as changes to sensory hairs in the auditory system, which may temporarily or permanently impair hearing. Temporary threshold shift (TTS) is a temporary hearing change, and its severity is dependent upon the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). TTSs can last minutes to days. Full recovery is expected, and this condition is not considered a physical injury. At higher received levels, or in frequency ranges where animals are more sensitive, permanent threshold shift (PTS) can occur. When PTS occurs, auditory sensitivity is unrecoverable (i.e., permanent hearing loss). The effect of sound exposure generally depends on a number of factors relating to the physical and spectral characteristics of the sound (e.g., the intensity, peak pressure, frequency, duration, duty cycle), and relating to the animal under consideration (e.g., hearing sensitivity, age, gender, behavioral status, prior exposures). Both TTS and PTS can result from a single pulse or from accumulated effects of multiple pulses from an impulsive sound source or from accumulated effects of non-pulsed sound from a continuous sound source. In the case of exposure to multiple pulses, each pulse need not be as loud as a single pulse to have the same accumulated effect.

As it is a permanent auditory injury, the onset of PTS may be considered an example of "Level A harassment" as defined in the MMPA. TTS is by definition recoverable, and is considered "Level B harassment" under the MMPA. Behavioral effects may also constitute Level B harassment and are expected to occur at received levels that may not cause TTS. Marine mammals hearing range and NMFS acoustic thresholds leading to TTS and PTS are discussed further in Section 6.2.2.2

Non-Auditory Physical or Physiological Effects

Marine mammals use hearing as a primary way to gather information about their environment and for communication; therefore, we assume that limiting these abilities is stressful. Individuals exposed can experience stress and distress; stress is an adaptive response that does not normally place an animal at risk, and distress is a stress response resulting in a biological consequence to the individual. Both stress and distress can affect survival and productivity (Curry and Edwards 1998; Cowan and Curry 2002; Herráez et al. 2007; Cowan and Curry 2008). Mammalian stress levels can vary by age, sex, season, and health status (St. Aubin et al. 1996; Gardiner and Hall 1997; Hunt et al. 2006; Romero et al. 2008).

Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur naturally. For example, multiple studies have investigated the impact of vessels on marine mammals (both whale-watching and general vessel traffic sound) and documented impacts (Erbe 2002; Williams et al. 2002; Williams and Ashe 2006; Williams and Noren 2009; Pirotta et al. 2015). Williams and Noren (2009) indicated that vessel disturbance from whale-watching in the Johnstone Strait resulted in lost feeding opportunities for killer whales. Shipping traffic and associated ocean sound decreased along the northeastern U.S following September 11, 2001. The decrease in ocean sound was associated with a significant decline in fecal stress hormones found in North Atlantic right whales, suggesting that chronic exposure to increased sound levels, although not acutely injurious, can produce stress (Rolland et al. 2012). Exposure to loud sound can also adversely affect reproductive and metabolic physiology; females appear to be more sensitive or respond more strongly than males in a variety of factors, including behavioral and physiological responses (Kight and Swaddle 2011).

If a sound is detected by a marine mammal, a stress response (e.g., startle or annoyance) or a cueing response (based on a past stressful experience) can occur. Although preliminary because of the small numbers of samples collected, different types of sounds have been shown to produce variable stress responses in marine mammals. Stress responses may also occur at levels lower than those required for TTS (Southall et al. 2007). Therefore, exposure to levels sufficient to trigger onset of PTS or TTS are expected to be accompanied by physiological stress responses (NRC 2003). Belugas demonstrated no catecholamine (hormones released in situations of stress) response to the playback of oil drilling sounds (Thomas et al. 1990) but showed an increase in catecholamines following exposure to impulsive sounds produced from a seismic water gun (Romano et al. 2004).

We expect that the proposed action may result in ESA-listed species experiencing Level B acoustic harassment and/or exhibiting behavioral responses from project activities. Therefore, we expect ESA-listed whales and sea lions may experience stress responses. If whales and sea lions are not displaced and remain in a stressful environment (i.e., within the behavioral harassment zone), we expect the stress response will dissipate shortly after the individual leaves the area or after the cessation of the acoustic stressor.

Behavioral Response

NMFS expects the majority of ESA-listed species responses to the proposed activities will occur in the form of behavioral response. Marine mammals may exhibit a variety of behavioral changes in response to underwater sound and the general presence of project activities and equipment, which can be generally summarized as:

- Modifying or stopping vocalizations
- Changing from one behavioral state to another
- Movement out of feeding, breeding, or migratory areas

The response of a marine mammal to an anthropogenic sound will depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sound was first conducted by Richardson et al. (1995). More recent reviews (e.g., Nowacek et al. 2007; Southall et al. 2007; Southall et al. 2009; Ellison et al. 2012) address studies conducted since 1995 and focus on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Except for some vocalization changes that may be compensating for auditory masking, all behavioral reactions are assumed to occur due to a preceding stress or cueing response; however, stress responses cannot be predicted directly due to a lack of scientific data (see following section). Responses can overlap; for example, a flight response is likely to be coupled with an increased respiration rate. Differential responses are expected among and within species since hearing ranges vary across species and individuals, the behavioral ecology of individual species is unlikely to completely overlap, and individuals of the same species may react differently to the same, or similar, stressor.

Marine mammal responses to anthropogenic sound vary by species, state of maturity, prior exposure, current activity, reproductive state, time of day, and other factors. This is reflected in a variety of aquatic, aerial, and terrestrial animal responses to anthropogenic sound that may ultimately have fitness consequences (Francis and Barber 2013).

Auditory Interference (masking)

Auditory interference, or masking, occurs when an interfering sound is similar in frequency and loudness to (or louder than) the auditory signal received by an animal while it is processing echolocation signals or listening for acoustic information from other animals (Francis and Barber 2013). Masking can interfere with an animal's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Francis and Barber 2013).

Clark et al. (2009) developed a methodology for estimating masking effects on communication signals for low frequency cetaceans, including calculating the cumulative impact of multiple sound sources. They found that two commercial vessels passing through a North Atlantic right whale's optimal communication space decreased the size of that space by 84 percent. Subsequent research for the same species and location estimated that an average of 63 to 67 percent of North Atlantic right whale's communication space has been reduced by an increase in background noise levels, and that sound associated with transiting vessels is a major contributor to the increase in background noise (Hatch et al. 2012).

Vocal changes in response to anthropogenic sound can occur across sounds produced by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic sound sources such as sonar, vessel sound, and seismic surveying. Vocalizations may also change in response to variation in the natural acoustic environment (e.g., from variation in sea surface motion) (Dunlop et al. 2014).

Hilcorp Alaska's oil and gas activities in Cook Inlet are not expected to result in extended periods of time where masking could occur. Masking only exists for the duration of time that the masking sound is emitted.

6.2.1 Minor Stressors on ESA-Listed Species

6.2.1.1 Production Drilling

On-platform production drilling itself creates sound due to the use of generators and other potentially sound-generating equipment. Sound producing rig engines are located above the platform's drill deck. The platform's drill deck is the top-most deck of the platform, ranging from approximately 80' to 140' above mean high water. Mud pumps are located on the jack up rig.

Located below the drill deck and above the supportive superstructure of the platform are multiple floors/levels of various production and operations equipment that run constantly including compressors, generators, turbines, fluids handling and pumping systems, etc. This permanently installed platform production equipment is greater in size and capacity and is physically located closer in proximity to the water column than any of the smaller and temporary rig equipment.

It is expected that sound from drilling in existing wells is quieter than drilling new wells because drilling of existing wells occurs hundreds to several thousand feet below the seafloor and within existing well slots or existing wellbores. However, there are no known underwater acoustic measurements for on-platform production drilling from existing wells. Underwater acoustic measurements of new wells were performed by Furie Operating Alaska, LLC northeast of Nikiski Bay in the vicinity of the Spartan 151 in water depths of 24.4 to 27.4 m (80 to 90 ft; Marine Acoustics Inc. 2011). Primary sources of rig-based acoustic energy were identified as coming from the D399/D398 diesel engines, the PZ-10 mud pump, ventilation fans, and electrical generators, which are all above water but can be heard in-water. The in-water source level of one of the loudest acoustic sources, the diesel generators, was estimated to be 137 dB re 1 μPa rms at 1 m in the 141 to 178 Hz frequency range. Sound source levels were also measured by JASCO for drilling and mud pumping from the Yost jack-up rig in 2016 in the Kitchen Lights Unit area for the drilling of a new well. The primary sources of continuous sounds measured in-water from the Yost were drilling (158 dB) and mud pumping (148.4 dB) that may produce 120 dB isopleths of 330 and 225 meters, respectively. The acoustic energy of drilling sound was found to be predominantly under 500 Hz (Denes and Austin 2016). We expect sound source levels to be less for drilling operations from existing wells, as is the case for the proposed action, than from the drilling of new wells.

Some characteristics of drilling sounds are similar to vessel sounds in that they are relatively low-level and low-frequency. It is thought that low frequency marine mammals are disproportionately affected by increases in low frequency noises, such as masking (Clark et al, 2009). In general, during the summer and fall, beluga whales occur in shallow coastal waters (Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b) and Hilcorp's platforms associated with the proposed action are located deeper water. Since the rig is stationary in locations with low marine mammal density, the impact of drilling sounds produced from the jack up rig is expected to be low. There is open water in all directions from drilling locations. Any marine mammal approaching the rig would be fully aware of its presence long before approaching; we are unaware of any specifically important habitat features (e.g., concentrations of prey or refuge from predators) within the rig's zone of influence that would encourage marine mammal use and exposure to higher levels of sound closer to the source. All drilling is within Cook Inlet beluga whale habitat. However, given the seasonality of Cook Inlet beluga whale distribution and infrequent sighting of Cook Inlet beluga whales in the action area, we do not expect low-level drilling noise in the area to impact important biological functions or measurably alter habitat use of the whales. While research specific to drilling noise is limited, acoustic monitoring by Bach et al. (2010) indicated that offshore platforms and drilling activities did not pose a significant threat to small cetaceans in the North Sea, although minor short-term effects are possible during periods of high noise intensity (e.g. platform construction).

The permanently installed platform equipment is located on a deck below where the mobile jack-up rig drilling operations occur. This permanently installed platform production equipment is greater in size and capacity than the mobile jack-up rig. Additionally, drilling will occur within existing well holes at depths of hundreds to thousands of feet below the seafloor. Therefore, it is not expected that the addition of the mobile jack-up rig will create a discernible increase in overall sound generated by platform operations.

With the recent range contraction of Cook Inlet belugas to their core range to the north and their occurrence during the summer and fall in shallow coastal waters in and near the Susitna River Delta, Knik Arm, Turnagain Arm, and Chickaloon Bay, and near Fire Island in the upper inlet

(Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b), as well as near the Kenai River in the lower Inlet (McGuire et al. 2020b), the number of belugas near drilling platforms is expected to be low. Other listed marine mammal densities are also low near platforms (Section 4.3). Drilling sound is naturally "ramped up" from an initial low rotation pressure, such that this non impulsive sound source is unlikely to startle an approaching animal. Additionally, Hilcorp will monitor prior to the starting up of drilling, further reducing the likelihood of a startle reaction of any listed species in the area. It is not expected that any impacts from drilling operations will cause a significant disruption in marine mammal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating. Therefore, the impact of drilling sound is expected to be very minor, and any effects to Cook Inlet beluga, Mexico DPS and Western North Pacific DPS humpback, fin whales, and western DPS Steller sea lions is expected to be immeasurably small.

6.2.1.2 P&A Activities

Hilcorp may use a multi-beam echosounder during P&A activities at Well 17589 to ensure the seafloor is clear of debris that might impede pinning the legs of the platform. The multibeam echosounder emits high frequency (240 kilohertz [kHz]) energy in a fan-shaped pattern of equidistant or equiangular beam spacing. The multi-beam echosounder operates at a frequency outside of marine mammal hearing range. The multi-beam echosounder would be used in conjunction with a support vessel, therefore, the potential effects from the physical presence of the multi-beam echosounder are expected to be unmeasurable compared to the support vessel. The use of the multi-beam echosounder and associated effects to Cook Inlet beluga, Mexico DPS and Western North Pacific DPS humpback, fin whales, and western DPS Steller sea lions is expected to be undetectable.

A water jet is a zero-thrust water compressor that is used for underwater removal of marine growth or rock debris on the structure. The system operates through a mobile pump, which draws water from the location of the work. Water jets that will likely be used in Cook Inlet include, but are not limited to, the CaviDyne CaviBlaster® and the Gardner Denver Liqua-Blaster. Hilcorp Alaska conducted underwater measurements during 13 minutes of CaviBlaster® use in Cook Inlet in April 2017 (Austin 2017). Sounds from the Caviblaster® were clearly detectable out to the maximum measurement range of 1.1 km. Using the measured transmission loss of 19.5 log R, the sound source level for the Caviblaster® was estimated as 176 dB re 1 μPa at 1 m yielding a 120 dB distance threshold of 860 m. The sounds were broadband in nature, concentrated above 500 Hz with a dominant tone near 2 kHz. Hilcorp's mitigation measures include monitoring a 1,000 m shutdown zone during the use of water jets. If a listed marine mammal is observed within the shutdown zone, the PSO or trained crewmember will call for a delay in commencement of the activity or cease the activity.

Impact wrenches (e.g., Stanley IW16 or IW12) will be used for torquing the lock-down-screws on the slip-lock wellhead as well as for flanging up the 20" riser from the wellhead connection to the rig blowout preventers. The impact wrenches will also be used to break flanges of the 20" riser and remove the slip-lock wellhead. The Stanley IW12 and IW16 impact wrenches have similar underwater acoustic properties, and the IW16 model has an estimated a source level of 167 dB re 1 μPa at 1m (Anthony et al. 2009). Because this sound source level was not measured in Cook Inlet we used a conservative transmission loss of 15 log R, with an estimated sound source level of 167 dB re 1 µPa at 1m, yields a 120 dB distance threshold of 1,359 m. Hilcorp's mitigation measures include monitoring a 1,400 m shutdown zone during the use of an impact wrench. If a listed marine mammal is observed within the shutdown zone, the PSO or trained crewmember will call for a delay in commencement of the activity or cease the activity.

Hilcorp may need to use other handheld tools during the plug and abandonment. Most tools are not expected to emit sound above 120 dB. For any other handheld tools that do admit a sound source between 120 dB and 167.7 re 1 µPa at 1m, Hilcorp will monitor a 1,500 m shutdown zone for these other handheld tools.

Water jets, impact wrenches, and other handheld tools are only expected to be used for a short period of time. No published data on marine mammal responses to sound associated with this equipment (stationary non-impulsive sound) exist. However, with the implementation of mitigation measures it is expected that any impacts to listed species will be minor and improbable.

Water jets produce sound between 0.5 kHz to 2 kHz, within the hearing ranges for the Cook Inlet beluga whales, fin whales, Mexico DPS humpback whales, Western North Pacific DPS Humpback whales, and Western DPS Steller sea lions, and therefore, masking of important sounds for ESA-listed species could occur. Masking only exists for the duration of time when water jets sound is emitted and would be short-term (30 minutes or less at any given time) and episodic. However, mitigation measures including shutting down prior to listed marine mammals entering a 120 dB behavioral threshold will reduce the likelihood of masking.

Out of all the ESA-listed species, beluga whales will more likely be affected by sound associated with water jets because water jet activity will take place in middle Cook Inlet where belugas are more common than other whales; however, the effects will likely be minimal due to the short duration of the activity. Fin whales, humpback whales and Steller sea lions are not frequently found in middle Cook Inlet where water jet activity will take place, and therefore, will not likely be greatly affected by sound from this activity. Hilcorp Alaska will implement mitigation and monitoring measure to reduce the potential impacts to ESA-listed species (Section 2.1.2).

In consideration of the mitigation measures to be implemented and the low likelihood of exposure above the 120 dB harassment threshold, impacts to the Cook Inlet beluga whales, fin whales, Mexico DPS humpback whales, Western North Pacific DPS Humpback whales, and western DPS Steller sea lions from P&A activities are expected to be undetectable and minor.

