ENVIRONMENTAL ASSESSMENT FOR THE ISSUANCE OF INCIDENTAL HARASSMENT AUTHORIZATIONS FOR THE TAKE OF MARINE MAMMALS BY HARASSMENT INCIDENTAL TO TUGS TOWING A RIG IN COOK INLET, ALASKA

LEAD AGENCY: U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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LOCATION: Cook Inlet, Alaska

ABSTRACT: National Marine Fisheries Service issued two Incidental Harassment Authorizations to Hilcorp Alaska LLC for the take of marine mammals incidental to tugs towing rigs in Cook Inlet, Alaska.

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Chapter 1 Introduction and Purpose and Need

1.0 Introduction and Background

The National Marine Fisheries Service (NMFS) received an application from Hilcorp Alaska LLC (Hilcorp), requesting incidental take of marine mammals by tugs towing a jack-up rig associated with production drilling in Cook Inlet, Alaska. NMFS is required to review applications and, if appropriate, issue Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.). In addition, the National Environmental Policy Act (NEPA), 40 Code of Federal Regulations (CFR) Parts 1500 -1508[1] (CEQ regulations), and the National Oceanic and Atmospheric Administration (NOAA) policy and procedures[2] require all proposals for major federal actions be reviewed with respect to environmental consequences on the human environment. Therefore, NMFS conducted an environmental review of Hilcorp's application and determined an Environmental Assessment (EA) is appropriate for NMFS' consideration to issue two Incidental Harassment Authorizations (IHAs) to Hilcorp.

This Chapter presents a summary of NMFS' authority to authorize incidental take of marine mammals, a summary of the applicant's request, and identifies NMFS' action and purpose and need. This Chapter also explains the background and environmental review process associated with the applicant's request and provides other information relevant to the analysis in this EA, such as the scope of the analysis and compliance with environmental laws and regulations. The remainder of this EA is organized as follows:

- Chapter 2 describes the applicant's activities and the alternatives carried forward for analysis as well as alternatives not carried forward for analysis.
- Chapter 3 describes the baseline conditions of the affected environment.
- Chapter 4 describes the direct, indirect and cumulative impacts to the affected environment, specifically impacts to marine mammals and their habitat associated with NMFS's action and alternatives.
- Chapter 5 lists document preparers.
- Chapter 6 lists references cited.

1.1 Marine Mammal Protection Act Overview

The MMPA prohibits, with certain exceptions, the "take[3]" of marine mammals in U.S. waters by U.S. citizens. The MMPA allows, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity within a specified geographic region.

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[1] This EA is being prepared using the 2020 CEQ NEPA Regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020, and reviews begun after this date are required to apply the 2020 regulations unless there is a clear and fundamental conflict with an applicable statute. 85 Fed. Reg. at 43372-73 (§§ 1506.13, 1507.3(a)).

[2] National Oceanic and Atmospheric Administration Administrative Order (NAO) 216-6A "Compliance with the National Environmental Policy Act and Executive Order 12114 Environmental Effects Abroad of Major Federal Actions 11988 and 13690 Floodplain Management; and 11990 Protection of Wetlands" and the Companion Manual for NAO 216-6A.

[3] "Take" means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Take of a marine mammal falls under three categories: mortality, serious injury, or harassment (i.e., injury and behavioral effects). Harassment is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment).

The exceptions to the prohibition on take in Sections 101(a)(5)(A) and (D) of the MMPA, gives NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals by harassment, provided certain determinations are made and statutory and regulatory procedures are met. The full text of the MMPA is available for review on NMFS' website: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act.

NMFS also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals, 50 Code of Federal Regulations (CFR) Part 216 and produced Office of Management and Budget (OMB)-approved application instructions (OMB Number 0648-0151) that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA.

1.2 Summary of Hilcorp's Incidental Take Authorization Request

NMFS has received a request from Hilcorp Alaska LLC (Hilcorp) for authorization to take marine mammals incidental to tugs towing a jack-up rig in Cook Inlet. Authorizations for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

The project includes three tugs simultaneously towing the jack-up rig to various well sites as well as positioning the jack-up rig at the appropriate location. The towing and positioning of the jack-up rig is in support of well plugging and abandonment activities as well as production drilling. Water jets, helicopters, generators, and mud pumps will also be utilized during these plugging and production activities. Work would be limited to Middle Cook Inlet and towing and positioning of the jack-up rig would occur for approximately fourteen days in Year 1 and sixteen days in Year 2.

1.3 Purpose and Need

1.3.1 Description of Action

NMFS' action is the issuance of two IHAs to Hilcorp pursuant to Section 101(a)(5)(D) of the MMPA and 50 CFR Part 216. The IHAs will be valid for one year each (sequentially) from date of issuance and would authorize take of marine mammals, by Level B harassment, incidental to Hilcorp's activities. NMFS' action is a direct outcome of Hilcorp's request for authorization. The action is also described in the notice of proposed IHAs published in the Federal Register (FR), under "Summary of Request" and "Description of

Specified Activities" and further explained in Chapter 2 of this EA.

1.3.2 Purpose

The purpose of NMFS' action is to make a decision regarding the authorization of take of marine mammals incidental to the tug towing rig activities by Hilcorp, consistent with applicable legal requirements. NMFS may issue ITAs allowing the take of a small number of marine mammals only if the taking would have no more than a "negligible impact" on those marine mammal species or stocks, and not have an "unmitigable adverse impact" on the availability of the species or stock for "subsistence" uses. In issuing ITAs, NMFS must prescribe the permissible methods of taking and other means of effecting the least practicable impact on the species or stocks of marine mammals and their habitat, paying particular attention to rookeries, mating grounds, and other areas of similar significance. NMFS must also prescribe means of effecting the least practicable impact on the availability of the species or stocks of marine mammals for subsistence uses. Finally, IHAs must include requirements or conditions pertaining to monitoring and reporting, in large part to increase NMFS' understanding of the effects of such taking on the species.

1.3.3 Need

U.S. citizens seeking to obtain authorization for the incidental take of marine mammals under NMFS' jurisdiction must submit such a request in the form of an application. Because Hilcorp submitted an adequate and complete application demonstrating the need and potential eligibility for two IHAs under the MMPA, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. Therefore, NMFS' responsibilities under section 101(a)(5)(D) of the MMPA and its implementing regulations establish and frame the need for NMFS' action.

1.4 Environmental Review Process

In accordance with NEPA and CEQ regulations, NMFS, to the fullest extent possible, integrates the requirements of NEPA with other regulatory processes required by law or by agency practice so that all procedures run concurrently, rather than consecutively. This includes coordination within the National Oceanic Atmospheric and Administration (NOAA), (e.g., the Office of National Marine Sanctuaries) and with other regulatory agencies (e.g., the U.S. Fish and Wildlife Service (USFWS)), as appropriate, during NEPA reviews prior to implementation of an action to ensure that requirements are met. Regarding the issuance of IHAs, NMFS relies substantially on the public process required by the MMPA for preparing proposed IHAs to develop and evaluate relevant environmental information and provide a meaningful opportunity for public participation when NMFS prepares associated NEPA documents. NMFS fully considered public comments received in response to the publication of proposed IHAs during the NEPA review process.

1.4.1 Scoping and Public Involvement

The NEPA process is intended to enable NMFS to make decisions based on an understanding of the environmental consequences and take actions to protect, restore, and enhance the environment. An integral part of the NEPA process is public involvement. Although agency procedures do not require publication of the draft EA prior to finalizing an EA, NMFS relied substantially on the public process pursuant to the MMPA to develop and evaluate environmental information relevant to an analysis under NEPA. NMFS made the IHA applications available to the public and published a notice of proposed IHAs for review and comment on May 9, 2022 (87 FR 27597). There, NMFS alerted the public it intended to use the MMPA public review process for the proposed IHAs to solicit relevant environmental information and provide the public an opportunity to submit comments. A draft EA was available on the internet along with the proposed IHAs. The Federal Register included a detailed description of the proposed action resulting from the MMPA IHA process; consideration of environmental issues and impacts of relevance related to the proposed IHAs; and potential mitigation and monitoring measures to avoid and minimize potential adverse impacts to marine mammals and their habitat. The Federal Register notice of proposed IHAs, the draft EA and the corresponding public comment period were are instrumental in providing the public with information on relevant environmental issues and offering the public a meaningful opportunity to provide comments for our consideration in both the MMPA and NEPA decision-making processes.

During the 30-day public comment period following the publishing of the notice of proposed IHAs, NMFS received a comment letter from Hilcorp (the applicant), from the Bureau of Ocean Energy Management (BOEM), and the Council for Biological Diversity (CBD) on behalf of a coalition of NGOs. Hilcorp's letter was supportive of NMFS' proposed action with several corrections and clarifications requested. BOEM's letter was also supportive with several recommendations, such as the inclusion of take of the Pacific white-sided dolphins based on acoustic detections in lower Cook Inlet. CBD expressed concerns about the overall status of Cook Inlet belugas and suggested that NMFS refrain from issuing incidental take until NMFS can say with certainty that issuance of these takes would not exacerbate the decline of the population. CBD also expressed concerns about the lack of cumulative impact analysis in the EA regarding this and other activities in Cook Inlet. Certain details that were not included in the draft EA, which were raised during the public comment period, are now included in the Final EA, such as the number of active permits and incidental take authorizations that authorize take of Cook Inlet beluga whales. Comments received in response to the publication of the proposed IHAs were considered and used to inform the analysis in this Final EA and to develop mitigation, monitoring and other conditions for the final IHAs. A more detailed summary of the comments, and NMFS' responses to those comments, is included in the Federal Register notice of issuance of the IHAs.

1.5 Other Environmental Laws or Consultations

NMFS must comply with all applicable federal environmental laws and regulations necessary to implement an action. NMFS' evaluation of and compliance with environmental laws and regulations is based on the nature and location of the applicant's activities and NMFS' action. Therefore, this section only summarizes environmental laws and consultations applicable to NMFS' issuance of IHAs to Hilcorp.

1.5.1 The Endangered Species Act

The Endangered Species Act (ESA) established protection over and conservation of threatened and endangered (T&E) species and the ecosystems upon which they depend. An endangered species is a species in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered within the near future throughout all or in a significant portion of its range. The USFWS and NMFS jointly administer the ESA and are responsible for the listing of species (designating a species as either threatened or endangered) and designating geographic areas as critical habitat for T&E species. The ESA generally prohibits the "take" of an ESA-listed species unless an exception or exemption applies. The term "take" as defined in section 3 of the ESA means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Section 7(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 designated critical habitat of such species. When a federal agency's action may affect a listed species, that agency is required to consult with NMFS and/or the USFWS under procedures set out in 50 CFR Part 402. NMFS and USFWS can also be action agencies under section 7. Informal consultation is sufficient for species the action agency determines are not likely to be adversely affected, if NMFS or USFWS concurs with the action agency's findings, including any additional measures mutually agreed upon as necessary and sufficient to avoid adverse impacts to listed species and/or designated critical habitat.

NMFS' issuance of IHAs is a federal action that is also subject to the requirements of section 7 of the ESA. As a result, NMFS is required to ensure that the issuance of IHAs to Hilcorp is not likely to jeopardize the continued existence of any T&E species or result in the destruction or adverse modification of designated critical habitat for these species. Because the humpback whale, fin whale, Cook Inlet beluga whale and Steller sea lion are ESA-listed species with confirmed or possible occurrence in Cook Inlet, NMFS Office of Protected Resources (OPR) Permits and Conservation Division initiated consultation with the NMFS' Alaska Regional Protected Resources Division on the issuance of IHAs to Hilcorp, pursuant to section 7 of the ESA. The resultant Biological Opinion determined that the proposed action was not likely to jeopardize the continued existence of beluga whales, humpback whales, fin whales, Steller sea lions, or modify or destroy designated critical habitat.

1.5.2 Magnuson-Stevens Fishery Conservation and Management Act

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), federal agencies are required to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency which may adversely affect essential fish habitat (EFH) identified under the MSFCMA. Although EFH was identified in Cook Inlet for walleye Pollock, rock sole, Pacific cod, skate, weathervane scallop, Pacific salmon, and sculpin, we do not anticipate NMFS' action of authorizing take of marine mammals and the associated mitigation and monitoring, to impact EFH; therefore, an EFH consultation was not conducted.

1.6 Document Scope

This EA was prepared in accordance with NEPA (42 USC 4321, et seq.), CEQ Regulations, and NOAA policy and procedures . The analysis in this EA addresses potential direct, indirect, and cumulative impacts to marine mammals and their habitat, resulting from NMFS' action to authorize incidental take associated with tugs towing a jack-up rig by Hilcorp. However, the scope of this analysis is limited to the decision for which NMFS is responsible (i.e., whether to issue the IHAs). This EA is intended to provide focused information on the primary issues and impacts of environmental concern, which is NMFS' issuance of IHAs authorizing the take of marine mammals incidental to Hilcorp's activities, and the mitigation and monitoring measures to minimize the effects of that take. For these reasons, this EA does not provide a detailed evaluation of the effects to the elements of the human environment listed in Table 1 below.

Table 1. Elements of the Environment Not Carried Forward for Analysis

Biological	Physical	Socioeconomic/Cultural
• Humans • Fisheries Resources and Essential Fish Habitat • Invertebrates • Invasive Species • Marine and Coastal Birds • Sea Turtles • Threatened and Endangered Fishes • Benthic Communities	• Air Quality • Farmland Geography • Geology/sediments • Land use • Oceanography • State Marine Protected Areas • Federal Marine Protected Areas • National Estuarine Research Reserves • National Marine Sanctuaries • National Wildlife Refuges • Park Land • Water Quality • Wetlands • Wild and Scenic Rivers	• Commercial Fishing • Historic and Cultural Resources • Indigenous Cultural Resources • Low Income Populations • Military Activities • Minority Populations • National Historic Preservation Sites • Other Marine Uses: Military activities, Shipping and marine transportation, and Boating • Recreational Fishing • Public Health and Safety

Chapter 2 Alternatives

2.0 Introduction

As indicated in Chapter 1, NMFS' Action is to issue two IHAs to Hilcorp to authorize the take of small numbers of marine mammals incidental to tugs towing a jack-up rig. NMFS' Action is triggered by Hilcorp's request for IHAs per the MMPA of 1972, as amended (16 U.S.C. 1361 et seq.). In accordance with NEPA and the CEQ regulations, NMFS is required to consider a reasonable range of alternatives to a Action as well as the No Action Alternative. Reasonable alternatives are viable options for meeting the purpose and need for the action. The evaluation of alternatives under NEPA assists NMFS with understanding, and as appropriate, minimizing impacts through an assessment of alternative ways to achieve the purpose and need for NMFS' Action. Reasonable alternatives are carried forward for detailed evaluation under NEPA while alternatives considered but determined not to meet the purpose and need are not carried forward. For the purposes of this EA, an alternative will only meet the purpose and need if it satisfies the requirements under section 101(a)(5)(D) of the MMPA. Therefore, NMFS applied the screening criteria and considerations outlined in Section 2.1 to the alternatives to identify which alternatives to carry forward for analysis.

2.1 Criteria and Considerations for Selecting Alternatives

Under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses ("least practicable adverse impact"). Consideration of the availability of marine mammal species or stocks for taking for subsistence uses pertains only to Alaska. NMFS does not have a regulatory definition for "least practicable adverse impact." However, NMFS' implementing regulations require applicants for ITAs to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)). In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, NMFS carefully considers two primary factors:

(1) The manner in which, and the degree to which, implementation of the measure(s) is expected to reduce impacts to marine mammal species or stocks, their habitat, and their availability for subsistence uses (when relevant). This analysis will consider such things as the nature of the potential adverse impact (such as likelihood, scope, and range), the likelihood that the measure will be effective if implemented, and the likelihood of successful implementation.

(2) The practicability of the measure for applicant implementation. Practicability of implementation may consider such things as cost, impact on operations, personnel safety, and practicality of implementation.

While the language of the least practicable adverse impact standard calls for minimizing impacts to affected species or stocks, NMFS recognizes that the reduction of impacts to those species or stocks accrues through the application of mitigation measures that limit impacts to individual animals. Accordingly, NMFS' analysis focuses on measures designed to avoid or minimize impacts on marine mammals from activities that are likely to increase the probability or severity of population-level effects, including auditory injury or disruption of important behaviors, such as foraging, breeding, or mother/calf interactions. In order to satisfy the MMPA's least practicable adverse impact standard, NMFS requires a suite of basic mitigation protocols that are required regardless of the status of a stock. Additional or enhanced protections are required for species whose stocks are in poor health and/or are subject to some significant additional stressor that lessens that stock's ability to weather the effects of the specified activity without worsening its status.