6.2.1.3 Supply Vessel Operations

Vessels of various types and sizes are used to support project activities, specifically for transport of crew and supplies to the rigs and platforms, and for other maintenance activities. The primary underwater sound associated with vessel operations is the continuous cavitation sound produced by the propeller arrangement. Bow thrusters are occasionally used for a short duration (20 to 30 seconds) to either push or pull a vessel in or away from the dock or platform. Other sound sources include onboard diesel generators and sound from the main engine, but both are subordinate to the thruster and main propeller blade rate harmonics (Gray and Greeley 1980).

Vessel sound and presence can impact whales by causing behavioral disturbances, auditory interference, or non-auditory physical and physiological effects (e.g., vessel strike). Based on a suite of studies of cetacean behavior due to vessel approaches, variables that determine whether marine mammals are likely to be disturbed by surface vessels include the number of vessels, distance between the animal and the vessel, vessel speed and vector, and behavioral state of the animal (Au and Perryman 1982; Hewitt 1985; Bauer and Herman 1986; Corkeron 1995; Bejder et al. 1999; Au et al. 2000; Nowacek et al. 2001; David 2002; Magalhaes et al. 2002; Ng and Leung 2003; Goodwin and Cotton 2004; Bain et al. 2006; Bejder et al. 2006; Lusseau 2006; Richter et al. 2006; Lusseau and Bejder 2007).

Free-ranging marine mammals may habituate to, tolerate, or avoid surface vessels moving toward them (Wartzok et al. 2003). Animals have been observed reducing their visibility at the water's surface and moving horizontally away from the source of disturbance or adopting erratic swimming strategies (Williams et al. 2002; Lusseau 2003; Lusseau 2006). Dive times increased, vocalizations and jumping decreased (with the exception of beaked whales), individuals in groups moved closer together, and swimming speeds increased (Kruse 1991; Evans et al. 1994). Most animals in confined spaces, such as shallow bays, tended to move towards more open, deeper waters when vessels approached. This movement likely provided more opportunities to avoid or evade vessels as conditions warranted. It is unclear if these responses are caused by the physical presence of the vessel, the underwater sound generated by the vessel, or an interaction between the two (Goodwin and Cotton 2004; Lusseau 2006). However, several authors suggest that the vessel sound is probably an important factor (Evans et al. 1992; Blane and Jaakson 1994; Evans et al. 1994).

Beluga whale responses to vessel sound varies greatly from tolerance to extreme sensitivity, depending on the activity of the whale and previous experience with vessels (Richardson et al. 1995). In the St. Lawrence River, where vessel traffic is common, belugas were more tolerant of vessels, but responded differentially to certain vessels and operating characteristics by reducing their calling rates (especially older animals). Belugas in the Canadian high Arctic, where vessel traffic is rare, were observed rapidly swimming away from ice-breaking vessels up to 80 km (49.7 mi) away. The whales also showed changes in surfacing, breathing, diving, and group composition (Finley et al. 1990).

Lesage et al. (1999) documented changes in the vocal behavior of beluga whales in the presence of a 7 m (23 ft) vessel powered by two 70 horsepower (HP) engines and an 80 m (260 ft) ferry with two 2,000 HP engines. Responses occurred more frequently when exposed to the ferry than the small vessel and included a reduction in call rate, an increase in emissions of certain call types, repetition of specific calls, and a shift in frequency bands. Gervaise et al. (2012b) suggested that the chronic anthropogenic sound associated with ship traffic in the Saguenay River mouth likely masks beluga whale communication and echolocation vocalizations, which supports the finding that belugas exposed to different vessel traffic in the St. Lawrence Estuary increased the intensity of vocalizations (Scheifele et al. 2005).

Belugas exhibited avoidance behavior in the presence of a 5 m (16 ft) inflatable boat with an outboard motor, and decreased surfacing, increased speed, and bunched into groups (Blane and Jaakson 1994). The whales resumed their previous behavior once the disturbance ceased. Belugas may not be affected by idling moored cargo vessels with a sound source level at or below (126 dB re 1 μPa) (Blackwell and Greene 2003).

There is concern that vessel sound masks Cook Inlet beluga vocalizations and echolocation. Eickmeier and Vallarta (2022) estimated the high-frequency auditory masking in beluga whales by commercial vessels in Cook Inlet. As described in the paper, Cook Inlet beluga whale residence in the upper Inlet overlaps with shipping lanes, exposing beluga whales to auditory masking by ships for hours which could compromise the beluga population's abilities to echolocate to find or capture prey. This paper suggests that container ship noise corresponds to large-scale masking in the frequency ranges of beluga whale communication.

Belugas typically occur in shallow coastal waters during the summer and concentrate in northern Cook Inlet near and within the Susitna River Delta, Knik Arm, Turnagain Arm, Chickaloon Bay, and near Fire Island in the upper inlet (Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b), as well as in and near the Kenai River in the lower Inlet (McGuire et al. 2020b), so the number of belugas near drilling platforms is expected to be low. In consideration of the mitigation measures to be implemented, the low likelihood of exposure to noise that would significantly disrupt an animal's behavioral patterns, the short duration of spatial overlap, and low densities of belugas in the area, any impacts to belugas from vessel sound, including bow thrusters, and vessel presence are expected to be undetectable and minor.

Baleen whales vocalize at low frequencies over long distances, and masking is a concern as their communication frequencies overlap with anthropogenic sounds such as shipping traffic. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects. Blue whales in California shifted their call frequencies downward by 31 percent since the 1960s, possibly to communicate below shipping sound frequencies (McDonald et al. 1995). Melcon et al. (2012) found that blue whales increased their call rates in the presence of low frequency shipping sounds, and significantly decreased call rates when exposed to mid-frequency sonar. Blue whales were also found to communicate more often in the presence of seismic surveys, which was attributed to compensating for an increase in ambient sound levels (Di Lorio and Clark 2010). On the East Coast, increased shipping has increased the overall background noise, and North Atlantic right whales have changed their vocal behavior as a result (Parks et al. 2007).

Baleen whales may also exhibit behavioral changes in response to vessel sound. Marine mammals that have been disturbed by anthropogenic sound and vessel approaches are commonly reported to shift from resting behavioral states to active behavioral states, suggesting an energetic cost to the affected animal. Humpback whales are especially responsive to fast moving vessels (Richardson et al. 1995), exhibiting aerial behaviors such as breaching or tail/flipper slapping (Jurasz and Jurasz 1979). In Hawaii, humpbacks responded to vessels at distances of 2 to 4 km (Baker et al. 1983); however, feeding humpbacks showed no reaction at distances beyond 800 m (Watkins 1981; Kreiger and Wing 1986). Despite the presence of vessels, temporarily disturbed whales often remain in the area (Baker et al. 1988; Baker et al. 1992).

Responding to vessels is likely stressful to humpback whales, but the biological significance of that stress is unknown (Bauer and Herman 1986). Mothers with newborn calves seem the most sensitive to vessel disturbance (Clapham and Mattila 1993). Humpback cow-calf pairs significantly reduced the amount of time spent resting and milling when vessels approached, as compared to undisturbed whales (Morete et al. 2007).

Watkins (1981) found that fin whales appeared startled and increased their swimming speed to avoid approaching vessels. Responses were observed at distances of about 1 km (Edds and Macfarlane 1987). Fin whales stopped feeding and swam away when closely approached by inflatable vessels (Jahoda et al. 2003). These animals also had increases in blow rates and spent less time at the surface, suggesting increases in metabolic rates (Jahoda et al. 2003). All of these responses can manifest as a stress response in which the animal undergoes physiological changes with exposure to one or more stressors. In addition to experiencing stress responses, behavioral and physiological events may be interrupted, and the animals' time budget may be altered (Sapolsky 2000; Frid and Dill. 2002). In consideration of the mitigation measures to be implemented, the low likelihood of exposure to noise that would significantly disrupt an animal's behavioral patterns, the short duration of spatial overlap, and low densities of humpback and fin whales in the area, any impacts to baleen whales from vessel sound, including bow thrusters, and vessel presence are expected to be undetectable and minor.

Potential impacts of vessel disturbance on Steller sea lions have not been well studied, and the responses will likely depend on the season and stage in the reproductive cycle (NMFS 2008b). The presence and movements of ships can cause disturbance to normal pinniped behaviors (Calkins and Pitcher 1982; Kucey 2005; Jansen et al. 2006), and Steller sea lions could potentially abandon their preferred breeding habitats (also referred to as rookeries) in areas with high traffic (Kenyon and Rice 1961). 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 2008b). Pups are the age-class most vulnerable to disturbance from vessel traffic (NMFS 2008b). Hilcorp's planned activities would not occur near any major pinniped haulouts or rookeries.

During Hilcorp's seismic operations in 2019, 60% of Steller sea lion sightings occurred during periods of no seismic activity, while 40% of sightings were observed during seismic activity, including during operation of the full airgun array. Two of the Steller sea lions showed detectable reactions, but these occurred during periods of no work; both animals exhibited a "look" reaction that appeared to be in response to vessel presence. The average sighting distance for Steller sea lions during periods of non-seismic activity was ~311 m, and ~1,928 m during seismic operations (Fairweather Science 2020).

The effects of vessel presence on sea lions in open water is likely to be temporary and transient in nature as the vessel approaches and passes sea lions. Increases in ambient noise, however temporary, has the potential to mask communication between sea lions, and affect their ability to detect predators (Richardson and Malme 1993; Weilgart 2007). In consideration of the mitigation measures to be implemented, the low likelihood of exposure to noise that would significantly disrupt an animal's behavioral patterns, the short duration of spatial overlap, and low densities of Steller sea lions in the area, any impacts to sea lions from vessel sound, including bow thrusters, and vessel presence are expected to be undetectable and minor.

Project vessel activity will increase vessel sound in Cook Inlet during the duration of the proposed action. Marine mammal responses to vessel noise may include changes in behavioral states (Richardson et al. 1995), changes in vocalizations (Lesage et al. 1999; Scheifele et al.

2005; Gervaise et al. 2012a) and temporarily displaced (Blane and Jaakson 1994; Erbe and Farmer 2000). However, any changes are not expected to cause a significant disruption of those behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating. Hilcorp will practice marine mammal viewing guidelines and implement mitigation and monitoring measures during transiting and docking of the supply vessels such as: 1) not positioning vessels in the path of a whale or cutting in front of a whale in a way or at a distance that causes a whale to change behavior, 2) staying 100 yards away from listed marine mammals, 3) avoiding changing direction and speed as well as reducing speed within 300 yards of whales, and 4) reducing speed when visibility is reduced (Section 2.1.2). These measures minimize effects on listed marine mammals and reduce the likelihood an animal will be exposed to vessel sound that could cause a significant disruption in behavioral patterns. Any overlap of marine mammal presence with the support vessels is expected to be short in duration and behavioral reactions are expected to be brief and minor.

In consideration of the mitigation measures to be implemented, the low likelihood of exposure to noise that would significantly disrupt an animal's behavioral patterns, the short duration of overlap, and low densities of marine mammals in the area, any impacts to marine mammals from vessel sound, including possible use of bow thrusters, and presence are expected to be undetectable and minor. It is not expected that any impacts will cause a significant disruption of those behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating.

6.2.1.4 Aircraft Sound

Helicopters will be used to support activities included in the proposed action. Helicopters will be used for crew changes and delivery of supplies to platforms and drilling rigs. Flight routes will follow a direct route to and from the rig or platform location at an altitude of 450 m (1,500 ft) above ground level, as practicable, to avoid acoustic harassment of marine mammals (Section 2.1.2). Fix-wings will fly at 305 m (1,000 ft) to effectively detect beluga whales during aerial surveys (Section 2.1.2); it is not expected that listed marine mammals will be harassed at these altitudes.

Helicopters generate sound from their engines, airframe, and propellers. Transmission of aircraft sound into the water is greatest directly below the aircraft, and much of the sound is reflected and does not penetrate at angles greater than 13 degrees from vertical. The duration of underwater sound from passing aircraft is also much shorter in water than air. A helicopter flying at an altitude of 152 m (~500 ft) is audible in air for 4 minutes, underwater at 3 m (10 ft) depth for 38 seconds, and underwater at 18 m (59 ft) depth for 11 seconds. Received sound levels in water from aircraft flying at an altitude of 152 m (~500 ft) were 109 dB re 1 μPa for a Bell 212 helicopter, 101 dB re 1 μPa for a small fixed-wing aircraft, 107 dB re 1 μPa for a twin otter, and 124 dB re 1 μPa for a P-3 Orion (four-engined, turboprop anti-submarine and maritime surveillance aircraft; Richardson et al. 1995). The dominant tones for helicopters and fixed-wing aircraft are generally <500 Hz (Richardson et al. 1995).

Marine mammals could be disturbed by the acoustic received sound or physical presence of low-flying aircraft. Airborne noise and visual cues are more likely to disturb individuals resting at the sea surface or hauled out on ice or land (BOEM 2012). Marine mammals underwater at the time of exposure could also be disturbed by sound propagating beneath the surface of the water or by shadows of an aircraft flying overhead. Observations made from low-altitude aerial surveys report highly variable behavioral responses from marine mammals ranging from no observable reaction to diving or rapid changes in swimming speed/direction (Efroymson and Suter 2001; Smultea et al. 2008). In general, it is difficult to determine if behavioral reactions are due to aircraft sound, to the physical presence and visual cues associated with aircraft, or a combination of those factors (Richardson et al. 1995).

Research into the responses of baleen whales to aircraft sound is limited. Reactions are likely influenced by group size and behavioral activity (Richardson et al. 1995; Patenaude et al. 2002; Weilgart 2007), with whales in larger feeding or social groups reacting less than whales in confined waters or with calves. Some humpback whales have shown a response to an aircraft at 305 m, while other whales have shown no response to an aircraft at 152 m (Richardson et al. 1995).

During NMFS Marine Mammal Laboratory aerial surveys, conducted in a fixed-wing aircraft at 244 m (800 ft), belugas are often seen swimming in the same direction and speed without any observed change in activity while the aircraft circles (Rugh et al. 2000). Individual responses may vary, depending on previous experiences, beluga activity at the time of the sound, and sound characteristics.

Steller sea lion response to aircraft is likely dependent upon age, sex, and season. Calkins (1979) found that dominant, territory-holding males and females with young are less likely to leave a haulout site in response to an aircraft overflight than are juveniles and pregnant females. Sea lion pups on land are vulnerable to trampling if adults are panicked by low flying aircraft. There are no known haulouts or rookeries in the action area.

The short-term impacts from aircraft activities are not expected to cause a significant disruption in behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering, resting or migrating. The implementation of the mitigation measures are expected to further reduce the potential for adverse impacts to ESA-listed species. Helicopters will follow a direct route (to and from the platform) and will maintain an altitude of 450 m (1,500 ft) or higher for all aircraft operations, unless human safety is at risk or it is operationally impossible. During take-off and landing of a helicopter, we expect only a small amount of sound would penetrate the water for a short period of time because the helicopter will be moving nearly vertically over the helipad and most of the sound is reflected by the water surface back into the atmosphere, and does not penetrate water at angles greater than 13 degrees from vertical. Helicopters descend onto the helipad (located approximately 80 to 100 ft above mean high water) at approximately 300 ft per minute and ascend approximately 500 ft per minute. Any sound that does penetrate the water from helicopters is expected to be low enough that it does not disrupt behavioral patterns of marine mammals (Marrett 1992).

Aircraft associated with this action are not expected to operate in the vicinity of Steller sea lion haulouts or rookeries, for which a minimum 915 m (3,000 ft) buffer should be maintained to avoid Steller sea lion habitat and possibly causing animals to trample one another as they flee. In consideration of the mitigation measures, the low likelihood of exposure to sound that could cause a significant disruption of behavioral patterns, and the brief exposure to very low intensity aircraft sound and brief visual exposure to their presence, any reactions are expected to be imperceptible or very mild and brief. Additionally, belugas typically occur in shallow coastal waters during the summer and concentrate in northern Cook Inlet near and within the Susitna River Delta, Knik Arm, Turnagain Arm, Chickaloon Bay, and near Fire Island in the upper inlet (Shelden et al. 2015b; Castellote et al. 2016a; McGuire et al. 2020b), as well as in and near the Kenai River in the lower Inlet (McGuire et al. 2020b), thus the number of belugas near drilling platforms is expected to be low. Other listed marine mammal densities are also low near platforms (Section 4.3). Therefore, any impacts to beluga whales, humpback whales, fin whales, or Steller sea lions are expected to be minimal or undetectable.