In the evaluation of specific measures, the details of the specified activity will necessarily inform each of the two primary factors discussed above (expected reduction of impacts and practicability), and will be carefully considered to determine the types of mitigation that are appropriate under the least practicable adverse impact standard. Analysis of how a potential mitigation measure may reduce adverse impacts on a marine mammal stock or species, and practicability of implementation, are not issues that can be meaningfully evaluated through a binary lens. The manner in which, and the degree to which, implementation of a measure is expected to reduce impacts, as well as its practicability in terms of these considerations, can vary widely. For example, a time/area restriction could be of very high value for decreasing population-level impacts (e.g., avoiding disturbance of feeding females in an area of established biological importance) or it could be of lower value (e.g., decreased disturbance in an area of high productivity but of less firmly established biological importance). Regarding practicability, a measure might involve operational restrictions that completely impede the operator's ability to conduct tugging activity (higher impact), or it could mean additional incremental delays that increase operational costs but still allow the activity to be conducted (lower impact). Expected effects of the activity and of the mitigation, as well as status of the stock, all weigh into these considerations. Accordingly, the greater the likelihood that a measure will contribute to reducing the probability or severity of adverse impacts to the species or stock, the greater the weight that measure is given when considered in combination with practicability to determine the appropriateness of the mitigation measure, and vice versa. No quantitative formula is provided by the MMPA or by regulation, and it is not reasonable to expect an assessment of the mitigation required to achieve the least practicable adverse impact other than as described here.

The emphasis given to a measure's ability to reduce the impacts on a species or stock considers the degree, likelihood, and context of the anticipated reduction of impacts to individuals as well as the status of the species or stock. The ultimate impact on any individual from a disturbance event (which informs the likelihood of adverse species- or stock-level effects) is dependent on the circumstances and associated contextual factors, such as duration of exposure to stressors. Though any mitigation needs to be evaluated in the context of the specific activity and the species or stocks affected, measures with the following types of goals are often applied to reduce the likelihood or severity of adverse species- or stock-level impacts:

- avoiding or minimizing injury or mortality;
- limiting interruption of known feeding, breeding, mother/calf, or resting behaviors;
- minimizing the abandonment of important habitat (temporally and spatially);
- minimizing the number of individuals subjected to these types of disruptions; and
- limiting degradation of habitat.

Mitigating these types of effects is intended to reduce the likelihood that the activity will result in energetic or other types of impacts that are more likely to result in reduced reproductive success or survivorship. It is also important to consider the degree of impacts that were expected in the absence of mitigation in order to assess the benefit of any potential measures. Finally, because the least practicable adverse impact standard authorizes NMFS to weigh a variety of factors when evaluating appropriate mitigation measures, it does not compel mitigation for every kind of individual take, even when practicable for implementation by the applicant.

2.2 Description of Hilcorp's Activities

A thorough description of Hilcorp's tug towing jack-up rig activities is in the notice of the issuance of IHAs under "Summary of Request" and "Description of Specified Activities" and is incorporated by reference and summarized below in the following subsections.

Hilcorp plans to use up to three ocean-going tugs to move a jack-up rig around middle Cook Inlet in support of Hilcorp's well plug and abandonment and production drilling activities. Tugging and positioning activities will occur for up to 14 or 16 days per year in support of the larger production drilling activities, which could occur for up to 180 days per year. The action area is limited to middle

Cook Inlet and the surrounding area as shown below (Figure 1).

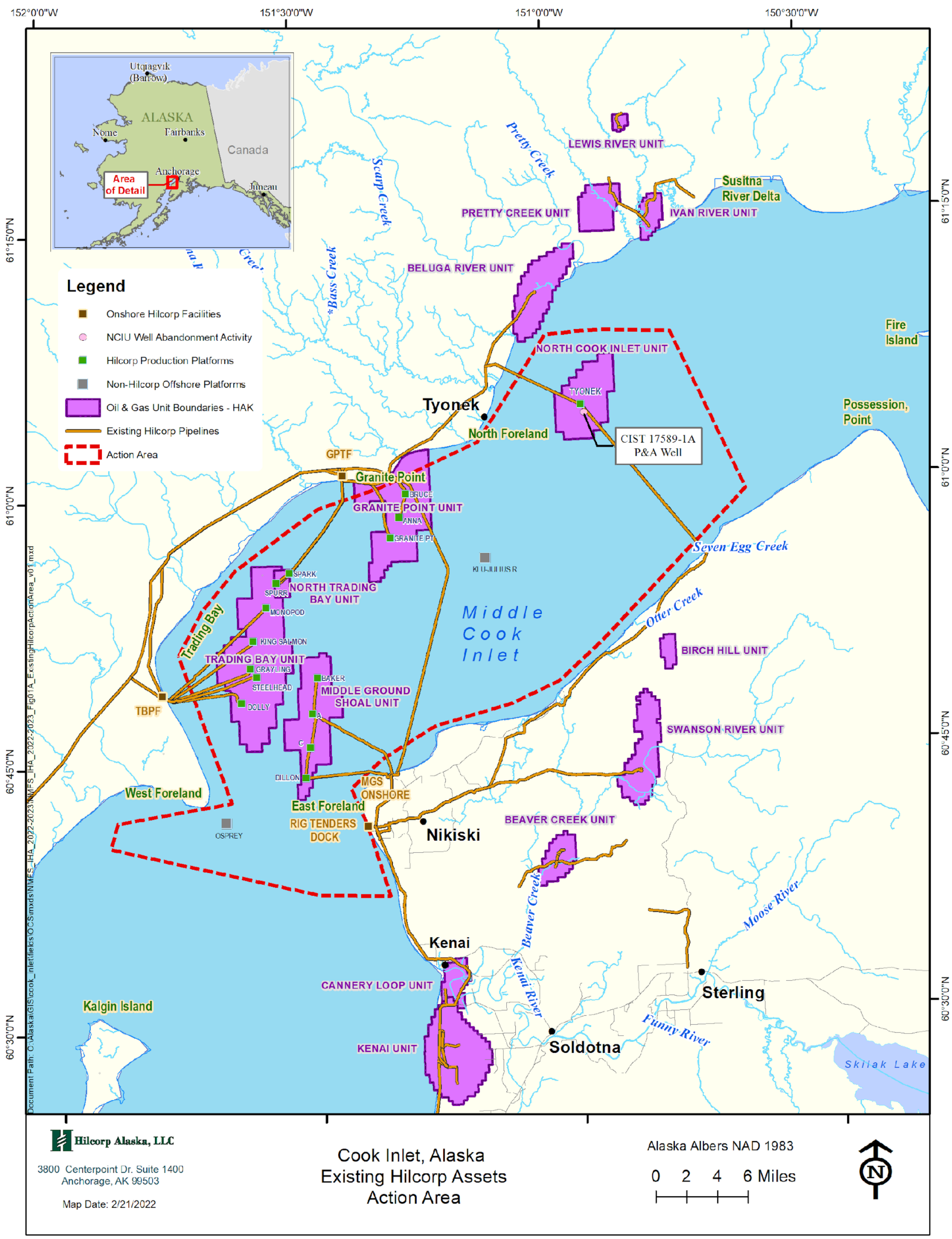

Figure 1. Hilcorp's Action Area.

2.2.1. Activity Overview

Hilcorp plans to conduct two types of activities that require the use of a jack-up rig pulled by three tugs: well plugging and abandonment (P&A) and support of production drilling platforms. Hilcorp plans to use the jack-up rig Spartan 151, or similar. The Spartan 151 (or similar) will be towed via three ocean-going tugs. Three tugs are needed to safely and effectively pull the jack-up rig into the correct position where it can be temporarily secured to the seafloor.

The amount of time the tugs are under load transiting, holding, and positioning the jack-up rig in Cook Inlet,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 will 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).

The jack-up rig will be mobilized and demobilized via towing by three ocean-going tugs from and to 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 for approximately three hours, 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 they would 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 requires less than half power of the engine, generally only 20 to 30 percent of total 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 rather than low slack tide to pin the legs down at an adequate height to ensure the hull of the jack-up rig remains above the water level of the subsequent incoming high tide. Because 12 hours elapse between each high slack tide, tugs are generally under load for those 12 hours, even if the towed distance is small, 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 2 to 3 hours. Positioning activities are generally at half power. If a second attempt is needed, the tugs would be under load holding or positioning the jack-up rig on a second day for up to 5 hours. The vast majority of the time, the jack-up rig can be successfully positioned over the platform in one or two attempts. A third attempt was not included in our exposure estimates as it is unlikely to occur and other positioning attempts may occur on the first try, which would average two attempts per positioning effort.

A location-to-location transport (e.g., platform-to-platform) of a jack-up rig is conducted similarly to the mobilization from the Rig Tenders Dock described above with one main difference. In a location-to-location transport in middle Cook Inlet or Trading Bay, there is no harbor available for temporary staging to avoid transiting against the tide. Maintaining position of the jack-up rig against the tidal current can 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 of time during the maximum tidal current, expected to be no more than 3 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.

2.2.2. Year 1

Year 1 – For the first year of activity, Hilcorp will use three tugs to pull the jack-up rig for plugging and abandonment (P&A) of Well 17589, which began in 2021 but was not completed due to equipment sourcing issues. Prior to pinning the jack-up rig legs to the seafloor, a multi-beam sonar may be used to ensure the seafloor is clear of debris that may impact the ability to pin down 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 sonar operates at a frequency outside of marine mammal hearing range and is not addressed further in our analysis. After the rig is secure, divers enter the water and use hand tools to complete the P&A process. In addition to the hand tools, the divers will also use water jets to wash away debris and marine growth on the structure (e.g. a CaviDyne CaviBlaster). Based on measurements conducted by Hilcorp during 2017 use of water jets, the source level for the CaviBlaster® was estimated as 176 decibels (dB) re 1 micropascal (μPa) root mean square (rms) with a Level B harassment threshold of 860 m, with most energy concentrated above 500 Hz with a dominant tone near 2 kHz. Hilcorp plans to put a protected species observer (PSO) on watch to monitor the full extent of the harassment zone and shutdown when a marine mammal approaches the zone during water jet use. Because of this, Hilcorp is not requesting take associated with water jet use and it is not considered further in our analysis.
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. Production drilling itself creates some small level of noise due to the use of generators and other potentially noise-generating equipment. Furie Operating Alaska, LLC, performed detailed underwater acoustic measurements in the vicinity of the Spartan 151 in 2011 (Marine Acoustics Inc. 2011) northeast of Nikiski Bay in water depths of 24.4 to 27.4 m (80 to 90 ft). 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. The source

level of one of the loudest acoustic sources, the diesel engines, was estimated to be 137 dB re 1 µPa rms at 1 m in the 141 to 178 Hz frequency range. Based on this measured level, the 120 dB rms acoustic received level isopleth would be approximately 50 m away from where the energy enters the water (jack-up leg or drill riser). Sound source levels were also measured by JASCO for drilling and mud pumping from the Yost jack-up rig in 2016. The primary sources of continuous sounds measured from the Yost were drilling (158 dB) and mu167d pumping (148.4 dB), producing 120 dB isopleths of 330 and 225 meters, respectively. The acoustic energy of drilling noise was found to be predominantly under 500 Hz (Denes and Austin 2016a). Denes and Austin (2016) did not record other rig-based activities including cementing, running casing, and tripping in and out of the hole with drill string; however, these activities may also produce sounds similar to mud pumping. There is open water in all directions from the drilling location. Additionally, Hilcorp plans to monitor the area around the drilling platform for 30 minutes prior to starting drilling activities and delay their activity if marine mammals are seen close to the platform. Any marine mammal approaching the rig would be fully aware of its presence long before approaching or entering the zone of influence for behavioral harassment, and 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 noise closer to the source. Given the absence of any activity-, location-, or species-specific circumstances or other contextual factors that would increase concern, we do not expect routine drilling noise to result in the take of marine mammals. In support of these activities, helicopters and support vessels transit from the mainland to the production sites to mobilize personnel and supplies. Helicopters will fly at 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 1,500 ft). During take-off and landing of a helicopter, it is expected that only a small amount of sound would penetrate the water because the helicopter will be moving vertically over the helipad and most of the sound is reflected and does not penetrate at angles greater than 13 degrees from vertical. Additionally, the platforms that helicopters are navigating to/from are already 100 or more feet above sea level, further reducing potential for harassment of marine mammals such that take is not requested nor authorized. Vessel trips to and from the location of the jack-up rig are expected to increase by two trips per day above normal activity levels. Hilcorp plans to maintain watch for marine mammals during supply vessel trips, stay at least 100 yards away from marine mammals, reduce speed in poor visibility, and handle supply vessel such that an encounter with a marine mammal is unlikely and additional take for supply vessel activities is not requested nor authorized.

2.2.3. Year 2

For the second year of activity, Hilcorp does not plan to conduct P&A activities with the jack-up rig and will only be tugging the jack-up rig in support of production drilling activities as described for Year 1 above. Tugging in Year 2 will occur for a maximum of 16 days, similar to the activity in Year 1.

2.3 Description of Alternatives

2.3.1 Alternative 1 – Issuance of Authorization with Mitigation, Monitoring, and Reporting Measures (Preferred Alternative)

Under this alternative, NMFS would issue two IHAs to Hilcorp allowing the incidental take, by Level B harassment, of marine mammals consistent with the activities described in Section 2.2 and more thoroughly in the IHAs, subject to additional mitigation and monitoring requirements prescribed by NMFS.

Mitigation Measures:

(1) Establish a 1,500 m clearance zone before commencing any tugging activities in daylight and employ two NMFS-approved PSOs to conduct marine mammal monitoring for the duration of the project. Prior to commencing activities for the day or if there is a 30 minute lapse in operational activities, the PSOs will monitor the clearance zone for marine mammals for 30 minutes. If no marine mammals are observed, operations may commence. If a marine mammal(s) is observed within the clearance zone during the clearing, the PSOs will continue to watch until the animal(s) is outside of and on a path away from the safety zone or 15 minutes have elapsed if the species was a pinniped or small cetaceans; for baleen whales the watch will extend to 30 minutes. Once the PSOs have cleared the area, operations may commence.

(2) Steps similar to those above will be taken before beginning tug activities at nighttime. For nighttime operations, PSOs will use night vision devices and will monitor to the greatest extent possible, which is likely less than 1,500 m.

(3) PSOs will monitor and carefully record any marine mammal behavior if a marine mammal is observed within the project area during tugging. No new operational activities will be started until the animal leaves the area. Shifting from towing to positioning without shutting down is not considered a new operational activity. PSOs will also collect behavioral information on marine mammals beyond the clearance.

(4) Hilcorp will minimize the acoustic footprint of the project by tugging with a favorable tide unless human safety or equipment integrity are at risk. Tugging will occur at night only in instances that accommodate a favorable tide.

(5) 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.

(6) When Hilcorp needs to tow the jack-up rig to or from the Tyonek platform during the time of the exclusion zone, Hilcorp will fly aerial surveys to attempt to clear the area of beluga whales. The exact conditions and stipulations of the aerial surveys are provided in the IHAs.

(7) Hilcorp will abide by NMFS marine mammal viewing guidelines while operating vessels or other equipment not considered in Hilcorp's application, including not actively approaching marine mammals within 100 yards and slowing vessels to the minimum speed necessary. NMFS Alaska Marine Mammal Viewing Guidelines may be found at https://alaskafisheries.noaa.gov/pr/mm-viewing-guide.

Monitoring and reporting measures:

(1) Hilcorp will utilize NMFS-qualified, vessel-based PSOs to visually watch for and monitor marine mammals from the tugs or the jack-up rig. During nighttime operations, PSOs will be equipped with night vision devices.

(2) In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by these IHAs, such as an injury, serious injury, or mortality (Level A harassment), Hilcorp shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, designees, and the Alaska Regional Stranding Coordinators. The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- The name and type of vessel involved (if ship strike);
- The vessel's speed during and leading up to the incident (if ship strike);
- Description of the incident;
- Status of all operational activities;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- The fate of the animal(s); and
- Photographs or video footage of the animal (if equipment is available).

(3) Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with Hilcorp to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Hilcorp may not resume their activities until notified by NMFS via letter, email, or telephone.

(4) In the event that Hilcorp discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), applicants will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, designees, and the Alaska Regional Stranding Coordinators. The report must include the same information identified in the paragraph above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with applicants to determine whether modifications in the activities are appropriate.