6.2.1.5 Vessel Strike

Between 1978 and 2011, there were 108 reports of whale-vessel collisions in Alaska waters (Neilson et al. 2012). Among larger whales, humpback whales are the most frequent victims of ship strikes in Alaska, accounting for 86 percent of all reported collisions. There have been three documented large cetacean vessel collisions in Cook Inlet since 2001; one humpback whale, one fin whale, and one unidentified large cetacean (NMFS Alaska Regional Office Stranding Database accessed May 2022).

The minimum mean annual mortality and serious injury rate due to ship strikes reported in Alaska for humpback whales between 2014 and 2018 was 2.9 whales (Muto et al. 2021). Most vessel collisions with humpbacks are reported from Southeast Alaska; however, there are also reports from the southcentral, Kodiak Island, and Prince William Sound areas of Alaska (Young et al. 2020). A humpback whale was discovered on the bulbous bow of a 710 ft container ship as it docked in the Port of Anchorage in 2001, and it is unknown where the vessel may have collided with the whale (NMFS Alaska Regional Office Stranding Database accessed May 2019). The difference in ship strike rates between Southeast Alaska and other portions of the humpback whale range in Alaska may be due to differences in reporting, amount of vessel traffic, densities of animals, and/or other factors (Muto et al. 2021). These incidents account for a very small fraction of the total humpback whale population (Laist et al. 2001).

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). Fin whale mortality due to ship strikes in Alaska waters was reported to the NMFS Alaska Region marine mammal stranding network in 2014, 2016, and 2018 (Young et al. 2020), resulting in a minimum mean annual mortality and serious injury rate of 0.6 fin whales due to ship strikes between 2014 and 2018 (Muto et al. 2021). In 2015, a dead fin whale was discovered at the Port of Anchorage on the bulbous bow of a ship traveling from Seattle; it is unknown where the strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2022).

Ship strikes of smaller cetaceans are less common than large whales, possibly due to their smaller size and more agile nature. Cook Inlet beluga whales have been photographed with propeller scars (McGuire et al. 2014). Individual belugas photographed during the period 2005-2017, along with stranding records, were examined to determine prevalence of scars indicative of anthropogenic trauma (McGuire et al. 2020c). Scars were classified by likely source (e.g., entanglements, vessel strikes, puncture wounds, and research). Out of 78 whales examined, 7 had signs of trauma confirmed or possibly from entanglement with rope or lines, 6 had signs of trauma that were possibly from entanglement or from a vessel collision, 3 had signs of trauma possibly from a vessel collision or a predation attack, 4 had signs of possible puncture scars consistent with bullets, arrows, or harpoons, and 2 had signs of trauma consistent with a vessel collision. A Cook Inlet beluga whale death in October 2007 was attributed to a potential vessel strike based on bruising consistent with blunt force injuries (NMFS unpublished data) and a beluga necropsy conducted in October 2012 indicated the most likely cause of death was “blunt trauma such as would occur with a strike with the hull of the boat” (NMFS unpublished data).

Similar to belugas, the agility of Steller sea lions is likely to preclude vessel strikes. Although risk of ship strike has not been identified as a significant concern for Steller sea lions (Loughlin and York 2000), this species may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated (e.g., near rookeries or haulouts; NMFS 2008b). In 2007, a Steller sea lion was found in Kachemak Bay with two separate wounds consistent with blunt trauma, which may have been due to a boat collision (NMFS Alaska Regional Office Stranding Database accessed May 2022).

Identifying and avoiding areas or transit routes that may have a higher probability of interaction between vessels and marine mammals, is important in reducing risk of vessel strike and is paramount for reducing risk (Schoeman et al. 2020). In a review of records of human-caused mortality of Alaska marine mammals from 2013-2017, 28 out of 481 serious injuries or mortalities were due to ship strike (Delean et al. 2020). Burek Huntington et al. (2021) found that 8 percent of sea otter fatalities in Alaska over the period 2002-2012 were due to trauma. None of these cases in Delean et al. (2020) or Burek Huntington et al. (2021) were attributed to oil and gas activities.

There may be an increased risk of vessel strike due to the increased traffic associated with the proposed action. For the proposed action, tugs towing a jack-up rig may include up to 16 days with periods of active towing, holding, or positioning of the jack-up rig each year. Generally, tugs will be actively under load with a jack-up rig for only a portion of a 24-hour period with these hours potentially spread over several calendar days at a time. Tugs towing the jack-up rig with travel at an average of four knots. Support vessel trips to and from the platform while drilling is occurring are anticipated to increase (on average) by two trips per day from normal platform operations. During mobile drill rig mobilization and demobilization, one support vessel is used continuously for approximately 30 days to facilitate moving rig equipment and materials.

Collisions with beluga whales are not a common cause of mortality. In addition, the very low number of Steller sea lions, humpback whales, and fin whales in upper Cook Inlet, greatly reduces the probability of vessel strikes of those species occurring in this area. As previously stated, most ship strikes of large whales occur when vessels are traveling at speeds of 10 knots or more (Laist et al. 2001; Jensen and Silber 2004). The typical velocity of a tug towing the jack-up rig in Cook Inlet is four knots or less, and the dive support vessels typically transit at speeds of seven knots. Support vessels typically travel at 7 knots and cannot exceed 9 knots, due to cooling system constraints. The slow operational speeds of project vessels and the implementation of mitigation measures (i.e. not approaching marine mammals within 100 yards, not changing direction or speed and reducing speeds around marine mammals) will help minimize the risk of collision for marine mammals that may be present in the action area. These factors limit the risk of strike from the proposed action; therefore, likelihood of vessel strike is considered to be improbable.

6.2.1.6 Seafloor Disturbance and Habitat Alteration

The presence of the drill rig is not expected to result in permanent loss of marine mammal habitat, but it could result in a temporary loss of marine mammal habitat. Seafloor disturbance, turbidity, and discharge from activities may impact marine mammal prey species and potentially the fitness of marine mammals. The sources of seafloor disturbance from activities included in the proposed action include P&A of Well 17589 and production drilling. The area of disturbance may vary based on ocean currents and other environmental factors, but in general includes disturbance from the anchoring system for the drilling unit (e.g., legs of the jack up rig), displacement of sediments, discharge of drilling waste (BOEM 2017), and divers using a water jet to wash away debris during P&A of Well 17589.

Placement and removal of the jack-up rig stabilizers (i.e., the drilling rig legs) disturbs the seafloor. The total area of disturbed sediment will depend on the rig design and diameters of the legs. Hilcorp proposes to use a rig similar to the *Spartan 151* drill rig, a 150 H class independent leg, cantilevered jack-up drill rig with a drilling depth capability of 7,620 m (25,000 ft) that can operate in maximum water depths up to 46 m (150 ft). BOEM (2017) estimated that 2.5 acres of seafloor are disturbed during the setup of a jack-up rig.

Discharging drill cuttings or other liquid waste streams produces temporary turbidity in the water column and localized alteration of the benthic environment around individual wellsites. Benthic impacts including burial and smothering are most likely to occur within a radius of approximately 500 m (1,640 ft) around each wellsite, affecting an area of 0.78 km^2 per wellsite. The settling of drilling fluid and cutting discharge causes physical disturbance of habitats by smothering benthic areas/species and disturbing pelagic species (Tetra Tech Inc. 2012).

Short-term turbidity increases could occur during the P&A of Well 17589, especially when the water jet is used. The physical suspension of sediments could produce localized turbidity plumes that could last from a few minutes to several hours.

Seafloor disturbance, turbidity, and discharge from activities may affect the prey species distribution and diversity as well as the ability of marine mammals to locate prey in the immediate area of the plug and abandonment and drilling activities. However, the resuspension of sediments would likely be highly localized and temporary due to the currents and tidal actions in Cook Inlet and any sediment plumes generated would be a minor contribution to the existing level of suspended sediments (Brabets et al. 1999). The discharge of drilling fluids and cuttings during drilling activities is unlikely to have large-scale effects on marine mammals, either directly through contact with marine mammals or indirectly by affecting their prey, because the effects would be restricted primarily to the areas immediately surrounding the drill-site. Additionally, no appreciable adverse impacts on benthic populations would be expected due in part to the large reproductive capacities and naturally high levels of predation and mortality of these populations. Any mortalities or impacts that might occur as a result of the proposed action are minor compared to the naturally high reproductive and mortality rates of benthic organisms (BOEM 2015b). In addition, disturbed areas, depending on substrate types, community composition, and ocean current speed and direction, would begin the process of recolonization after deposition has completed following the benthic disturbance (Conlan and Kvitek 2005; BOEM 2015a). Amphipods, copepods, shrimp, nematodes, and polychaetes are among the first to recolonize, taking generally less than a year for establishment in new locations (Trannum et al. 2011).

6.2.1.7 Entanglement and ingestion of trash and debris

Tow lines between each tug and the jack-up rig pose a risk of entanglement to ESA-listed species. However, entanglement is highly unlikely as there will be a limited number of tow lines in use and marine mammals are more likely to become entangled with slack lack lines. Lines associated with tugs towing the jack-up rig are in the air when the tugs are pulling the jack-up rig and they are taut.

Project trash and debris could be released into the marine environment. Discharge of trash and debris in this manner is illegal, and can pose significant risks to marine mammals; it is thought to be more common, widespread, and impactful than oil spills. The project will generate trash comprised of paper, plastic, wood, glass, and metal mostly from galley and food service operations. A substantial amount of waste products could also be generated from production and decommissioning activities.

Hilcorp will comply with Federal regulations, and the amount of trash and debris within the action area is expected to be minimal. The impact of trash and debris is expected to be very minor, and adverse effects to ESA-listed species will be immeasurably small.

6.2.1.8 Pollution

Authorized discharges from project activities and ongoing production associated with Hilcorp's oil and gas operations would include drilling fluids and cuttings, deck drainage, sanitary and domestic waste, desalination unit brine, cooling water, bilge and ballast water, and other miscellaneous discharges. Most of these discharges would be rapidly diluted in receiving waters such that there would be very limited potential for effects on any listed marine mammals. Benthic impacts including burial and smothering are most likely to occur within a radius of approximately 500 m (1,640 ft) around each wellsite, affecting an area of 0.78 km^2 per wellsite. Discharges are regulated through the NPDES permit, and impacts to listed species from exposure to pollutants, suspended solids, or bacteria-or virus-containing effluents discharged in compliance with permit requirements are likely undetectable (BOEM 2017).

Probability of a spill

The exposure to oil needs to be in sufficient quantity to produce adverse effects from either external oiling, internal absorption from ingestion of oil and prey, aspiration of oil, inhalation of volatile vapors in the air, or a combination.

Increased vessel activity in the action area will temporarily increase the risk of accidental fuel and lubricant spills. Accidental spills may occur from a vessel leak or if the vessel runs aground. Associated vessels and structures will maintain and adhere to approved Spill, Prevention, Control, and Countermeasure 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).

A well blowout is a potential risk, although it would be an extremely rare event. Four gas blowouts have occurred in Cook Inlet since 1962, with the last occurring in 1987[23]. Oil spills of up to 250 barrels have occurred from offshore platforms in Cook Inlet, but no additional oil well blowouts have been documented.

There are different probabilities of potential occurrence between the various sized oil spills (small, large, and very large oil spill [VLOS]). The size of the spill affects the number of individual animals that will be exposed and the duration of exposure. However, the general responses of individual animals to oil exposure do not differ with the size of a spill.

Oil and gas production platforms in Cook Inlet all have transmission pipelines associated with them to transport their products to market. Most of the transmission pipelines in Cook Inlet would not exist but for the Cook Inlet-based production platforms (Some pipelines may be transporting product from terrestrial-based facilities on the west side of Cook Inlet to the eastern shore of the inlet). There have been recent spills from pipelines in Cook Inlet, including Hilcorp pipelines, however none of them have been large or very large oil spills.

[23] https://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch

Table 10. BOEM's estimated total number of refined and crude or liquid gas condensate oil spills during the exploration and development of the OCS blocks of Lease Sale 244 (BOEM 2016; BOEM 2017).

Activity	Source of Spill	Number of Spill(s)[1]		Size of Spill(s) (in bbl)	Estimated Total Spill Volume	Frequency of Occurrence
Small Spills (Crude, Condensate, or Diesel and other Refined Products)						
Development Plan Activities (Development, Production, Decommissioning)	Offshore and/or Onshore Operational Spills from All Sources	~450[1] Total			~300[1] bbl	>99.5% of a small spill
		<1 bbl	432[1]	3 gallons	10 bbl	
		1-<50 bbl	16	3 bbl	48 bbl	
		50-<500 bbl	2	126 bbl	252 bbl	
		500-<1,000 bbl	0	0 bbl	0 bbl	
Large Spill or Gas Release (Crude, Condensate, Diesel or Refined, or Natural Gas)						
Development Plan Activities (Production)	Onshore Pipeline, or Offshore Pipeline, or Offshore Platform/ Storage Tank/Well	0.24 Total NEPA and Biological Assessment analysis assumes up to 1 from either		2,500 bbl, or 1,700 bbl, or 5,100 bbl	2,500 bbl, or 1,700 bbl, or 5,100 bbl	78%[2] chance of no large spills occurring; 22% chance of one or more large spills over the entire life.
	Offshore Platform/Well	1 gas release		8 million ft^3	8 million ft^3	3.6 $x10^{-4}$ per well
Very Large Oil Spills (Crude)						
Development Plan Activities						Not estimated to occur $>10^{-4}$ to $<10^{-5}$

[1] These numbers have been adjusted for rounding.
[2] Estimated from a mean large spill number of 0.243.

The Oil Spill Risk Analysis conducted by BOEM (2017) estimated that large condensate and diesel fuel spills in Cook Inlet would evaporate and disperse, generally within 1–10 days depending on size of spill. A large crude oil spill was estimated to persist much longer and could cover an estimated discontinuous area of 59 km^2 after 3 days and 1,159 km^2 after 30 days, if the spill occurred during the open-water season (April 1 through October 31). Broken ice conditions would slow oil spill dispersal; however, oiled ice that drifts and subsequently melts would introduce oil into in new areas (BOEM 2016; BOEM 2017).

General Effects of Exposure to Oil and Gas

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. 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. Toxic substances can also 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. 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); and,
- Oiling of skin, eyes, and conjunctive membranes causing corneal ulcers, conjunctivitis, swollen nictitating membranes and abrasions.

Contact with the skin, eyes, or inhalation and ingestion of fresh oil could result in temporary irritation or long-term endocrine or reproductive impacts, depending on the duration of exposure. 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 (Engelhardt 1982; Geraci and St. Aubin 1990; Frost et al. 1994; Spraker et al. 1994; Jenssen 1996; Jenssen et al. 1996). 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).

If a very large oil spill were to occur, a large number of marine mammals could be impacted. The duration of impacts could range from temporary (such as skin irritations or short-term displacement) to permanent (e.g., endocrine impairment or reduced reproduction), and would depend on the length of exposure and means of exposure (i.e., whether oil was directly ingested, the quantity ingested, and whether ingestion was indirect through prey consumption). Displacement from the spill is likely due to the presence of oil and increased vessel activity. The impacts may be greater if the spill occurs in biologically important areas.

Beluga, Fin, and Humpback Whales

Research has shown that while cetaceans are capable of detecting oil, they do not seem to avoid it. For example, researchers saw large whale species 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 hydrocarbons, 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).

Small spills in upper Cook Inlet are more likely to affect beluga whales, while small spills in the lower Inlet are more likely to affect humpback and fin whales. All species would likely be exposed to some degree, if a large oil spill were to occur; an estimated 1,159 km^2 (72 mi^2) is expected to be affected thirty days post-spill, (NMFS 2017b).