(5) In the event that Hilcorp discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the authorized activities (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), applicants shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, designees, the Alaska Regional Stranding Coordinators within 24 hours of the discovery. Applicants shall provide photographs or video footage (if available) or

other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

(6) Hilcorp will submit monthly reports to NMFS' Permits and Conservation Division and a final report within 90 days after the end of the year's activity. The monthly report shall include a summary of marine mammal sightings and operations as well as PSO observer log sheets. The annual report will include:

- Summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);
- Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);
- Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover; and
- Analyses of the effects of tugging operations.

(7) NMFS will review the draft annual report. Applicants must submit a final annual report to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, within 30 days after receiving comments from NMFS on the draft annual report. If NMFS decides that the draft annual report needs no comments, the draft report shall be considered to be the final report.

2.3.2. Alternative 2 – No Action Alternative

In accordance with NOAA's implementing procedures, the Companion Manual (CM) for NOAA Administrative Order 216-6A, Section 6.B.i, NMFS is defining the No Action Alternative as not authorizing the requested incidental take of marine mammals under Section 101(a)(5)(D) of the MMPA. This is consistent with our statutory obligation under the MMPA to either: (1) deny the requested authorization or (2) grant the requested authorization and prescribe mitigation, monitoring, and reporting requirements. Under the No Action Alternative, NMFS would not issue IHAs to Hilcorp, in which case NFMS assumes this applicant would not proceed with their tug towing jack-up rig activities as described in the application. The requested take would not occur and mitigation, monitoring, and reporting for marine mammals would not be implemented. Although the No Action Alternative would not meet the purpose and need to allow incidental takes of marine mammals under certain conditions (i.e., when the statutory requirements are satisfied), the CEQ regulations require consideration and analysis of a No Action Alternative for the purposes of presenting a comparative analysis to the action alternatives. The No Action Alternative, consistent with CEQ regulations and the CM, serves as a baseline against which the impacts of the Preferred Alternative will be compared and contrasted.

2.3.3. Alternatives Considered but Rejected from Further Consideration

In developing the Action, two variations of the Preferred Alternative were identified during the preparation of the IHAs. The two variations of the Preferred Alternative were issuing IHAs without mitigation, monitoring, and reporting required by NMFS, and exploring alternative technologies to accomplish Hilcorp's objectives. However, NMFS determined these alternatives did not meet the purpose and need for the Action or merit further analysis for the reasons noted below. Thus, the analyses of alternatives in this EA are limited to the Preferred Alternative and the No Action Alternative.

- Not requiring mitigation, monitoring, or reporting would be in violation of the MMPA and its implementing regulations
- NMFS is not aware of alternative techniques available that would allow Hilcorp to move the jack-up rig to various well sites without generating noise, which is the primary activity that has the potential to take marine mammals by harassment.

Chapter 3 Affected Environment

NMFS reviewed all possible environmental, cultural, historical, social, and economic resources based on the geographic location associated with NMFS' action and alternatives and the applicant's request for two ITAs for the tugging and positioning of a jack-up rig in Cook Inlet, Alaska. Based on this review, this section describes the affected environment and existing (baseline) conditions for select resource categories (e.g., marine environment). As explained in Chapter 1, certain resource categories not affected by NMFS' action and alternatives were not carried forward for further consideration or evaluation in this EA (See Table 1) and where appropriate, the analysis in the notice of issuance of IHAs related to the marine environment is incorporated by reference and summarized within this document.

3.1 Physical Environment

As discussed in Chapter 1, our action and alternatives relate only to the authorization of incidental take of marine mammals and not to the physical environment. However, marine mammal habitat is one aspect of the physical environment that is relevant to our action.

Cook Inlet is a complex Gulf of Alaska estuary (as described in BOEM, 2016) that covers roughly 7,700 square miles (mi^2; 20,000 square kilometers (km^2)), with approximately 840 miles (mi) (1,350 linear kilometer (km)) of coastline (Rugh et al*.,* 2000). The physical oceanography of Cook Inlet is characterized by complex circulation with variability at tidal, seasonal, annual, and inter-annual timescales (Musgrave and Statscewich, 2006). This region has the fourth largest tidal range in the world and as a result, extensive tidal mudflats that are exposed at low tides occur throughout Cook Inlet, especially in the upper reaches. The project area is located a few kilometers east/northeast of the village of Tyonek down toward Nikiski at the Forelands.

3.1.1. Marine Mammal Habitat

NMFS presented information on marine mammal habitat and the potential impacts to marine mammal habitat in the FR notice of the proposed IHAs. In summary, several marine mammal species use the waters of Cook Inlet for foraging, calving, and other important life history functions. The mouths of rivers and streams are important beluga whale feeding habitat. Harbor seals haul-out along the Cook Inlet shoreline. Killer whales, humpback whales, and Steller sea lions more commonly use the lower Cook Inlet area, but can venture into the upper Inlet where the project will occur. Fin whales, gray whales, minke whales, Dall's porpoises, harbor porpoises, and Steller sea lions occasionally use the lower Inlet and could be sighted in the middle Inlet. California sea lions have only been sighted twice in the Inlet (Lomac-MacNair 2013).

Pursuant to the ESA, critical habitat has been designated for Cook Inlet beluga in the project area. The action falls within critical habitat designated in Cook Inlet for beluga whales. On April 11, 2011, NMFS announced the two areas of critical habitat (76 FR 20180) comprising 7,800 km^2 (3,013 mi^2) of marine habitat (Figure 2). Critical habitat includes two areas (Areas 1 and 2) that encompass 7,800 km^2 of marine and estuarine habitat in Cook Inlet. Designated beluga whale Critical Habitat Area 1 consists of 1,909 km^2 of Cook Inlet, north of Three Mile Creek and Point Possession. Critical Habitat Area 1 contains shallow tidal flats or mudflats and mouths of rivers that provide important areas for foraging, calving, molting, and escape from predators. 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 and their habitat in Critical Habitat Area 1. Critical Habitat Area 2 consists of 5,891 km^2 located 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. Hilcorp's activities would likely occur from April through September throughout Critical Habitat Area 2.

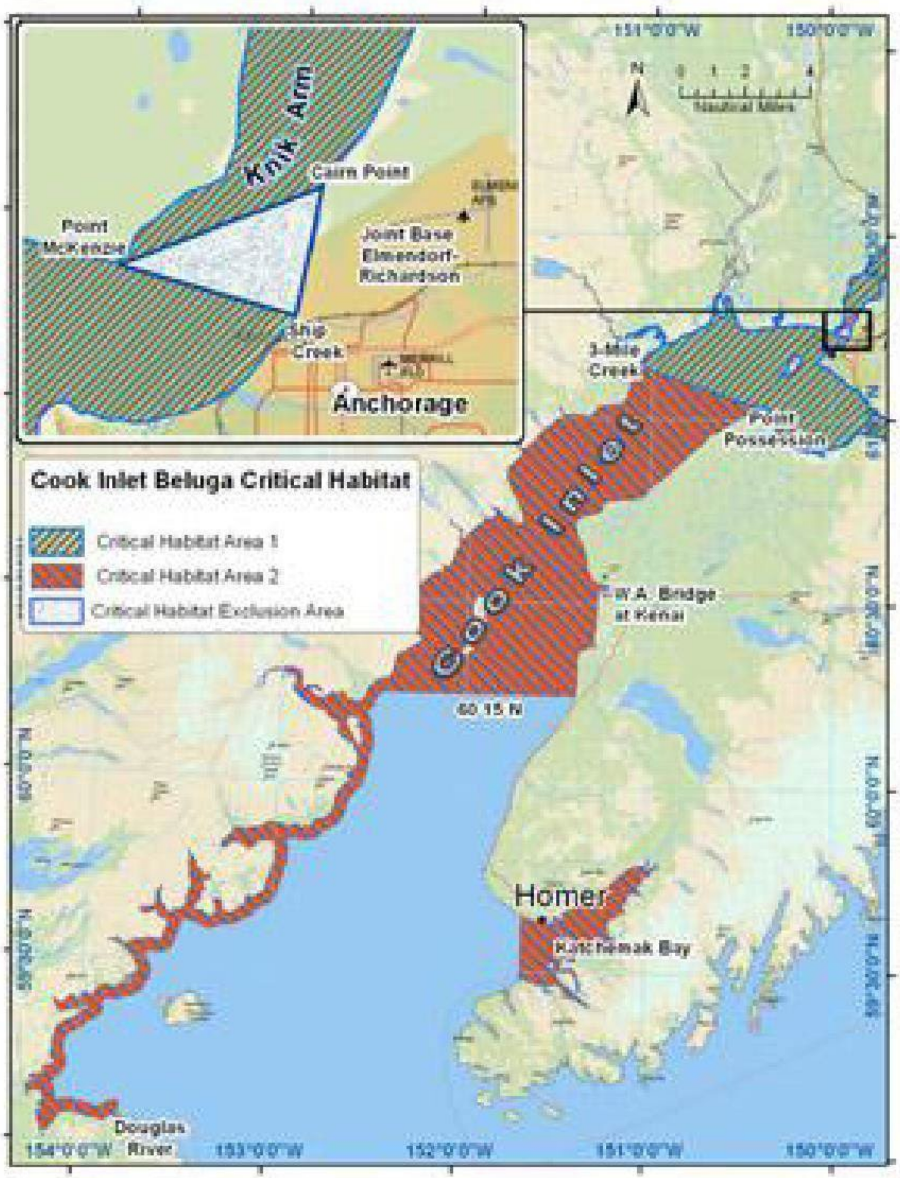

Figure 2. Final critical habitat of Cook Inlet beluga whales (76 FR 20180, April 11, 2011).

3.2 Biological Environment

3.2.1. Marine Mammals

Twelve species of marine mammals may be harassed incidental to conducting the rig towing activities. NMFS has included take for species such as California sea lions, in the rare event they enter the project area, because once under load and operating, the tugs are unable to be stopped, due to safety reasons. Cook Inlet beluga whales, harbor porpoises, and harbor seals are the species most likely to be present during the activities. The likelihood of occurrence of these species factors in scientific research surveys, monitoring reports from previous IHAs authorized for Cook Inlet, and anecdotal evidence from ship captains, local residents, etc. Table 2 provides a summary of the abundance and status of the species likely to occur in the operation areas of the activities.

Table 2. Abundance estimates, conservation status, and population trends of the marine mammal species for which take authorized.

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-, -, N	26,960 (0.05, 25,849, 2016)	801	131
Family Balaenidae						
Humpback whale	*Megaptera novaeangliae*	Western North Pacific	E, D, Y	1,107 (0.3, 865, 2006)	3	2.8
Humpback whale	*Megaptera novaeangliae*	Central North Pacific	E, D, Y	10,103 (0.3, 7,890, 2006)	83	26
Minke whale	*Balaenoptera acutorostrata*	Alaska	-, -, N	N/A (see SAR, N/A, see SAR)	UND	0
Family Balaenopteridae (rorquals)						
Fin whale	*Balaenoptera physalus*	Northeast Pacific	E, D, Y	see SAR (see SAR, see SAR, 2013)	see SAR	0.6
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae						
Beluga whale	*Delphinapterus leucas*	Cook Inlet	E, D, Y	279 (0.061, 267, 2018)	0.53	0
Killer whale	*Orcinus orca*	Alaska Resident	-, -, N	2,347 c (N/A, 2347, 2012)	24	1
Killer whale	*Orcinus orca*	Gulf of Alaska, Aleutian Islands, and Bering Sea Transient	-, -, N	587 c (N/A, 587, 2012)	5.87	0.8

Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	North Pacific	-,-,N	26,880 (N/A, unknown, 1998)	UND	0
Family Phocoenidae (porpoises)						
Harbor porpoise	*Phocoena phocoena*	Gulf of Alaska	-, -, Y	31,046 (0.21, N/A, 1998)	UND	72
Dall's porpoise	*Phocoenoides dalli*	Alaska	-, -, N	see SAR (0.097, see SAR, 2015)	131	37
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
Steller sea lion	*Eumetopias jubatus*	Western	E, D, Y	52,932 a (see SAR, 52,932, 2019)	318	254
California sea lion	*Zalophus californianus*	U.S.	-, -, N	257,606 (N/A,233,515, 2014)	14011	>320
Family Phocidae (earless seals)						
Harbor seal	*Phoca vitulina*	Cook Inlet/ Shelikof	-, -, N	28,411 (see SAR, 26,907, 2018)	807	107
[1] - Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.						
[2] - NMFS marine mammal stock assessment reports online at: *www.nmfs.noaa.gov/pr/sars/*. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable depending on the methodology described in the stock assessment report (SAR) and the date of last available survey data. Where necessary, NMFS refers reader to the SAR for more detail.						
[3] - These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual mortality and serious injury often cannot be determined precisely and is in some cases presented as a minimum value or range.						

NMFS (2018) describes generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall et al. (2007) retained. The hearing groups and the associated frequencies are indicated in Table 3 (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group).

Table 3. Marine Mammal Hearing Groups (NMFS, 2018).

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

* Represents 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).

3.2.2. ESA Listed Marine Mammals

Cook Inlet Beluga Whale

Beluga whales appear seasonally throughout Alaskan waters, except in the southeast region and the Aleutian Islands. Five stocks are recognized in Alaska: Beaufort Sea stock, eastern Chukchi Sea stock, eastern Bering Sea stock, Bristol Bay stock, and Cook Inlet stock (Allen and Angliss, 2013). The Cook Inlet stock is the most isolated of the five stocks, as it is separated from the others by the Alaska Peninsula and resides year round in Cook Inlet (Laidre et al., 2000). Only the Cook Inlet stock inhabits the project area.

NMFS began comprehensive, systematic aerial surveys on beluga whales in Cook Inlet in 1994. Unlike previous efforts, these surveys included the upper, middle, and lower inlet. These surveys documented a decline in abundance of nearly 50 percent between 1994 and 1998, from an estimate of 653 to 347 whales (Rugh et al., 2000). In response to this decline, NMFS initiated a status review on the Cook Inlet beluga whale stock pursuant to the MMPA and the ESA in 1998 (63 FR 64228, November 19, 1998). The annual abundance surveys conducted each June since 1999 provide the following abundance estimates: 357 beluga whales in 1999; 435 beluga whales in 2000; 386 beluga whales in 2001; 313 beluga whales in 2002; 357 beluga whales in 2003; 366 beluga whales in 2004; 278 beluga whales in 2005; 302 beluga whales in 2006; 375 beluga whales in 2007; 321 beluga whales in 2009; 340 beluga whales in 2010; 284 whales in 2011; 312 whales in 2012 (Hobbs et al., 2000; Rugh et al., 2003, 2004a, 2004b, 2005a, 2005b, 2005c, 2006, 2007, 2010; NMFS, 2010; Hobbs et al., 2011, Shelden et al., 2012). The overall population trend for the past 10 years for Cook Inlet beluga whales shows that they are not recovering and still in decline at an annual rate of 0.4 percent (NMFS, 2016a).

Figure 3 depicts the distribution of beluga whales in upper Cook Inlet and is based upon Marine Mammal Laboratory (MML) data including NMFS aerial surveys. Additional information on beluga whale distribution is known from NMFSsatellite-tagged belugas data, and opportunistic sightings (NMML, 2004); baseline studies of beluga whale occurrence in Knik Arm (Funk et al., 2005); baseline studies of beluga whale occurrence in Turnagain Arm conducted in preparation for Seward Highway improvements (Markowitz et al., 2007); marine mammal surveys conducted at Ladd Landing to assess a coal shipping project (Prevel Ramos et al., 2008); and marine mammal surveys off Granite Point, the Beluga River, and further down the inlet at North Ninilchik (e.g., Brueggeman et al., 2007, 2008).

The collective NMFS aerial survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (i.e., north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups were reported farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, no longer occurring in the central or southern portions of Cook Inlet (Hobbs et al., 2008). Based on these aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be fairly consistent from June to October (Rugh et al., 2000, 2004a, 2005a, 2006, 2007; Shelden et al., 2008, 2009, 2010).

Other studies and monitoring programs have revealed additional information about beluga whale distribution in Cook Inlet. Studies for KABATA in 2004 and 2005 confirmed the use of Knik Arm by beluga whales from July to October (Funk et al., 2005). Data from tagged whales (14 tags between July and March during the years 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn (Hobbs et al., 2005). As late as October, beluga whales tagged with satellite transmitters continued to use Knik Arm, Turnagain Arm, and Chickaloon Bay, but some ranged into lower Cook Inlet south to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in the fall (Hobbs et al., 2005). In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September (Hobbs et al., 2005). By December, beluga whales were distributed throughout the upper to mid-inlet. From January into March, they moved as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales also made occasional excursions into Knik Arm and Turnagain Arm in February and March in spite of ice cover greater than 90 percent (Hobbs et al., 2005). While they moved widely around Cook Inlet there was no indication from the tagged whales that beluga whales had a seasonal migration in and out of Cook Inlet (Hobbs et al., 2005).