The Cook Inlet beluga whale population is small and resident; any impact from direct or indirect effects from a large oil spill has the potential for population-level impacts (NMFS 2016). The Cook Inlet Beluga Recovery Plan indicated that a spill in a more centrally located area of Cook Inlet beluga habitat will increase the exposure of the animals and increase the severity of the impact, to the point recovery of the population could be delayed (NMFS 2016).

A large oil spill could displace beluga whales from, or prevent or disrupt access to, affected habitat areas. The loss of nursing/calving habitats by female beluga whales with calves and juveniles could create additional stresses, both physical and psychological, that may reduce the fitness of some individual belugas over time. Belugas might not easily recover from some of the effects of displacement, compromising the ability of the stock to recover.

Maternal exposure to crude oil during pregnancy may negatively impact the birth weight of young, and ingestion can decrease nutrient absorption (St. Aubin 1988). Decreased food absorption could be especially important in very young animals, those feeding seasonally, and those needing to develop large amounts of fat for survival. If a spill occurred when many beluga whale calves were present, a substantial portion of that age class cohort could be lost and recruitment and species population growth could take decades to recover.

The probability of a large spill (5,100 bbl from a production platform) occurring is low. Impacts of a large spill on Cook Inlet belugas would depend on the size of the spill, spill response plans, the co-occurrence of belugas and the spill, and the dispersion/weathering over hours or possibly days of the spill (BOEM 2016).

Humpback whales are at highest risk from impacts to oil spills during the summer and fall in waters around Kodiak Island, which are considered Biologically Important Areas (BIAs) for humpback and fin whale feeding (Ferguson et al. 2015). Humpback whale densities in this BIA are highest from July through September (Witteveen and Quinn Ii 2007; Witteveen et al. 2011). Another area of high use by humpback whales in the summer occurs just north of the feeding BIA, on the southern extent of the Kenai Peninsula (BOEM 2016). Because of their distribution, the primary potential adverse effect on humpback whales would be from a large spill that contacted waters adjacent to Kodiak Island, including Shelikof Strait, especially during the summer and into the fall when humpback whale densities are highest in this area (BOEM 2016).

Fin whale densities near lower Cook Inlet peak from June through August, although they have been observed year-round in the area (BOEM 2016). Mizroch et al. (2009) concluded that fin whales are likely present in the waters of Shelikof Strait, off the Kodiak Archipelago, and other northerly areas in winter due to prey presence and distribution. This suggests that a spill at any time of year may overlap with fin whales.

A large spill could reduce feeding opportunities for humpback and fin whales, leading to modified distribution of these whales (BOEM 2015b; BOEM 2016). The significance of the loss depends on the whales' ability to meet annual energy demands with other feeding opportunities. Fate, recovery, and availability of zooplankton and fish populations in similar quantities and locations as pre-spill conditions in subsequent years would depend on a variety of factors. Duesterloh et al. (2002) concluded that phototoxic effects on copepods could cause ecosystem disruptions, which have not been accounted for in traditional oil spill damage assessments. The greatest impact of an oil spill on humpback and fin whales could occur indirectly (BOEM 2016).

Given their longevity, beluga, fin, and humpback whales are thought to be vulnerable to incremental long-term accumulation of pollutants. Individual whales may experience multiple large and small polluting events, as well as chronic pollution exposure within their lifetime, due to increasing development within their range and long-distance transport of other pollutants (BOEM 2016). There is evidence suggesting that Cook Inlet belugas appear to be bioaccumulating PAHs from the environment and prey (Norman et al. 2015).

Steller Sea Lions

In the event of an oil spill, Western DPS Steller sea lions could be adversely affected to varying degrees depending on habitat use, densities, season, and various spill characteristics. Much of what is known about the impacts of crude oil spills on Steller sea lions was learned from the Exxon Valdez oil spill. Sea lions did not seem to avoid the oil, and were sighted swimming in or near slicks (Calkins et al. 1994). Carcasses recovered in Prince William Sound immediately following the spill had the highest levels of PAHs and bile samples collected seven months post-spill indicated levels of PAH metabolites consistent with PAH exposure (Calkins et al. 1994). However, no lesions that could be attributed to hydrocarbon contamination were detected during histological examinations (Calkins et al. 1994).

Crude oil immersion studies with captive ringed seals resulted in 100 percent mortality (Geraci and Smith 1976). Inhalation of highly concentrated petroleum vapors can cause inflammation and damage to the mucous membranes of airways, lung congestion, hemorrhagic bronchopneumonia, and pulmonary edema in severe cases (Zieserl 1979). After extreme exposure, asphyxiation may occur (Geraci and St Aubin 1982). Pinnipeds in the wild would have haulouts as a resting/escape platform or, water depth and distance for escape routes from an oil spill, which some individuals might detect and avoid (Geraci and St. Aubin 1990).

For Steller sea lions, the reduction in quantity and quality of prey species due to an oil spill could result in decreased rates of reproduction or survivorship by reducing individual condition or fitness, or habitat displacement from loss of prey availability (BOEM 2016). While reduction or contamination of food sources would be localized relative to the area of a spill, multiple exposures to contaminated prey over an individual sea lion's lifetime accumulate and increase tissue contamination levels. A VLOS could expose a large number of sea lions to contaminated prey for a sustained amount of time. The statistical probability of large, and especially very large, oil spills occurring is very small, and any consumption of contaminated prey is unlikely to accumulate to levels that would harm individual sea lions.

Based on the localized nature of small oil spills, the relatively rapid weathering expected for <1,000 bbl of oil, and the safe guards in place to avoid and minimize oil spills, the probability of Cook Inlet beluga whales, humpback whales, fin whales, and Steller sea lions being exposed to a small oil spill is extremely unlikely. If exposure were to occur, NMFS does not expect detectable responses from listed marine mammals due to the ephemeral nature of small, oil spills.

Large and very large oil spills are a low probability but high impact event in which large numbers of listed marine mammals may experience prolonged exposure to toxic fumes, and/or ingest large amounts of oil, which could result in injury and mortality to a substantial number of animals.

Spill Response

Listed marine mammals could be exposed to a multitude of short- and long-term human activity associated with initial spill response, cleanup, and post-event human activities that include increased vessel and aircraft traffic associated with reconnaissance and monitoring. These activities would be intense during the initial spill cleanup operations and could continue at reduced levels for many years after the event. Specific marine mammal mitigation measures would be employed and modified, as needed, to meet the needs of the response effort. The response contractor would 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).

Any authorized discharge are expected to be rapidly diluted in receiving waters such that there would be very limited potential for effects on any listed marine mammals. Benthic impacts including burial and smothering are most likely to occur within a radius of approximately 500 m (1,640 ft) around each wellsite, affecting an area of 0.78 km^2 per wellsite. Discharges are regulated through the NPDES permit, and impacts to listed species from exposure to pollutants, suspended solids, or bacteria-or virus-containing effluents discharged in compliance with permit requirements are likely undetectable (BOEM 2017). Based on the localized nature of small oil spills, the relatively rapid weathering expected for <1,000 bbl of oil, and the safe guards in place to avoid and minimize oil spills, the probability of listed species being exposed to a small oil spill is extremely unlikely. Large and very large oil spills have a low probability of occurring. We conclude that any adverse effects to listed species from pollution will be minor and undetectable or improbable.

6.2.2 Major Stressors on ESA-Listed Species

The Exposure and Response analysis section (Section 6.2) analyzes the stressors likely to adversely affect ESA-listed species due to underwater anthropogenic sound. Hilcorp Alaska intends to conduct oil and gas activities that would introduce acoustic disturbance in the action area (Section 2.2). The anticipated major acoustic stressor that was likely to expose listed species to Level A or B acoustic harassment is tugs towing the jack-up rig.

First, we provide a brief explanation of the sound measurements and acoustic thresholds used in the discussions of acoustic effects in this opinion. Table 11 lists acoustic stressors and their sound source levels that may result in Level B acoustic harassment from Hilcorp Alaska's oil and gas activities in Cook Inlet. Sound source levels (measured or modeled) for each sound source were determined based on a literature review of the best available science.

Table 11. Summary of sound sources for each activity anticipated to cause Level B acoustic harassment.

Activity	Sound Pressure Levels (dB re 1 µPa)	Frequency
Tugs towing the Jack-Up Rig	185 dB rms at 1m	<500Hz
Note: Section 6.2.2.1 describes NMFS acoustic analysis explaining the reasoning behind assuming a 185 dB rms at 1 m for tugs towing a jack-up rig.		

6.2.2.1 Tugs Towing the Jack-Up Rig

The specific configuration of tugs towing the jack-up-rig as proposed by Hilcorp has not been acoustically analyzed previously. Hilcorp contracted JASCO Applied Sciences to conduct a sound source verification (SSV) to measure tugs pulling the jack-up-rig at various power outputs in Cook Inlet during October 2021. The SSV returned a source level of 167.3 dB re 1 µPa for the 20 percent power scenario and a source level of 205.9 dB re 1 µPa for the 85 percent power scenario. Assuming a linear scaling of tug power, a source level of 185 dB re 1 µPa was calculated as a single point source level for three tugs operating at 50% power output. This is approximately five dB higher than the literature summary described below.

Hilcorp conducted a literature review of available source level data for tugs under load in varying power output scenarios. Table 12 below provides values of measured source levels for tugs varying from 2,000 to 8,200 horsepower. For the purposes of this table, berthing activities could include tugs either pushing or pulling a load. The sound source levels appear correlated to speed and power output, with full power output and higher speeds generating more propeller cavitation and greater sound source levels than lower power output and lower speeds. Additional tug source levels are available from the literature but they are not specific to tugs under load.

Table 12. Literature values of measured tug source levels.

Vessel	Vessel Length (m)	Speed (knots)	Activity	Source Level @1 m (re: 1 µPa)	Horsepower	Reference
Eagle	32	9.6	Towing barge	173	6,770	Bassett *et al.* 2012
Valor	30	8.4	Towing barge	168	2,400	
Lela Joy	24	4.9	Towing barge	172	2,000	
Pacific Eagle	28	8.2	Towing barge	165	2,000	
Shannon	30	9.3	Towing barge	171	2,000	
James T Quigg	30	7.9	Towing barge	167	2,000	
Island Scout	30	5.8	Towing barge	174	4,800	
Chief	34	11.4	Towing barge	174	8,200	
Lauren Foss	45	N/A	Berthing barge	167	8,200	Austin *et al.* 2013
Seaspan Resolution	30	N/A	Berthing at half power	180	6,000	Roberts Bank Terminal 2 Technical Report 2014
Seaspan Resolution	30	N/A	Berthing at full power	200	6,000	

The Roberts Bank Terminal 2 Technical Report (2014), although not in Cook Inlet, includes repeated measurements of the same tug operating under different speeds and loads. This allows for a comparison of source levels from the same vessel at half power versus full power, which is an important distinction for Hilcorp's activities as a small fraction of the total time spent by tugs under load will be at greater than 50 percent power. The Seaspan Resolution's half-power berthing scenario has a sound source level of 180 dB re 1 µPa at 1 m. In addition, the Roberts Bank Report (2014) analyzed 650 tug transits under varying load and speed conditions and reported mean tug source levels of 179.3 dB re 1 µPa at 1 m, the 25th percentile was 179.0 dB re 1 µPa at 1 m, and 5th percentile source levels were 184.9 dB re 1 µPa at 1 m.

Based solely on the literature review, a source level of 180 dB for a tug under load would be appropriate. However, Hilcorp's use of a three tug configuration, in which one or two tugs are primarily under load and the third tug sits off to the side, increases the source level to approximately 185 dB; NMFS still considers these tugs to be simultaneous sources. When considered with the SSV conducted by JASCO for Hilcorp's specific configuration, NMFS decided to use a source level of 185 dB for tugs towing a jack-up rig for analyzing effects to species for this consultation.

6.2.2.2 Acoustic Thresholds

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871, 1872; January 11, 2005). NMFS has developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS) (83 FR 28824; June 21, 2018; 81 FR 51693; August 4, 2016). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels,[24] expressed in root mean square[25] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA) (16 U.S.C § 1362(18)(A)(ii)):

impulsive sound: 160 dB_{rms} re 1 μPa

non-impulsive sound: 120 dB_{rms} re 1μPa

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds (Table 14) for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 U.S.C § 1362(18)(A)(i)) (NMFS 2018e). Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS 2018). The generalized hearing range for each hearing group is in Table 13.

Table 13. Underwater marine mammal hearing groups (NMFS 2018e).

Hearing Group	ESA-listed Marine Mammals In the Project Area	Generalized Hearing Range[1]
Low-frequency (LF) cetaceans *(Baleen whales)*	Humpback whales Fin Whales	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans *(dolphins, toothed whales, beaked whales)*	Cook Inlet beluga whales	150 Hz to 160 kHz
High-frequency (HF) cetaceans *(true porpoises)*	None	275 Hz to 160 kHz
Phocid pinnipeds (PW) *(true seals)*	None	50 Hz to 86 kHz
Otariid pinnipeds (OW) *(sea lions and fur seals)*	Steller sea lions	60 Hz to 39 kHz

[1]Respresents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 db threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (L_E) and peak sound level (PK) for impulsive sounds and L_E for non-impulsive sounds.

Level A harassment radii can be calculated using the optional user spreadsheet[26] associated with NMFS Acoustic Guidance, or through modeling.

[24] 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.
[25] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.
[26] The Optional User Spreadsheet can be downloaded from the following website: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

Table 14. PTS Onset Acoustic Thresholds for Level A Harassment (NMFS 2018e).

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

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

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

While the ESA does not define "harass," NMFS issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). For purposes of this consultation, any exposure to Level A or Level B disturbance sound thresholds under the MMPA constitutes an incidental "take" under the ESA and must be authorized by the ITS (Section 10 of this opinion) (except that take is not prohibited for threatened species that do not have ESA section 4(d) regulations).

As described below, we anticipate that exposures to listed marine mammals from sound associated tugs towing a jack up rig may result in disturbance. However, no mortalities or permanent impairment to hearing are anticipated.

6.2.2.3 Ensonified Area

As described above (Section 6.2.2.1), based on in situ measurements of Hilcorp's tug and a review of the available literature of tugs under load, a source level of 185 dB re 1 µPa was used for Hilcorp's three tug configuration for towing the jack-up-rig. Hilcorp contracted SLR Consulting to model the extent of the Level B harassment isopleth as well as the extent of the PTS isopleth for their proposed activity. Described below are the operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and transmission loss coefficient. NMFS reviewed and accepts the parameters inputted into the model and the results from the model for determining exposure from tugs towing the drill rig. The analysis below focuses on hearing groups of ESA-listed species affected by this action (i.e. low frequency cetaceans, mid-frequency cetaceans, and otariid pinnipeds).

Rather than applying practical spreading loss, SLR created a more detailed propagation loss model in an effort to improve the accuracy of the results by considering the influence of environmental variables (e.g. bathymetry) at the specific well sites, as Hilcorp's operational locations are known in advance. Modeling was conducted using dBSea software. The fluid parabolic equation modeling algorithm was used with 5 Padé terms (Hilcorp 2022) to calculate the transmission loss between the source and the receiver at low frequencies (1/3-octave bands, 31.5 Hz up to 1 kHz). For higher frequencies (1 kHz up to 8 kHz) the ray tracing model was used with 1,000 reflections for each ray. Sound sources were assumed to be omnidirectional and modeled as points. The received sound levels for the project were calculated as follows: (1) one-third octave source spectral levels were obtained via reference spectral curves with subsequent corrections based on their corresponding overall source levels; (2) Transmission loss was modeled at one-third octave band central frequencies along 100 radial paths at regular increments around each source location, out to the maximum range of the bathymetry data set or until constrained by land; (3) The bathymetry variation of the vertical plane along each modeling path was obtained via interpolation of the bathymetry dataset which has 83 m grid resolution; (4) The one-third octave source levels and transmission loss were combined to obtain the received levels as a function of range, depth, and frequency; and (5) The overall received levels were calculated at a 1-m depth resolution along each propagation path by summing all frequency band spectral levels.