Depending upon the season, beluga whales can occur in both offshore and coastal waters. Although they remain in the general Cook Inlet area during the winter, they disperse throughout the upper and mid-inlet areas. Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during the winter months (November-April), with animals found between Kalgin Island and Point Possession. Based upon monthly surveys (e.g., Rugh et al., 2000), opportunistic sightings, and satellite-tag data, there are generally fewer observations of these whales in the Anchorage and Knik Arm area from November through April

(NMML, 2004; Rugh et al., 2004a).

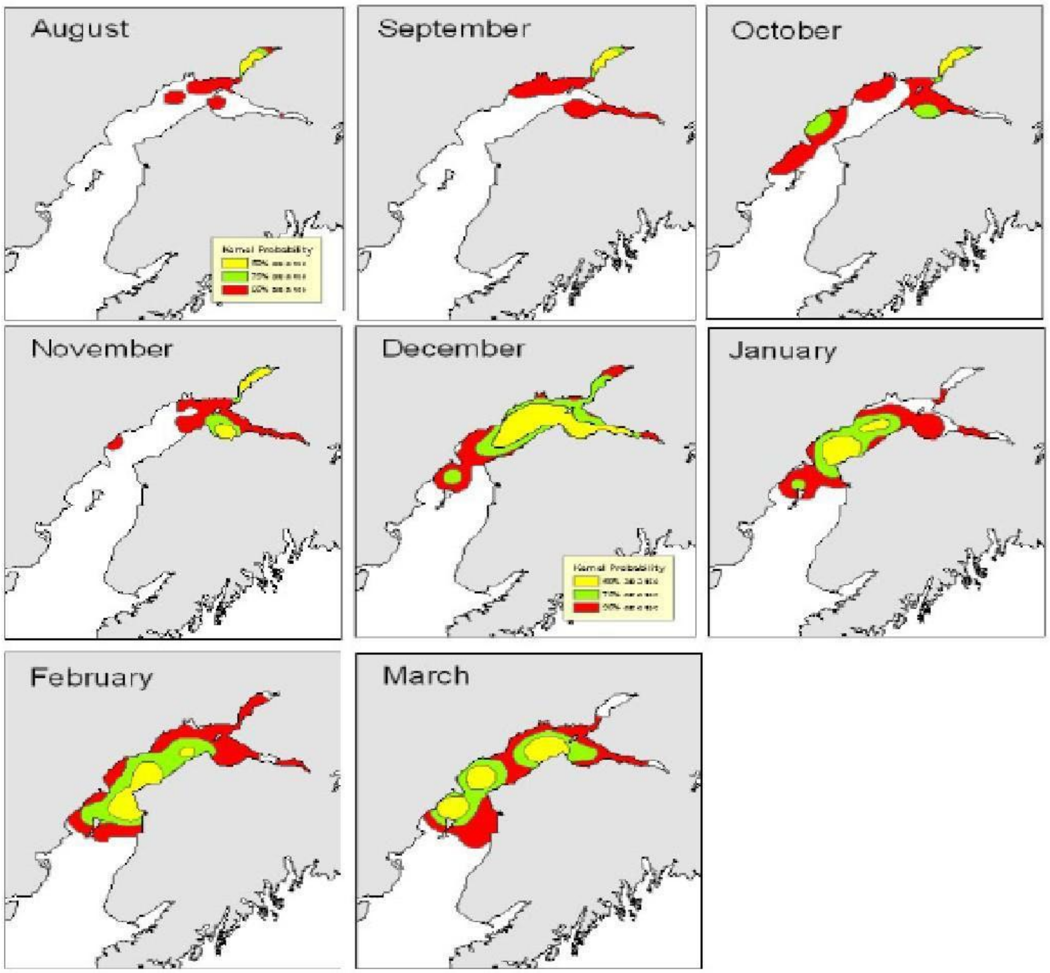

Figure 3. Predicted beluga distribution by month based upon known locations of 14 satellite tagged belugas (predictions derived via kernel probability estimates; Hobbs et al., 2005). Note the large increase in total area use and offshore locations beginning in December and continuing through March. The red area (95 percent probability) encompasses the green (75 percent) and yellow (50 percent) regions. From NMFS, 2008b.

During the spring and summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore et al., 2000). Most beluga whale calving in Cook Inlet occurs from mid-May to mid-July in the vicinity of the river mouths, although Native hunters have described calving as early as April and as late as August (Huntington, 2000).

Beluga whale concentrations in upper Cook Inlet during April and May correspond with eulachon migrations to rivers and streams in the northern portion of upper Cook Inlet (NMFS, 2003; Angliss and Outlaw, 2005). Data from NMFS aerial surveys, opportunistic sightings, and satellite-tagged beluga whales confirm that they are concentrated along the rivers and nearshore areas of upper Cook Inlet (Susitna River Delta, Knik Arm, and Turnagain Arm) from May through October (NMML, 2004; Rugh et al., 2004a). Beluga whales are commonly seen from early July to early October at the mouth of Ship Creek where they feed on salmon and other fish, and also in the vicinity of the Port of Anchorage (e.g., alongside docked ships and within

300 ft of the docks) (Blackwell and Greene, 2002; NMML, 2004). Beluga whales have also been observed feeding immediately offshore of the tidelands north of the Port of Anchorage and south of Cairn Point (NMFS, 2004).

Steller Sea Lion

The western distinct population segment (DPS) of Steller sea lions is the DPS that occurs in the project area and is the only one listed under the ESA. Steller sea lions occur in Cook Inlet but south of Anchor Point around the offshore islands and along the west coast of the upper inlet in the bays (Chinitna Bay, Iniskin Bay, etc.) (Rugh et al., 2005a). Portions of the southern reaches of the lower inlet are designated as critical habitat, including a 20-nautical mile buffer around all major haul-out sites and rookeries. Rookeries and haul-out sites in lower Cook Inlet include those near the mouth of the inlet, which are far south of the project area. Presence of Steller sea lions in the project area is anticipated to be rare.

Humpback whale

On October 11, 2016, NMFS revised the listing status of the humpback whale into 14 DPSs and the species-level endangered listing was removed (81 FR 62259). Now, two DPSs are listed as endangered, two DPSs are threatened, and the remaining 10 DPSs are no longer listed under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the Western North Pacific DPS, listed as endangered under the ESA; the Mexico DPS, a threatened species; and the Hawaii DPS, which is no longer listed as endangered or threatened under the ESA. Humpback whales in the Gulf of Alaska are most likely to be from the Hawaii DPS (89 percent probability) (Wade et al*.,* 2016). Humpback whales that occur in Cook Inlet, albeit infrequently, are considered part of the Hawaii DPS.

Humpback whales occur occasionally in Cook Inlet, particularly in the South toward Barren Islands, as the Central North Pacific stock of humpbacks is known to migrate to Alaska for summer feeding. It is possible that some whales in Cook Inlet belong to the Western North Pacific stock of humpback whales, which is considered depleted under the MMPA, as animals that winter in the South China Sea can migrate to Alaska for optimal feeding grounds. Some of the whales that summer in Alaska have been tagged and are known to migrate in winter to Hawaii. NMFS aerial surveys have sighted as many as 47 whales in a single survey period, however they have not sighted more than 10 whales in a survey since 2006 (NMFS, 2012). Humpback whales maintain a seasonal presence in the south of the Inlet, although humpbacks are occasionally sighted as far north as Anchorage in summer months.

Fin whale

Fin whales were listed as endangered under the ESA since 1990 and are depleted under the MMPA. For management purposes, three stocks of fin whales are currently recognized in U.S. Pacific waters: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii. Recent analyses provide evidence that the population structure should be reviewed and possibly updated, however substantially new data on the stock structure is lacking (Muto et al., 2019).The Northeast Pacific stock is categorized as a strategic stock. No critical habitat has been designated or proposed for fin whales in the North Pacific.

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, 2010a). 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. Toxicity and resulting deaths, as seen in recent years, from harmful algal blooms producing biotoxins could result from warming waters (Muto et al., 2021).

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). 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 rarely observed in Cook Inlet and most sightings occur near the entrance of the inlet.