Model Inputs – Bathymetry data used in the model was collected from the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (AFSC 2019). Using NOAA's temperature and salinity data, sound speed profiles were computed for depths from 0 to 100 meters for May, July, and October to capture the range of possible sound speed depending on the time of year Hilcorp's work could be conducted. These sound speed profiles were compiled using the Mackenzie Equation (1981; Table 8 in Hilcorp 2022). Geoacoustic parameters were also incorporated into the model. The parameters were based on substrate type and their relation to depth (Table 9 in Hilcorp 2022). These parameters are presented in Table 9 of Hilcorp's final IHA application. The locations used in the stationary and mobile source models are depicted in Figure 23 below.

Detailed broadband sound transmission loss modeling in dBSea used the source level of 185 dB re 1 µPa at 1 m calculated in one-third octave band levels (31.5 Hz to 64,000 Hz) for frequency dependent solutions. The frequencies associated with tug sound sources occur within the hearing range of marine mammals in Cook Inlet. Received levels for each hearing marine mammal group based on one-third octave auditory weighting functions were also calculated and integrated into the modeling scenarios of dBSea. For modeling the distances to relevant PTS thresholds, a weighting factor adjustment was not used; instead, the data on the spectrum associated with their source was used and incorporated the full auditory weighting function for each marine mammal hearing group.

Because Hilcorp plans to use the tugs towing the jack-up-rig for essentially two functions (positioning and towing), the activity was divided into two parts (stationary and mobile) and two approaches were taken for modeling the relevant isopleths.

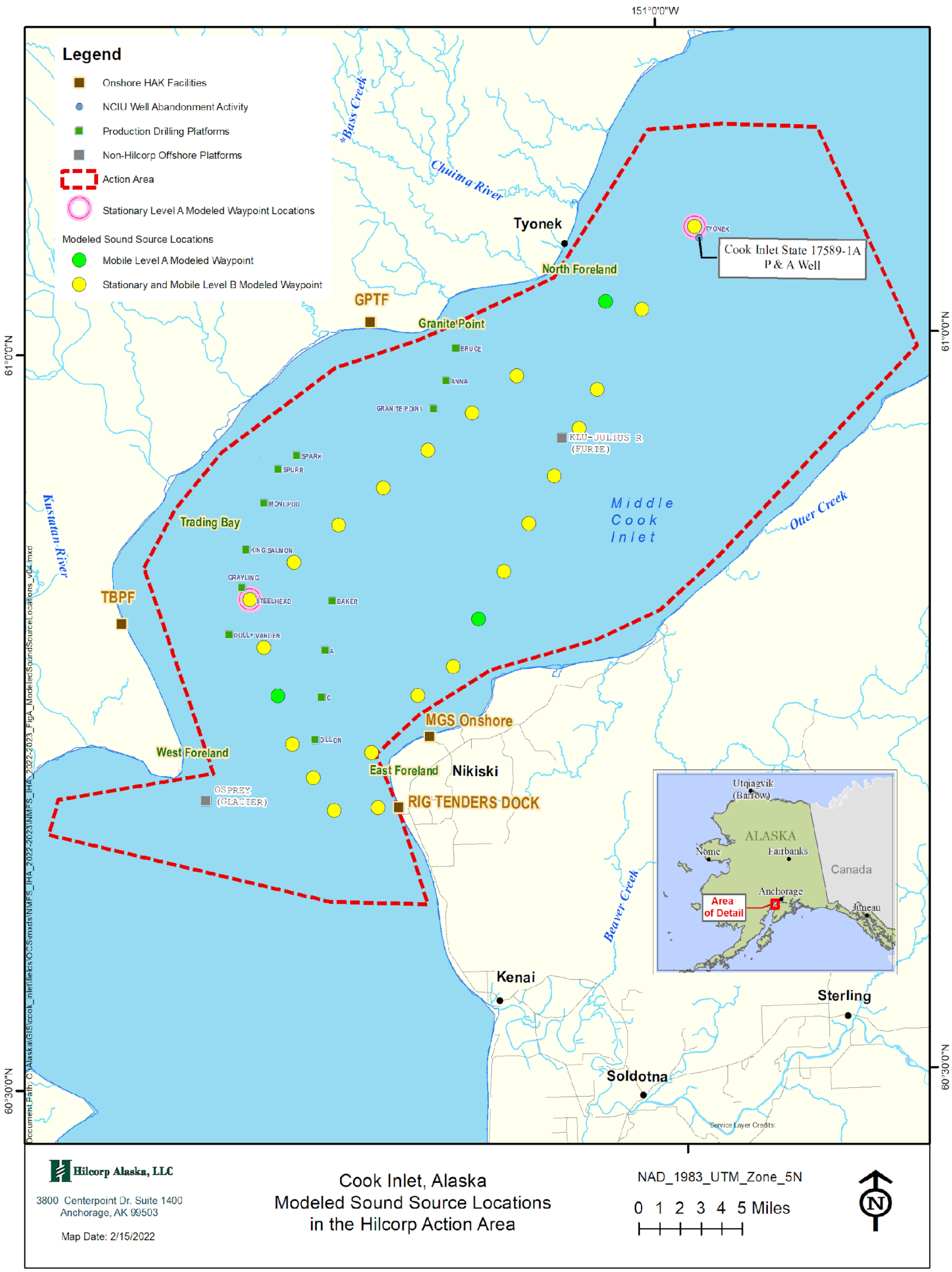

Figure 23. Locations Used for Stationary and Mobile Isopleth Models

Stationary - For stationary activity, two locations representative of where tugs will be stationary positioning the jack-up rig were selected for the model. These locations are in middle Cook Inlet near the Tyonek platform, and in lower Trading Bay where the production platforms are located, with water depths of 40 m and 20 m respectively. The modeling at these locations assumed a stationary five-hour exposure to a broadband spectrum of 185 dB as described above. If the first positioning attempt is not successful, the jack-up rig will be pinned down at a nearby location and the tugs will be released from the jack-up rig and no longer under load until the next attempt. A five-hour exposure duration was chosen to account for the up to five-hour positioning attempts on individual days as well as events where the tugs need to hold the jack-up rig while waiting for a following tide. Stationary model results are presented in Table 15. These distances to the PTS thresholds assume that a marine mammal is in the threshold for 24 hours to reach PTS.

Table 15. Average Distances to PTS Thresholds for Stationary Activity

Location	**Season**	**Average distances (m) to PTS threshold by functional hearing group**		
		Low Frequency (humpback fin whales)	**Mid-frequency** (beluga whales)	**Otariid Pinnipeds** (sea lions)
Trading Bay	May	100	72	59
Trading Bay	July	122	73	63
Trading Bay	October	98	72	59
Middle Cook Inlet	May	83	83	77
Middle Cook Inlet	July	89	85	78
Middle Cook Inlet	October	80	84	78
AVERAGE		**95**	**78**	**69**

Mobile – For the mobile portion of the activity, a representative route was used from the Rig Tender's dock in Nikiski to the Tyonek platform, the northernmost platform in Cook Inlet (representing Middle Cook Inlet), as well as from the Tyonek Platform to the Dolly Varden platform in lower Trading Bay and then from the Dolly Varden platform back to the Rig Tender's Dock in Nikiski. This route is representative of a typical route the tugs may take; the specific route is not yet known because the order in which platforms will be drilled with the jack-up rig is not yet known. The mobile source modeling assumed a transit speed of 4 knots (2.06 m/s) for the tug configuration, with the source being omnidirectional and the ship moving in a straight line. The average distance to PTS thresholds for mobile sources for low frequency cetaceans, mid-frequency cetaceans, and otariid pinnipeds was calculated to be less than zero.

Because there is no temporal component associated with NMFS' current Level B threshold, making it a potentially conservative assumption given the transitory nature of the rig towing activity, the results of the modeled distance to the 120 dB threshold for both stationary and mobile tug use are presented in Table 16 below. The average of these distances was used for calculation of estimated exposure to Level B harassment (3,850 m).

Table 16. Average Distances to Level B Threshold (stationary and mobile) (120 dB)

Waypoint	Average distance to 120 dB threshold (m)			Season average distance to threshold (m)
	May	July	October	
M1	4,215	3,911	4,352	4,159
M2	3,946	3,841	4,350	4,046
M3	4,156	3,971	4,458	4,195
M4	4,040	3,844	4,364	4,083
M5	4,053	3,676	4,304	4,011
M6	3,716	3,445	3,554	3,572
M7	2,947	2,753	2,898	2,866
M8	3,270	3,008	3,247	3,175
M9	3,567	3,359	3,727	3,551
M10	3,600	3,487	3,691	3,593
M11	3,746	3,579	4,214	3,846
M12	3,815	3,600	3,995	3,803
M13	4,010	3,831	4,338	4,060
M14	3,837	3,647	4,217	3,900
M15	3,966	3,798	4,455	4,073
M16	3,873	3,676	4,504	4,018
M18	5,562	3,893	4,626	4,694
M20	5,044	3,692	4,320	4,352
M22	4,717	3,553	4,067	4,112
M24	4,456	3,384	4,182	4,007
M25	3,842	3,686	4,218	3,915
M26	3,690	3,400	3,801	3,630
M27	3,707	3,497	3,711	3,638
M28	3,546	3,271	3,480	3,432
M29	3,618	3,279	3,646	3,514
AVERAGE	**3,958**	**3,563**	**4,029**	**3,850**

6.2.2.4 Marine Mammal Occurrence

The following outlines the best available information about the presence, density, or group dynamics of marine mammals that was used to calculate exposure estimates. Densities for marine mammals in Cook Inlet were derived from Marine Mammal Laboratory beluga whale aerial surveys, typically flown in June, from 2000 to 2018 (Rugh et al. 2005; Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017; Shelden and Wade 2019). While the surveys are focused on belugas and are concentrated for a few days in June annually, which may skew densities for seasonally present species, they are still the best available long-term dataset of marine mammal sightings available in Cook Inlet. Density was calculated by summing the total number of animals observed and dividing the number observed within the survey area. The total number of animals observed accounts for both lower and upper Cook Inlet. Densities are presented in Table 17 below.

Table 17. Densities of Marine Mammals in Cook Inlet

Species	Density (indiv/km^2)
Humpback whale	0.001770
Fin whale	0.000311
Beluga whale (MML lower Cook Inlet)	0.000023
Beluga whale (MML middle Cook Inlet)	0.001110
Goetz beluga – Lower Cook Inlet	0.011106
Goetz beluga - Northern Cook Inlet	0.001664
Goetz beluga – Trading Bay	0.015053
Steller sea lion	0.007609

For beluga whales, two densities were considered as a comparison of available data. The first source considered was directly from the Marine Mammal Laboratory beluga whale aerial surveys, as described above. Sighting data collected during aerial surveys is collected and then several correction factors are applied to address perception, availability, and proximity bias. These corrected sightings totals are then divided by the total area covered during the survey to arrive at a density value. Densities were derived for the entirety of Cook Inlet as well as for middle and lower Cook Inlet. Densities across all three regions are low and there is a known effect of seasonality on the distribution of the whales. Thus, densities derived directly from surveys flown in June might underestimate the density of beluga whales in lower Cook Inlet at other ice-free times of the year if many whales migrate to lower Cook Inlet during winter as they are presumed to.

The other method NMFS used for deriving beluga whale density considered the Goetz et al. (2012) habitat-based model. This model is derived from sightings (prior to 2012) and incorporates depth soundings, coastal substrate type, environmental sensitivity index, anthropogenic disturbance, and anadromous fish streams to predict densities throughout Cook Inlet. The output of this model is a beluga density map of Cook Inlet, which predicts spatially explicit density estimates for Cook Inlet belugas. Using the resulting grid densities, average densities were calculated for two regions applicable to Hilcorp's operations. The densities based on Goetz et al. 2012 habitat model that are applicable to the area of activity (*i.e.,* the North Cook Inlet Unit density for middle Cook Inlet activities and the Trading Bay density for activities in Trading Bay) are provided in Table 18.

Table 18. Cook Inlet beluga whale densities based on Goetz et al. (2012) Habitat Model

Project Location	Beluga Whale Density (ind/km^2)
North Cook Inlet Unit (middle Cook Inlet)	0.001664
Trading Bay Area	0.004453-0.015053

We used the NMFS aerial survey-derived data to derive exposure estimates for middle Cook Inlet, except for within the waters of Trading Bay. For Trading Bay waters, we used the Goetz habitat model-derived densities to obtain more precautionary (higher) estimates of exposure. For Trading Bay the higher end of the range was used to calculate more precautionary exposure estimates.

6.2.2.5 Exposure Estimate

This section outlines how an exposure estimate was calculated using the acoustic harassment thresholds and marine mammal density information provided above (Section 6.2.2.2, 6.2.2.3 and 6.2.2.4).

Hilcorp's tug towing rig activity was divided into two portions for the purpose estimating exposure: stationary and mobile activity. Stationary represents when the tugs are attempting to position the jack up rig. Mobile activity represents when tugs are towing the jack-up rig from one platform to another or during mobilization and demobilization to and from Nikiski.

In year 1, it is assumed that stationary activities (i.e. positioning of the jack-up rig) will occur on 14 days for 5 hours of sound production per day (7 moves or segments, with 2 positioning attempts per move (2 separate days)).

For the mobile portion of the activity, we assumed that 1 day of 9 hours of mobile activity during rig demobilization to Nikiski would occur (assuming a source velocity of 2.06 m/s) and 6 days of 6 hours per day of mobile activity would occur when moving the rig from platform to platform, for a total of 7 rig moves. If the first positioning attempt is not successful, the jack-up rig will be pinned down at a nearby location and the tugs will be released from the jack-up rig and no longer under load until the next attempt.

In year 2, we assumed that stationary activities (i.e. positioning of the jack-up rig) will occur on 16 days for 5 hours of sound production per day (8 moves or segments, with 2 positioning attempts per move (2 separate days)).

For the mobile portion of the activity in year 2, it is assumed that there will be 2 days of 9 hours of mobile activity during rig mobilization and 6 days of 6 hours per days of moving the rig from one platform, for a total of 8 rig moves. These parameters are summarized in Table 19.

The ensonified areas calculated per activity type (stationary and mobile) for a single day were multiplied by marine mammal densities to calculate an exposure estimate per day. This was then multiplied by the number of days of that type of activity (stationary or mobile) to arrive at the number of estimated exposures per activity type per year. These exposures by activity type were then summed to result in a number of exposures per year for all tug towing rig activity. Table 19 summarizes exposure estimate for each listed species. There are two estimates for beluga whales provided in the tables below to demonstrate the difference in the calculations based on the aerial survey-derived and Goetz habitat model-derived densities.

Table 19. Summary of Parameters used to calculate exposure estimates and total calculated exposures (Level B) for Year 1 and 2

Group	Species	Density	Year 1 Tug Towing Rig Parameters	Year 1 Exposure Estimate (# of animals)	Year 2 Tug Towing Rig Parameters	Year 2 Exposure Estimate (# of animals)
Low Frequency Cetaceans	Humpback whale	0.001770	*7 moves with 2 positioning attempts per move* Stationary: Positioning 14 days, w/ 5 hours per day Mobile Demob 1 day, w/ 9 hours Mobile Platform to Platform (includes P&A) 6 days, w/ 6 hours per day	3.065	*8 moves with 2 positioning attempts per move* Stationary: Positioning 16 days, w/ 5 hours per day Mobile: Mob/Demob 2 days, w/ 9 hours Mobile: Platform to Platform 6 days, w/ 6 hours per day	4.058
	Fin whale	0.00031		0.538		0.712
Mid-Frequency Cetaceans	Beluga whale Aerial survey for middle Cook Inlet (excluding Trading Bay)	0.00111		1.922		2.545
	Beluga whale Goetz habitat model for Trading Bay	0.01505		9.411		11.651
Otariids	Steller sea lion	0.00761		13.176		17.448

Based on the analysis described above (Section 6.2.2.2 and 6.2.2.3), NMFS concludes that it is unlikely any exposure to listed marine mammals will result in injury (i.e. Level A harassment) related to Hilcorp's tug towing drill rig activity. For mobile tugging, the distances to the PTS thresholds low frequency, mid-frequency, and otarrid pinnipeds was less than zero. For stationary positioning of the jack up rig, the PTS isopleths are calculated based on the assumption that an animal would remain within several hundred meters of the jack-up rig for the full five hours of sound-producing activity. Given that the location of the activity is not in an area known to be habitat of a type that we would expect to be used by for any listed marine mammal continuously over the course of two days, the occurrence of PTS is unlikely.

As illustrated in Table 19, the estimated number of exposures for humpbacks and beluga whales (based on aerial surveys) is low and for fins it is less than one per year. Humpbacks and fins have been previously sighted in Cook Inlet and some are unlikely to occur as solitary individuals. As discussed in Section 6.2.2.4, the densities used to estimate exposure of humpbacks, fins, belugas, and Steller sea lions are based on Cook Inlet beluga aerial surveys, therefore, the methodology does not adequately gather information on large cetacean or Steller sea lion abundance in Cook Inlet. Belugas tend to travel and forage along the coastline. Therefore, these aerial surveys focus on this more coastal habitat, which introduces bias for density estimates of more pelagic species. Because large cetaceans are not the focus of these surveys, there is no visibility correction factor for large whales that may remain submerged throughout the entire passing of the survey aircraft. For all species using densities to calculate exposure estimates assumes uniform distribution across an area, however, many marine mammals travel in groups. Therefore, we evaluated each species calculated exposure to determine if it adequately covered the average group size for each species. As described below, NMFS determined that the calculated exposures used for humpbacks, fin whales, and belugas are likely underestimates. Since Steller sea lions are not typically seen in large groups, therefore, we determined the calculated exposure estimates were appropriate.

NMFS evaluated typical group size observed during aerial surveys and looked at other marine mammal monitoring efforts to determinate appropriate adjustments to the calculated exposure estimates. There were 94 groups of 195 humpbacks seen during NMFS beluga aerial surveys from 1993 – 2018, humpback whale group size exhibited a mode of 1 and a median of 2, indicating that over half of the animals observed were individuals or pairs. The 95th percentile of group size is 5.35 humpback whales, which means that very few groups are made up of 6 or more whales (Shelden *et al.* 2013, 2015, 2016, 2019). During the Harvest Alaska CIPL monitoring from May through September (north of the Forelands, closest to the action area), observers saw 2 groups of humpback whales for a total of 3 animals (Sitkiewicz et al. 2018). During Hilcorp's Seismic activities in 2019, Hilcorp observed 14 groups of humpbacks with 38 individuals observed, group size ranged from 1 to 14 animals (Fairweather Science 2020). We expect a small number of humpback whale groups will be exposed, with most of these groups consisting of one or two animals. There is a small probability more humpbacks will be exposed than what we have estimated; 3 humpbacks in year 1 and 4 in year 2, therefore, we added one additional group exposure to each year; a group of median size, resulting in an exposure estimate of 5 humpbacks in year 1 and 6 in year 2.

NMFS aerial surveys in Cook Inlet from 1993 to 2018 recorded 10 sightings of an estimated 28 individual fin whales in lower Cook Inlet, with group sizes ranging from 1 to 13. Fin whale group size exhibited a mode of 1 and a median of 2, indicating that over half of the animals observed were individuals or pairs (Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017; Shelden and Wade 2019). The Harvest Alaska CIPL project did not see any fin whales (Sitkiewicz et al. 2018), however, during seismic surveys conducted in 2019 by Hilcorp in the lower Cook Inlet, 8 fin whale groups were recorded ranging in size from 1 to 15 (Fairweather Science 2020). Of the 18 groups observed during NMFS aerial surveys and Hilcorp's Seismic monitoring program, one group had 15 individuals, another had 13 individuals, and one group had 3 individuals, the remaining groups were either a single animal or a pair. Considering fin whales are seen less often in Cook Inlet, we expect Hilcorp may see one to two groups of fin whales, with each group to containing one to two animals. Since the median group size of fin whales seen during NMFS aerial surveys is 2, we expect that a maximum of 2 fin whale groups will be exposed with 2 individuals resulting in an exposure estimate of 4 fin whales per year.

Depending on the density data used for each activity, the estimated annual exposures for beluga whales is 2 to 12 animals. Since belugas are often seen in groups of 2 or more individuals NMFS assessed the calculated exposure estimate with the average group size. The 2018 MML aerial survey (Shelden and Wade 2019) estimated a median group size of approximately 11 beluga whales, although group sizes were highly variable (two to 147 whales) as was the case in previous survey years (Boyd et al. 2019). This is also supported by data collected during previous monitoring at the POA between 2008 and 2012. Beluga whale group size exhibited a mode of 1 and a median of 2, indicating that over half of the beluga groups observed over the 5-year span of the monitoring program were of individual beluga whales or pairs. The 95th percentile of group size from the Alaska Pacific University (APU) scientific monitoring data set is 11.1 beluga whales(NMFS 2020b). The average monthly group size at the POA in 2020 ranged from 2.1 to 4.9 (61 North Environmental 2021). Group size was not reported in the POA 2021 monitoring report (61 North Environmental 2022). Additionally, beluga whale groups in the Susitna River Delta during 2019 (roughly 24 km [15 miles] north of the Tyonek Platform) ranged from 5 to 200 animals (McGuire et al. 2021). The very large groups seen in the Susitna River Delta are not expected near Hilcorp's platforms, however, smaller groups (i.e., around the median group size) could be traveling through to access the Susitna River Delta and other nearby coastal locations, particularly in the shoulder seasons when belugas are more likely to occur in middle Cook Inlet. NMFS concludes that a likely exposure estimate of up to 11 belugas in year 1 (one group of a size that is equal to the 95th percentile group size) and 22 belugas in year 2 (two such groups) would account for any larger groups of beluga whales, with a great likelihood that several smaller groups may be observed. Table 20 indicates the number of calculated versus adjusted exposures.

Table 20. Exposures (Level B Harassment) calculated versus adjusted Year 1 and Year 2

Species	Year 1 Calculated Exposures	Year 1 Adjusted Exposures	Year 2 Calculated Exposures	Year 2 Adjusted Exposures
Humpback whale	3.065	5	4.058	6
Fin whale	0.538	4	0.712	4
Beluga whale	1.922 (MML) 9.411 (Goetz)	11	2.545 (MML) 11.651 (Goetz)	22
Steller sea lion	13.176	13	17.448	17

6.2.2.6 Response to Tugs Towing Jack-Up Rigs

Tugs towing the jack-up rig may effect marine mammals through acoustic and visual disturbance. As discussed at the beginning of this Section (6.2), effects may include threshold shifts, non-auditory physical or physiological effects, behavioral responses, or auditory interference with biologically important sounds.

The Cook Inlet beluga recovery plan states that due to industrial activity and development in the current range of beluga, a wide variety of anthropogenic noise sources that could potentially interfere with recovery are present in CI beluga habitat. The recovery plan indicates that based on signal characteristics and the spatio-temporal (space and time) acoustic footprint, tug boat noise (propeller cavitation [the formation of bubbles in a liquid] and engine noise including azimuth/bow thruster noise) is of most importance when considering anthropogenic noise. The order of importance was determined by considering the following factors: intensity (loudness), frequency (range of tones), and duration of acoustic signal; area affected by the sound source; and duration of sounds in both seasonal terms (e.g., happening all summer) and frequency of occurrence (e.g., happening once per week throughout the summer; M. Castellote, NMFS, unpub. Data; NMFS 2016).

A study focused on understanding whether anthropogenic noise could drive beluga habitat preference was conducted in Eagle River, Trading Bay, and Tuxedni Bay (Small et al. 2017). Even though noise metrics (sound pressure level and noise duration) appeared in high-ranking models as covariates for occupancy probability, the data were insufficient to indicate better predictive ability beyond those models that only included environmental covariates, thus the study was inconclusive (Small et al. 2017). Castellote et al. (2018) evaluated the diversity and acoustic properties of anthropogenic noise detected in 8,756 hours of acoustic recordings from 7 different locations within beluga critical habitat. Nine total sources of noise were identified: commercial ship, dredging, helicopter, jet aircraft (commercial or military non-fighter), fighter jet, propeller aircraft, outboard motor, pile driving, and sub-bottom profiler, as well as four repetitive noises of unidentified mechanical origin. Several anthropogenic noise sources were reported at levels with the potential to chronically mask beluga communication and hearing in most of the locations and periods sampled in the study. Sounds from activities such as shipping and dredging exceeded behavioral harassment levels on a daily basis. Ship noise was identified as the top priority focus for noise mitigation management actions (Castellote et al. 2018).

For continuous sounds (e.g. tug sound), NMFS generally uses a received level of 120 dB re 1 μPa (rms) as the threshold for estimating when Level B harassment is predicted to occur, though there are other qualitative factors that may be considered. NMFS guidance on 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). Tugboats under load are slow-moving compared to typical recreational and commercial vessel traffic. Exposure to sound from the moving tugs is on the order of minutes for a fixed location (a 185 dB sound source moving at 4 knots, assuming a spherical spreading loss coefficient of 20, will exceed 120 dB received level at a fixed point for a maximum duration of 53.4 minutes).

Listed animals will have ample opportunity to avoid tugs towing rigs before the sound from them may cause harassment. However, other factors (such as feeding on schools of fish) may compel them to endure such acoustic exposure. It is the exposure of these animals to tug sound that we have estimated.

The slow, predictable, and generally straight path of this tug configuration (as straight of a path as feasible due to the logistical difficulties of navigating a multi-tug configuration) may further lessen the likelihood that exposures at the expected levels would result in the harassment of marine mammals.

Hilcorp has used a multi-tug configuration to tug a jack-up rig in 2021 and 2022. There were no ESA listed species observed during these activities, however, other marine mammals were observed and their behaviors were documented. Previous movements of a jack-up rig through Cook Inlet have not documented any significant behavior changes in marine mammals. In July 2021, an unknown pinniped was observed 3,500 m (11,483 ft) away from the nearest tug while tugs were pulling the Spartan 151. The animal exhibited a looking behavior. A sea otter also exhibited a looking behavior approximately 500 m (1,640 ft) from the jack-up rig. The jack-up rig was self-supported and engaged in positioning activities. The tugs were not under load with the jack-up rig at the time of the sea otter sighting. The sea otter dove once, reappeared in same location and did not reappear after a second dive. A single harbor porpoise was observed on July 17, 2021. The animal exhibited traveling and diving behaviors approximately 1,000 m (3,281 ft) from the nearest tug while the tugs were sitting idle during jack-up rig positioning. No tugs were under load from the jack-up rig at the time of the harbor porpoise sighting. The harbor porpoise surfaced twice and did not reappear after a final dive. Harbor porpoise are known to be elusive, therefore, the fact that the harbor porpoise was not observed again is not considered unusual.

Hilcorp observed several non-ESA listed species in 2022 during the transport of the jack-up rig on June 2 and 3. Marine mammals were either observed having no reaction or at most observed looking towards the activity. The following is a description of each marine mammal sighting and the behavior observed during the sighting.

June 2, 2022

- 05:02 – One harbor seal was observed prior to tugs attaching to the Spartan 151. The animal exhibited a looking behavior and was approximately 350 m (1,148.3 ft) from the observation vessel. As the tugs were not yet attached to the jack-up rig, this sighting was not a potential Level B exposure.
- 09:30 – One harbor porpoise was observed while the tugs were holding the Spartan 151 stationary. The animal exhibited a traveling behavior and was approximately 3,000 m (9,842.5 ft) from the nearest tug.
- 09:49 – One harbor porpoise was observed while the tugs were holding the Spartan 151 stationary. The animal exhibited a traveling behavior and was approximately 500 m (1,640.2 ft) from the nearest tug.
- 10:30 – One harbor porpoise was observed while the tugs were holding the Spartan 151 stationary. The animal exhibited a swimming behavior and was approximately 200 m (656 ft) from the nearest tug.
- 11:32 – One harbor seal was observed while the tugs were holding the Spartan 151 stationary. The animal exhibited a looking behavior and was approximately 3,500 m (11,482.9 ft) from the nearest tug.
- 13:38 – Three harbor porpoises were observed while the tugs were holding the Spartan 151 stationary. The animals exhibited a traveling behavior and were approximately 75 m (246 ft) from the nearest tug.
- 15:16 – One harbor porpoise was observed while the tugs were pulling the Spartan 151. The animal exhibited a traveling behavior and was approximately 4,960 m (16,273 ft) from the nearest tug. The harbor porpoise was not within the Level B threshold.
- 16:04 – Two harbor porpoises were observed while the tugs were pulling the Spartan 151. The animals exhibited a traveling behavior and were approximately 2,950 m (9,678.5 ft) from the nearest tug.
- 16:21 – One harbor porpoise was observed while the tugs were pulling the Spartan 151. The animal exhibited a traveling behavior and was approximately 50 m (160 ft) from the nearest tug.
- 6:35 – One harbor seal was observed while the tugs were pulling the Spartan 151. The animal exhibited a looking behavior and was approximately 250 m (820 ft) from the nearest tug.
- 16:51 – One harbor porpoise was observed while the tugs were pulling the Spartan 151. The animal exhibited a traveling behavior and was approximately 2,150 m (7,053.81 ft) from the nearest tug.
- 17:30 – Two harbor seals were observed while the tugs were pulling the Spartan 151. The animals exhibited a traveling behavior and were approximately 2,563 m (8,408.8 ft) from the nearest tug.

3 June, 2022

- 02:59 – One harbor seal was observed while the tugs were holding the Spartan 151 stationary. The animal exhibited a looking behavior and was approximately 300 m (984.3 ft) from the nearest tug.
- 10:52 – One harbor seal was observed while tugs were holding the Spartan 151 stationary. The animal exhibited a looking behavior and was approximately 3,648 m (11,968.5 ft) from the nearest tug.

Based on observations made during previous tug towing a jack-up rig activities, it is not apparent if this activity causes harassment to the extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (Wieting 2016). However, because no listed marine mammals were observed and with the highly endangered Cook Inlet beluga overlapping with the action area, NMFS decided to conservatively estimate exposure to sounds capable of causing harassment in this consultation. Such harassment may occur because Hilcorp cannot discontinue controlled rig transport without causing risk to life, property, or the environment (i.e. cannot shutdown once tug operations have begun).

6.2.3 Effects on Prey Species

Underwater soundscape is important for marine life because sounds are used for a variety of purposes including communication, orientation, predatory avoidance, and foraging (McQueen et al. 2020). Zooplankton, and benthic prey are a food source for several marine mammal species, as well as a food source for fish that are prey for marine mammals. Fish are the primary prey species for marine mammals in Cook Inlet. Beluga whales feed on a variety of fish, shrimp, squid, and octopus (Burns and Seaman 1986). Common prey species in Knik Arm include salmon, eulachon and cod. Steller sea lions are generalist predators that eat a variety of fish and cephalopods (Pitcher and Calkins 1981; Calkins and Goodwin 1988; NMFS 2008b). Humpback whales feed on small schooling fishes, euphausiids, and other large zooplankton. Humpbacks' fish prey species in the North Pacific include Pacific herring, capelin, juvenile walleye pollock, sand lance, eulachon, Atka mackerel, Pacific cod, saffron cod, Arctic cod, juvenile salmon, and rockfish (Hain et al. 1982). 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 1980). Population effects on prey could therefore have indirect effects on marine mammals.

Prey species use sound to communicate, detect prey and predators, determine orientation, migrate, select habitat, and conduct mating behavior (Popper and Hawkins 2019). Anthropogenic sound can result in mortality to fish, but may also cause temporary hearing impairment, physiological changes, changes in behavior and the masking of biologically important sounds (Popper et al. 2014; Erbe et al. 2016; Popper and Hawkins 2019). Fish behavioral responses may vary with their age and condition, environmental conditions, different sound sources, and the received sound source level. Sound pressure levels generated by activities of the proposed action (vessel traffic, drilling, etc.) may cause temporary behavioral changes of prey species at close range, such as a startle or stress response. Literature reviews on the effects of sound on fish conclude little is known about sound effects and it is not possible to extrapolate from one research project to other single parameters of the same sound, to other types of sound, to other effects, or to other species.

The primary generators of sound energy associated with activities in this opinion include tugs towing the jack-up rig, drilling operations, well plugging and abandonment, water jets, and handheld underwater power tools with source levels <167 dB re 1 μPa at 1 m. There is no available information on the effects of sound from drilling, waterjets, and handheld tools such as the impact wrench on prey species, therefore, NMFS evaluates effects from pile driving sound to consider what population level effects may occur from the proposed action on prey species.

Popper and Hastings (2009) reviewed information on the effects of pile driving on invertebrates and concluded that there are no substantive data on whether the high sound levels from pile driving or any man-made sound would have physiological effects on invertebrates. Any such effects would be limited to the area very near (1–5 m [3.2–16.4 ft]) the sound source and would result in no population effects due to the relatively small area affected at any one time and the reproductive strategy of most zooplankton species (short generation, high fecundity, and very high natural mortality).

(Popper et al. 2005), reviewed the effects of sound on fish and concluded that salmonids were able to respond to low-frequency sound and to react to sound sources within a few feet of the source. Fish exposed to pile-driving sounds may show alarm responses, including an increase in swimming speed and changes in ventilation and heart rate. These transient startle responses are unlikely to result in adverse impacts because the fish often rapidly return to normal behavior. However, stronger more sustained behavioral responses to longer duration sounds may place an energetic load on the fish by generating oxygen debt as ventilation rates increase. In addition, anthropogenic sound may interfere with fishes' ability to detect, locate, and identify predator threats (Popper and Hawkins 2019).

The authors speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few feet is because they react to water particle motion/acceleration, not sound pressures. Detectable particle motion is produced within very short distances of a sound source, although sound pressure waves travel farther. Several caged fish studies on the effects of pile driving have been conducted, and most have involved salmonids. Ruggerone et al. (2015) exposed caged juvenile coho salmon (93–135 millimeters) at two distance ranges (near 1.8–6.7 m and distance 15 m) to 0.5-m-diameter steel piles driven with a vibratory hammer. Sound pressure levels reached 208 dB re 1 μPa peak, 194 dB re 1 μPa rms, and 179 dB re 1 μPa^2s SEL, leading to a cumulative SEL of approximately 207 dB re 1 μPa^2s during the 4.3-hr period. All observed behavioral responses of salmon to pile strikes were subtle; avoidance response was not apparent among fish. No gross external or internal injuries associated with pile driving sounds were observed. The fish readily consumed hatchery food on the first day of feeding (day 5) after exposure. The study suggests that coho salmon were not significantly affected by cumulative exposure to the pile driving sounds.

Rodkin (2009) similarly exposed caged juvenile (86–124 millimeters, 10–16 grams) coho salmon to sheet pile driving in Cook Inlet using vibratory and impact hammers. Sound pressures measured during the acoustic monitoring were relatively low, ranging from 177 to 195 dB re 1 μPa peak, and cumulative SEL sound pressures ranging from 179.2 to 190.6 dB re 1 μPa^2s. No measured peak pressures exceeded the interim criterion of 206 dB. Six of the 13 tests slightly exceeded the SEL criterion of 187 dB for fish over 2 grams. No short-term or long-term mortalities of juvenile hatchery coho salmon were observed in exposed or reference fish, and no short- or long-term behavioral abnormalities were observed in fish exposed to pile driving sound pressures or in the reference fish during post-exposure observations.

Fish have been shown to react when engine and propeller sounds exceed a certain level (Olsen et al. 1983; Ona 1988; Ona and Godø 1990). Avoidance reactions have been observed in fish such as cod and herring when vessel sound levels were 110–130 dB re 1 µPa rms (Ona and Toresen 1988; Ona and Godø 1990; Nakken 1992). Vessel sound source levels in the audible range for fish are typically 150–170 dB re 1 µPa/Hz (Richardson et al. 1995). The tugs towing the jack-up rig used are expected to produce levels of 185 dB re 1 µPa rms when in transit. Based upon the reports in the literature and the predicted sound levels from these vessels, there may be some avoidance by fish in the immediate area.

In general, fish perceive underwater sounds in the frequency range of 50 to 2,000 Hz, with peak sensitivities below 800 Hz (Popper et al. 2005). However, fish are sensitive to underwater impulsive sounds due to swim bladder resonance. As the pressure wave passes through a fish, the swim bladder is rapidly squeezed as the high-pressure wave passes through the fish. The swim bladder may repeatedly expand and contract at the high SPLs, creating pressure on the internal organs surrounding the swim bladder. (Hastings and Popper 2005) suggest that the available scientific evidence suggested that a single-strike SPL of 208 dB and a single strike SEL of 187 dB were appropriate thresholds for the onset of physical injury to fishes. NMFS uses 150 dB re 1 µPa (rms) as the sound pressure level that may result in onset of behavioral effects to fish species. The loudest activity associated with Hilcorp's activities is the use of tugs towing a jack-up rig at a 185 dB re 1 µPa, when using a transmission loss coefficient of 15, this results in a 150 dB isopleth at 200 m radius. Given the slow speed of the tugs towing the jack-up rig through open water, where there is ample amount of space available to prey species to move, it is expected that any effects to prey species will be minor.

The species most likely to be affected by substrate vibration are the species that live in, on, or just above the substrate. Marine mammals that feed near the substrate could also detect vibrations. It is unknown if vibrations detected by fish, invertebrates, and potentially marine mammals interfere with biologically important vibrations similar to how anthropogenic sounds interfere with biologically important sounds in the water column for fish (Popper and Hawkins 2019; Popper et al. 2022) and marine mammal vocalizations.

Hawkins et al. (2021) discusses the potential effects that vibrations (or particle motion) from anthropogenic equipment and associated sounds can have on substrate and the fish and invertebrates that use benthic habitat. Relatively few studies have been conducted on the effects of vibration on substrate; thus, the authors admit there are limited data to understand how fish and invertebrates may be affected. Sound-detection organs vary greatly among species of fish and invertebrates. Therefore, it is likely that each species has a different sensitivity to these perturbations. Further studies are needed to better assess the behavioral implications when fish and invertebrates are exposed to vibrations from anthropogenic sources (Hawkins et al. 2021).

Effects on prey species from the proposed action may include temporary hearing impairment, physiological changes, changes in behavior and the masking of biologically important sounds. However any impacts are only expected to affect fish species in close range to the tugs towing the jack-up rig, drilling, waterjets, and handheld activities. Additionally there are not expected population level effects to occur from the activities due in part to large reproductive capacities and naturally high levels of predation and mortality of these populations. Any mortalities or impacts that might occur would be expected to be negligible compared to the naturally occurring high reproductive and mortality rates.

Therefore NMFS concludes that any affects to Cook Inlet beluga whale, Mexico DPS and Western North Pacific DPS humpback, fin whale, and western DPS Steller sea lion due to prey impacts will be immeasurably small and unlikely to occur.

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.

All of the activities described in the *Environmental Baseline* (Section 5) are expected to continue into the future. 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).

While many of the activities (e.g., oil and gas development, development and dredging at or near the POA, and coastal development) described in the *Environmental Baseline* are expected to occur into the future, these activities likely have a Federal nexus and will require ESA section 7 consultation. Activities without a Federal nexus that are expected to continue into the future include state fisheries, pollution, and tourism, and are discussed in the following sections.

7.1 Fisheries (State of Alaska managed)

Fishing, a major industry in Alaska, is expected to continue in Cook Inlet. As a result, there will be continued risk to marine mammals of prey competition, ship strikes, harassment, and entanglement in fishing gear. Illegal shooting of listed species in association with commercial fisheries has also occurred, although it is not known to have occurred in Cook Inlet to date. For Cook Inlet beluga whales, there is also a notable risk of displacement from former summer foraging habitat (e.g., waters within and near the outlets of the Kenai and Kasilof Rivers during salmon season; (Figure 12; Castellote et al. 2016b). ADFG will continue to manage fish stocks and monitor and regulate fishing under their jurisdiction[27] in Cook Inlet to maintain sustainable stocks. It remains unknown whether and to what extent marine mammal prey may be less available due to commercial, subsistence, personal use, and sport fishing, especially near the mouths of streams up which salmon and eulachon migrate to spawning areas. The Cook Inlet Beluga Whale Recovery Team considered reduction in availability of prey due to activities such as fishing to be a moderate threat to the population.

7.2 Pollution

As the population in urban areas around Cook Inlet continues 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. Oil spills could occur from vessels traveling within the action area. In addition, oil spilled from outside the action area could migrate into the action area. 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

[27] https://www.adfg.alaska.gov/index.cfm?adfg=fishing.main

airports into Cook Inlet and beluga whale 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. However, pollutants of emerging concern such as flame retardants and estrogen mimics are unregulated and are not monitored.

7.3 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 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, high turbidity, and swift currents). We are aware, however, that some aircraft have circled around groups of Cook Inlet beluga whales, disrupting their breathing patterns and possibly their feeding activities. NMFS has undertaken outreach efforts to educate local pilots of the potential consequences of such actions, providing guidelines and encouraging pilots to "stay high and fly by".

Humpback whales are sufficiently numerous and easy to find within the action area such that whale watching may affect the behavior of some whales in lower Cook Inlet, primarily in the vicinity of Homer. Fin whales, being less common and arguably less charismatic than either humpback or beluga whales, are not likely to be a target for whale watching operations, but if sighted whale watching operations would likely stop to observe those that they may encounter.

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 speed often cause little to no reaction among whales in Cook Inlet (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 and other small watercraft operators to approach the beluga whales more closely than the 100-m minimum approach distance recommended by NMFS marine mammal viewing guidance (https://alaskafisheries.noaa.gov/pr/mm-viewing-guide).

While they are likely engaged in personal use and sport fishing to a far greater degree than any aspect of tourism, watercraft operators have been observed to harass belugas in the Twentymile River during April. Harassment of belugas also occurs during late summer coho salmon runs in the same area. Structured observation efforts from August 10-October 9, 2018, indicate belugas presence in these waters on 12 of 22 occasions (Beluga Whale Alliance, unpublished data). NMFS is cooperating with partners to assess the degree to which such boating activities may be a cause for concern due to the associated reduced access to concentrations of prey.

Watercraft regularly approach Western DPS Steller sea lion non-major haulouts (haulouts that were not used in determining the extent of critical habitat) near Homer, but data are not available indicating whether such marine mammal viewing adversely affects the animals.

8. Integration and Synthesis

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

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

As part of our risk analyses, we identified and addressed all potential stressors and considered all consequences of exposing listed species to all the stressors associated with the proposed action, individually and cumulatively, given that the individuals in the action area for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range.

In this opinion, our analysis focuses on the project activities that Hilcorp has proposed for the next two years; however, we recognize that a portion of these activities may continue into the future (e.g., 30 years). The proposed action is not expected to increase Hilcorp's future oil and gas production; therefore the project is not expected to increase aircraft, support vessels, and other platform operations outside of the drilling season. The activities that are likely to continue include the activities associated with production operations, and we assume that Hilcorp will continue to operate in a manner similar to production operations prior to the proposed action. There are, however, many variables that may affect Hilcorp's future activities (e.g., whether existing platforms will continue to produce oil and gas, the price of oil and gas, etc.), and the extent of Hilcorp's future activities in Cook Inlet is unclear given its notice to utilities that Hilcorp does not have sufficient reserves to provide for new gas contracts.[28] Although we do not have additional information on Hilcorp's activities after 2024, it is likely that Hilcorp will apply for future MMPA authorization(s) which will be subject to ESA consultation.

8.1 Cetacean Risk Analysis

Based on the results of the *Exposure Analysis*, we expect Cook Inlet beluga whales, fin whales, and Western North Pacific DPS and Mexico DPS humpback whales may be adversely affected by exposure to tugs towing a jack-up rig. With the implementation of mitigation measures, exposure to drilling sound, sounds associated with well plug and abandonment, vessel sound, aircraft sound, water jet sound, handheld tool sound, sea floor disturbance, and small oil spills may occur, but the expected effects are considered minimal and improbable, and are not expected to result in take. The probability of impacts on marine mammal prey occurring from the

[28] https://www.adn.com/business-economy/energy/2022/05/17/hilcorp-warns-alaska-utilities-about-uncertain-cook-inlet-natural-gas-supplies/

proposed project is very small, and thus adverse effects are improbable. If impacts to prey species due occur they are expected to be minor. Finally, exposure to large and very large oil spills, vessel strike, unauthorized discharge, and marine debris is improbable.

Our consideration of probable exposures and responses of listed whales to oil and gas production 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.

NMFS estimated that, over the course of the two years of this project the proposed action will expose 33 Cook Inlet beluga whales, 8 fin whales, 11 humpback whales (includes Hawaii DPS, Mexico DPS, and Western North Pacific DPS), and 30 Steller sea lions to sounds capable of causing behavioral harassment (i.e. Level B harassment; Section 6.2.2.3). These estimates represent the total number of takes that could potentially occur over two years, but not necessarily the number of individuals taken, as a single individual may be taken multiple times over the course of the proposed action. Exposure to sounds capable of causing a permanent threshold shift in hearing is not expected to occur.

Exposure to drilling sound, vessel sound, aircraft sound, sea floor disturbance, and unintentional pollutants may occur as part of the proposed action, however, with the implementation of mitigation measures, the effects are considered highly unlikely to occur or be extremely small in impact, and would not rise to the level of take. Vessel strikes are considered unlikely due to the implementation of mitigation measures. We have records of five cetaceans with vessel collisions that were reported in Cook Inlet. However, for some of the reports, the location of the strike could have occurred outside of Cook Inlet as the vessel's transit included areas outside of Cook Inlet (Section 6.2.4).

Consistent with AS 46.06.080, trash will be disposed of in accordance with state law. All closed loops will be cut prior to disposal and all ropes, nets, and other marine mammal entanglement hazards will be secured, making exposure to harmful marine debris and entanglement hazards unlikely.

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 the proposed action causing a small oil spill and exposing beluga, fin, Mexico DPS humpback, or Western North Pacific DPS humpback whales in Cook Inlet is sufficiently small as to be considered improbable.

Large and very large oil spills are considered low probability. The effects of a large oil spill would be significantly greater than that of small spills. A low probability, high-impact circumstance where large numbers of whales experience prolonged exposure to toxic fumes, and/or ingest large amounts of oil, could result in injury and mortality that exceeds potential biological removal (zero for Cook Inlet beluga whales, 3 for Western North Pacific DPS humpback whales, unknown for Mexico DPS humpback whales, and 2.1 for fin whales). However, due to the low likelihood of multiple large oil spills, and even lower likelihood of a VLOS, the risk of significant long term exposures of whales to accidental discharges of oil is extremely low. In addition, a number of regulatory changes have been put in place since Deepwater Horizon in an effort to reduce the risk of spills associated with oil and gas development and production activities (e.g., prescriptive and performance based regulations and guidance, as well as OCS safety and environmental protection requirements (BOEM 2012).

The hypothetical exploration and development scenario associated with Lease Sale 244 (an OCS lease sale in lower Cook Inlet) estimates a 22 percent likelihood of 1 to 2 large oil spills or gas releases if the assumed 215 million barrels of oil and natural gas are developed and produced between years 6 and 40 (BOEM 2017). No VLOS is expected (the estimated probability is $1x10^{-4}$ to $1x10^{-5}$ per well; (BOEM 2016)) based on historical occurrence and low number of activities being authorized. Based on these factors, the risk of significant long term exposures of whales to accidental discharges of oil is low.

Although the proposed activities may cause some individual whales to experience changes in their behavioral states, these responses are not likely to alter the physiology, behavioral ecology, and social dynamics of individual whales in ways or to a degree that would reduce their fitness. Activities likely to adversely affect listed whales (i.e. tugs towing a jack up rig) will only occur for a short duration (up to 16 non-consecutive days per year). At any given time, the harassment threshold of 3.8 km is a small footprint in comparison to the available habitat in Cook Inlet and is not expected to transverse through important foraging habitat. We expect that the whales may respond by continuing to actively forage in waters around operations or will seek alternative foraging areas. 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, we expect foraging to occur year-round on seasonally available prey. During spring and summer, beluga whales congregate in upper Cook Inlet feeding mainly on anadromous fish, including eulachon and Pacific salmon near river mouths. The majority of the proposed action will not occur along the coast, where beluga whales typical forage, but rather will occur further from shore in portions of the inlet where belugas typically do not feed during summer. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to markedly reduce the energy budgets of listed humpback, fin and Cook Inlet beluga 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). Their probable exposure to sound sources is 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. Therefore, these responses 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.

Due to the implementation of mitigation measures, exposures to sound at received levels that could cause harassment to listed whales are expected to be minimal. Mitigation measures will reduce exposure of listed whales to loud sound from the action through project timing, and by putting into place measures that facilitate early detection of approaching marine mammals and reduction of acoustic output if marine mammals appear likely to enter associated disturbance zones. Individuals may experience sounds capable of causing behavioral harassment (from tugs towing rigs), may experience masking, and may exhibit behavioral responses from project activities. Therefore, we expect ESA-listed whales may experience stress responses. If whales are not displaced and remain in a stressful environment (i.e., within the behavioral harassment zone), we expect the stress response will dissipate shortly after the acoustic stressor has passed by or ceased. TTS may occur if a listed species is within the disturbance harassment threshold (i.e. Level B harassment threshold); however, the severity of TTS depends on the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). Although the tugs towing the jack up rig 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 mentioned in the *Environmental Baseline* section, Cook Inlet beluga whales, fin whales, and Western North Pacific DPS and Mexico DPS humpback whales, may be impacted by a number of anthropogenic activities present in Cook Inlet. 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, oil and gas development, ship strikes, sound pollution, water pollution, prey reduction, fisheries, tourism, direct mortalities, and research, in addition to factors operating on a larger scale such as predation, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. Cumulative effects of multiple stressors (e.g. prey availability, anthropogenic activities, predation, subsistence harvest, pollution, habitat degradation) are considered to be a high concern for the recovery of Cook Inlet belugas. In the absence of a single threat clearly limiting recovery, the cumulative effects from multiple stressors limiting recovery is a most plausible explanation for why the Cook Inlet beluga population has not recovered (NMFS 2016). Because of the unknown cause for the decline and recovery of Cook Inlet belugas, all actions with a federal nexus have undergone extensive evaluation to understand impacts and inform development of additional mitigation measures when necessary to reduce impacts to Cook Inlet beluga whales. In recent years, most applicants have implemented strict mitigation measures to shut down if a Cook Inlet beluga enters a behavioral disturbance harassment zone (i.e., zone within which MMPA Level B Harassment may occur), even when take has been authorized, to further reduce the likelihood that the anthropogenic activity will reduce the fitness of an individual whale.

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 whales 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 such populations). For the same reasons, an action that is not likely to reduce the viability of those populations is not likely to increase the extinction probability of the species those populations comprise; in this case, the Cook Inlet beluga, fin, Mexico DPS humpback, or Western North Pacific DPS humpback whale. As a result, the proposed action is not likely to appreciably reduce the Cook Inlet beluga, fin, Mexico DPS humpback, or Western North Pacific DPS humpback whales' likelihood of recovering or surviving in the wild.

We have concluded that the proposed action will have, at most, only an extremely small impact on humpback whale and fin whale populations, if it has any impact at all, because upper Cook Inlet, where most effects from the proposed action will occur, is utilized only occasionally by humpbacks and fin whales, and then only in very small numbers. Because the action will not reduce the reproduction, numbers, or distribution of the species, NMFS concludes that the proposed action is not expected to appreciably reduce the likelihood of survival or recovery of Mexico DPS or Western North Pacific humpback whales or fin whales.

NMFS estimated the Cook Inlet beluga population to be about 279 animals as of 2018, a 10-year (2008-2018) declining trend of -2.3 percent/year (95 percent predication interval of -4.1 percent to -0.6 percent) (Shelden and Wade 2019) . The 2 to 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 (Figure 11). Whereas Cook Inlet beluga whales 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. Coastal development and boat traffic, especially near Anchorage, has the potential to disrupt beluga whale behavior, and may alter movements between and within important summer habitat patches through acoustic disruption (e.g., pile driving may hinder passage between Knik Arm and the Susitna Delta area). Seismic exploration in upper Cook Inlet has caused both Level A and Level B takes of Cook Inlet beluga whales. Aircraft have been observed to cause behavioral changes in feeding groups of Cook Inlet beluga whales in the Susitna Delta when aircraft circled or passed low over those groups. Pollution and contaminants were listed as a low relative concern for impeding the recovery of Cook Inlet beluga whales (NMFS 2016; Muto et al. 2018). Only one known beluga whale mortality associated with fisheries interaction was reported in over 10 years. There is no current subsistence harvest of Cook Inlet beluga whale (Muto et al. 2018).

Oil and gas development in Cook Inlet remains a concern regarding the recovery of the Cook Inlet beluga DPS; however, little is known regarding how possible threats, alone or cumulatively, are impacting recovery of this DPS.

Based on the best information currently available, the proposed action is not expected to appreciably reduce the likelihood of recovery of Cook Inlet beluga, fin, Mexico DPS humpback, or Western North Pacific DPS humpback whales.

8.2 Western DPS Steller Sea Lion Risk Analysis

Based on the results of the Exposure Analysis, we expect Western DPS Steller sea lions may experience sounds capable of causing behavioral harassment through exposure to underwater sound from tugs towing the jack-up rig. Exposure to sounds from water jets, production drilling, well plugging and abandonment, vessels, aircrafts, and other handheld tools, as well as impacts from seafloor disturbance, would have a very small impact, and we conclude that these stressors will not result in take of sea lions. The probability of Steller sea lions being exposed to small oil spills is improbable because a small spill will impact an insignificant portion of Steller sea lions occupied habitat. The probability of impacts on WDPS Steller sea lion prey occurring from the proposed project is very small, and thus adverse effects are extremely unlikely to occur. Therefore, the expected effects are considered minor and improbable.

Exposure to large and very large oil spills, vessel strike, authorized discharge, and marine debris are considered extremely unlikely to occur. One Steller sea lion was reported within Cook Inlet with two separate head wounds consistent with blunt trauma, with suspected vessel strike as the cause of the trauma (NMFS Alaska Regional Office Stranding Database accessed May 2017). There are no other reported vessel collisions or prop strikes of Steller sea lions in Cook Inlet. The increase in ship traffic due to the proposed action is unlikely to change this pattern markedly due to the slow vessel speeds for project vessels. Therefore, we consider the likelihood of additional strikes resulting from this action to be very improbable. Exposure to nonbiodegradable marine debris, specifically to debris that can cause entanglement, remains an unquantifiable risk, but associated effects from this project would be minimal. Best practices regarding waste management (cutting loops prior to disposal) will further reduce the impact of debris on Steller sea lions. Because large and very large oil spills are considered extremely unlikely to occur, the effects from those events are also considered improbable. Finally, large and very large oil spills are considered low probability, high-impact events (Section 6.2.1.8). Due to the low likelihood of multiple large oil spills, and even lower predicated likelihood of a VLOS, the risk of significant long term exposures of sea lions to accidental discharges of oil is low.

Our consideration of probable exposures and responses of Western DPS Steller sea lions to production 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 Western DPS Steller sea lions. Implementation of mitigation measures will further reduce the potential impacts to Western DPS Steller sea lions.

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 2008b). While the pupping and breeding season overlaps with the proposed action activities, no Steller sea lion rookeries or haulouts are within the action area. Individual and cumulative energy costs of the behavioral responses we have discussed are not likely to measurably reduce the energy budgets of Steller sea lions. As a result, the Steller sea lions' probable responses (i.e., tolerance, avoidance, short-term masking, and short-term vigilance behavior) to close approaches by tugs towing a jack-up rig activities 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.

Exposure to vessel sound, drilling sound, aircraft sound, water jets, handheld underwater power tools with source levels <167 dB re 1 µPa at 1m, sea floor disturbance, and small oil spills may occur as part of the proposed action. However, with the implementation of mitigation measures the effects are considered minor and would not rise to the level of take. Exposure to vessel strike is extremely unlikely to occur. We have records suggesting that one Steller sea lion was likely killed by a vessel strike within Cook Inlet. The incremental increase in ship traffic due to the proposed action is unlikely to change this pattern markedly. In addition, the speed at which project vessels will typically be operating is below the velocity at which most lethal interactions occur. Therefore, we consider the likelihood of additional strikes resulting from this action to be very improbable.

The proposed oil and gas activities may cause some individual Steller sea lions to experience changes in their behavioral states that might have adverse consequences (Frid and Dill. 2002). However, 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. While a single individual may be exposed to harassing levels of sound, 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 (e.g. tugs towing a rig) in water.

We have concluded that the proposed action will have only an extremely small impact on the Western DPS Steller sea lion population because upper Cook Inlet, where most effects from the proposed action will occur, is utilized only occasionally by Steller sea lions, and then only in very small numbers. Because the action will not reduce the reproduction, numbers, or distribution of the species, NMFS concludes that the proposed action is not expected to appreciably reduce the likelihood of survival or recovery of Western DPS Steller sea lions.

As mentioned in the *Environmental Baseline* section, Western DPS Steller sea lions, may be impacted by a number of anthropogenic activities present in Cook Inlet. 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, oil and gas development, ship strikes, sound pollution, water pollution, prey reduction, fisheries, tourism, direct mortalities, and research, in addition to factors operating on a larger scale such as predation, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats.

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 Western DPS Steller sea lion. As a result, the proposed action is not likely to appreciably reduce the Western DPS Steller sea lion’s likelihood of recovering or surviving in the wild.

Western DPS Steller sea lions occur in the action area at low densities, but may occur there throughout all months of project activity.

Based on the best information currently available, the proposed action is not expected to appreciably reduce the likelihood of recovery in Western DPS Steller sea lions.

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 may affect but is not likely to adversely affect designated Cook Inlet beluga whale critical habitat and is not likely to jeopardize the continued existence of fin whale, Mexico DPS humpback whale, Western North Pacific DPS humpback whale, Western DPS Steller sea lion, or Cook Inlet beluga whale.

10. Incidental Take Statement

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. § 1532(19)). "Incidental take" is defined as take that results from, but is not the purpose of, the carrying out of an otherwise lawful activity conducted by the action agency or applicant (50 CFR § 402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 U.S.C. § 1362(18)(A)(i) and (ii)). For this consultation, the NMFS Permits Division anticipates that any take will be by Level B harassment only. No Level A takes are contemplated or authorized. Only those specific activities identified as exceeding MMPA take criteria (i.e. Level B Harassment) were evaluated for potential ESA harassment exposure. Using MMPA take criteria sets a conservative take threshold and ensures that all potential ESA take is considered: any activity that rises to harassment take under the ESA would constitute harassment take under the MMPA.

The ESA does not prohibit the take of threatened species unless special regulations have been promulgated, pursuant to ESA section 4(d), to promote the conservation of the species. Federal regulations promulgated pursuant to section 4(d) of the ESA extend the section 9 prohibitions to the take of Mexico DPS humpback whales (50 C.F.R. § 223.213).

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

10.1 Amount or Extent of Take

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

NMFS is reasonably certain the proposed Hilcorp project activities are likely to result in the incidental take of ESA-listed species by Level B harassment associated with sound of tugs towing a jack-up rig.

As discussed in Section 6 of this opinion, the proposed action is expected to result in take of listed marine mammals as indicated in Table 20. For a breakdown of calculations and exposure by stressor, see Section 6. The method used for estimating the number of instances of take for each species resulting from exposure to sound levels expected to result in harassment (i.e. Level B harassment) is described in Section 6.

NMFS Permits Division has indicated they will authorize the following number of instances of MMPA Level B take over a two year period covered by their incidental take authorization: 33 Cook Inlet beluga whales, 11 humpback whales (including Western North Pacific DPS and Mexico DPS), 8 fin whales, and 30 Steller sea lions.

Of the 11 humpback whales, 11 percent (i.e., 1 animal) is predicted to be from the Mexico DPS and 1 percent (i.e., 1 animal) is predicted to be from the Western North Pacific DPS (Wade 2021). To get to those numbers and based on presence in Cook Inlet, NMFS calculated that 11 percent of the 11 humpback whales authorized are predicted to be from the Mexico DPS (resulting in 1.21 instances of take overall; 0.55 instances during year 1 and 0.66 instances during year 2) and 1 percent are predicted to be from the Western North Pacific DPS (resulting in 0.11 instances of take; 0.05 instances during year 1 and 0.06 instances during year 2; Wade et al. 2021). While we are only authorizing take of 1 Mexico DPS humpback whale and 1 Western North Pacific DPS of humpback whale under the ESA, we will consider the ESA-authorized take limit to be exceeded if and when the MMPA-authorized limit on Level B take of humpback whales is exceeded because it is not possible to distinguish between DPSs in the field.

Based on the above information, NMFS AKR is authorizing takes for the number of ESA-listed individuals described in Table 21.

Table 21. Incidental take associated with the proposed tugs towing a jack-up rig.

Species	Year 1 Authorized Take	Year 2 Authorized Take
Humpback whale[a]	5	6
Fin whale	4	4
Cook Inlet beluga whale	11	22
Steller sea lion	13	17
[a]Includes Hawaii, Western North Pacific, and Mexico DPSs. The fractions of the listed DPSs that are expected to be exposed are in the text above.		

10.2 Effect of the Take

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

Although the biological significance of the expected behavioral responses of Cook Inlet beluga whales, fin whales, Mexico DPS humpback whales, Western North Pacific DPS humpback whales, and Western DPS Steller sea lions remains unknown, this consultation has assumed that exposure to disturbances associated with the Hilcorp oil and gas activities in Cook Inlet might disrupt one or more behavioral patterns that are essential to an individual animal’s life history. However, any behavioral responses of these whales and pinnipeds to major sound sources, and any associated disruptions, are not expected to affect the reproduction, survival, or recovery of these species.

The taking of Cook Inlet beluga whales, fin whales, Mexico DPS humpback whales, Western North Pacific DPS humpback whales, and Western DPS Steller sea lions will be by incidental (acoustic) harassment only.

10.3 Reasonable and Prudent Measures

“Reasonable and prudent measures” are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take.” (50 CFR 402.02). Failure to comply with RPMs (and the terms and conditions that implement them) may invalidate the take exemption and result in unauthorized take.

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

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of fin whale, Mexico DPS humpback whale, Western North Pacific DPS humpback whale, Western DPS Steller sea lion, or Cook Inlet beluga whale resulting from the proposed action.

1. The NMFS Permits Division will monitor for take (authorized and unauthorized) and the effects of their action on listed marine mammals and monitor and report the effectiveness of mitigation measures. In addition, they must submit a report to NMFS AKR that evaluates the mitigation measures and reports the results of the monitoring program.

10.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. These terms and conditions are in addition to the mitigation measures included in the proposed action, as set forth in Section 2.1.2 of this opinion. The NMFS Permits Division or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR § 402.14(i)(3))).

Any taking that is in compliance with these terms and conditions is not prohibited under the ESA (50 CFR § 402.14(i)(5)). As such, partial compliance with these terms and conditions may invalidate this take exemption and result in unauthorized, prohibited take under the ESA. If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the action may lapse.

These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

To carry out RPM #1, PR1 must undertake (or require their permittees to undertake) the following:

1. The NMFS Permits Division must provide NMFS AKR with written and photographic (if applicable) documentation of any effects of the proposed actions on listed marine mammals and implementation of the mitigation measures specified in Section 2.1.2 of the Biological Opinion.

11. Conservation Recommendations

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

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

NMFS AKR recommends:

1. Hilcorp delay delivery of supplies, when feasible, if there are marine mammals sighted from the platform.
2. Hilcorp continue to support and be involved in the annual Cook Inlet Beluga's Count event.
3. Hilcorp continue to support and be involved in the Cook Inlet Beluga Whale Recovery Implementation Task Force.
4. Hilcorp work with NMFS to pursue actions that would protect Cook Inlet beluga whale habitats important for feeding or reproduction, particularly in and near rivers that support large populations of salmon or eulachon used by Cook Inlet beluga whales.
5. Hilcorp continue to work with NMFS to support research to understand the impacts of anthropogenic activities on Cook Inlet belugas.

12. Reinitation of Consultation

As provided in 50 CFR § 402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately (50 CFR § 402.14(i)(4)).

13. Data Quality Act Documentation and Pre-Dissemination Review

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

13.1 Utility

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

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

13.2 Integrity

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

13.3 Objectivity

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

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

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

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

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