3.2.3. Non-ESA Listed Marine Mammals

Harbor seal

Harbor seals inhabit the coastal and estuarine waters of Cook Inlet. In general, harbor seals are more abundant in lower Cook Inlet than in upper Cook Inlet, but they do occur in the upper inlet throughout most of the year (Rugh et al., 2005). Harbor seals are non-migratory; their movements are associated with tides, weather, season, food availability, and reproduction. The major haul-out sites for harbor seals are located in lower Cook Inlet, and their presence in the upper inlet coincides with seasonal runs of prey species. For example, harbor seals are commonly observed along the Susitna River and other tributaries along upper Cook Inlet during the eulachon and salmon migrations (NMFS, 2003). During aerial surveys of upper Cook Inlet in 2001, 2002, and 2003, harbor seals were observed 24 to 96 km (15 to 60 mi) south-southwest of Anchorage at the Chickaloon, Little Susitna, Susitna, Ivan, McArthur, and Beluga Rivers (Rugh et al., 2005). During a 2D test program in March 2011, two harbor seals were observed by vessel-based PSOs. Harbor seals haul-out on rocks, reefs, beaches, and drifting glacial ice, and feed on capelin, eulachon, cod, pollock, flatfish, shrimp, octopus, and squid in marine, estuarine, and occasionally fresh waters.

Killer Whale

Numbers of killer whales in Cook Inlet are small compared to the overall population and most are recorded in the lower Cook Inlet. Killer whales are rare in upper Cook Inlet, where transient killer whales are known to feed on beluga whales, and resident killer whales are known to feed on anadromous fish (Shelden et al., 2003). The availability of these prey species largely determines the likeliest times for killer whales to be in the area. Twenty-three sightings of killer whales were reported in the lower Cook Inlet between 1993 and 2004 in aerial surveys by Rugh et al. (2005a). Surveys over 20 years by Shelden et al. (2003) reported 11 sightings in upper Cook Inlet between Turnagain Arm, Susitna Flats, and Knik Arm. No killer whales were spotted during surveys by Funk et al. (2005), Ireland et al. (2005), Brueggeman et al. (2007a, 2007b, 2008), or Prevel Ramos et al. (2006, 2008). Eleven killer whale strandings have been reported in Turnagain Arm, six in May 1991, and five in August 1993. Very few killer whales, if any, are expected to approach or be in the vicinity of the operation areas.

Harbor Porpoise

The most recent estimated density of harbor porpoisesin Cook Inlet is 7.2 per 1,000 km^2 (386 mi^2) (Dahlheim et al., 2000) indicating that only a small number use Cook Inlet. Harbor porpoises have been reported in lower Cook Inlet from Cape Douglas to the West Foreland, Kachemak Bay, and offshore (Rugh et al., 2005a).

Small numbers of harbor porpoises have been consistently reported in the Upper Cook Inlet between April and October, except for a recent survey that recorded higher numbers than usual. Highest monthly counts include 17 harbor porpoises reported for spring through fall 2006 by Prevel Ramos et al. (2008), 14 for spring of 2007 by Brueggeman et al. (2007a), 12 for fall of 2007 by Brueggeman et al. (2008), and 129 for spring through fall in 2007 by Prevel Ramos et al. (2008) between Granite Point and the Susitna River during 2006- 2007; the reason for the recent spike in numbers (129) of harbor porpoises in the upper Cook Inlet is unclear and quite disparate with results of past surveys, suggesting it may be an anomaly. The spike occurred in July, which was followed by sightings of 79 harbor porpoises in August, 78 in September, and 59 in October in 2007. The number of porpoises counted more than once was unknown. Therefore, because NMFS lacks information regarding double counting, it is possible that the actual numbers are smaller than reported. On the other hand, recent passive acoustic research in Cook Inlet by the Alaska Department of Fish and Game (ADF&G) and the MML have indicated that harbor porpoises occur more frequently than expected, particularly in the West Foreland area in the spring (Castellote et al., 2016), although overall numbers are still unknown at this time. In 2012, Apache marine mammal observers recorded 137 sightings of 190 estimated individuals; a similar count to the 2007 spike previously observed. The increase of sightings in the upper Cook Inlet may reflect movement of harbor porpoise distributions.

Gray Whale

Each spring, the Eastern North Pacific stock of gray whales migrates 8,000 km (5,000 mi) northward from breeding lagoons in Baja California to feeding grounds in the Bering and Chukchi seas, reversing their travel again in the fall (Rice and Wolman, 1971). Their migration route is for the most part coastal until they reach the feeding grounds. A small portion of whales do not annually complete the full circuit, as small numbers can be found in the summer feeding along the Oregon, Washington, British Columbia, and Alaskan coasts (Rice et al., 1984; Moore et al., 2007).

Most gray whales migrate past the mouth of Cook Inlet to and from northern feeding grounds. However, small numbers of summering gray whales have been observed within Cook Inlet, mostly in the lower inlet (e.g., Owl Ridge, 2014). Gray whales have not been observed in the upper inlet; however, seismic surveys bordering the lower and upper inlet (including the project area) have observed gray whales. On June 1, 2012, there were three gray whale sightings during marine mammal monitoring for a seismic survey (SAE, 2012). It is not known if this was the same animal observed multiple times or multiple individuals. A lone gray whale was also observed near the middle inlet in 2014 and in May 2015. What was believed to be a gray whale, based on blow shape, was observed during marine mammal monitoring conducted for seismic surveys (SAE, 2014, 2015).

Dall's porpoise

Dall's porpoises are widely distributed across the north Pacific, but they are infrequently sighted in upper Cook Inlet (Muto et al., 2020). Dall's porpoises have been observed in lower Cook Inlet, around Kachemak Bay, and rarely near Anchor Point (BOEM, 2015). Dall's porpoises are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Muto et al., 2019). Threats to, and vulnerabilities of, Dall's porpoises include natural and anthropogenic factors such as habitat modifications and climate change. The nearshore areas, bays, channels, and inlets that Dall's porpoises frequent are of particular concern. These areas are subject to substantial changes with urbanization and industrialization, including waste management and nonpoint source runoff pollution (Linnenschmidt et al., 2013).

Throughout most of the eastern north Pacific they are present during all months of the year, although there may be seasonal onshore-offshore movements along the west coast of the continental U.S. and winter movements of populations out of areas with ice such as Prince William Sound (Muto et al., 2019). No Dall's porpoises were observed during the Cook Inlet Pipeline (CIPL) project monitoring program in middle Cook Inlet in 2018 (Sitkiewicz et al., 2018). Dall's porpoises were observed (two groups of three individuals) during Apache's 2014 seismic survey which occurred in the summer months (Lomac-MacNair et al., 2014). Dall's porpoises were observed during the month of June in 1997 (Iniskin Bay), 1999 (Barren Island), and 2000 (Elizabeth Island, Kamishak Bay, and Barren Island) (Shelden et al., 2013). Dall's porpoises have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point (Owl Ridge, 2014). One Dall's porpoise was observed in August north of Nikiski in the middle of Cook Inlet during SAExploration's 2015 seismic program (Kendall et al., 2015). There were 10 sightings of 30 Dall's porpoises observed during the 2019 Hilcorp lower Cook Inlet seismic survey in the fall (Fairweather Science, 2020).

Minke Whale

Minke whales are a cetacean not commonly found in the Cook Inlet region. Minke whales are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA. Presumably, minke whales breed in warm, low latitude waters during winter, give birth every other year to one calf, and reach sexual maturity at 7 to 9 m (23 to 30 ft) in length (Perrin and Brownell, 2009). Potential threats to, and vulnerabilities of, minke whales include natural and anthropogenic factors, including man-made sound emissions underwater, impacts on prey distribution, climate change, fishing operations, vessel strikes, and oil and gas operations (Muto et al., 2018).

Minke whales are most abundant in the Gulf of Alaska during summer and occupy localized feeding areas (Zerbini et al., 2006). Concentrations of minke whales have occurred along the north coast of Kodiak Island and along the south coast of the Alaska Peninsula (Zerbini et al., 2006). The current estimate for minke whales between Kenai Fjords and the Aleutian Islands is 1,233 individuals (Zerbini et al., 2006). During shipboard surveys conducted in 2003, three minke whale sightings were made, all near the eastern extent of the survey from nearshore Prince William Sound to the shelf break (MML, 2003). Minke whales become scarce in the Gulf of Alaska in fall; most whales are thought to leave the region by October (Consiglieri et al., 1982). Minke whales are migratory in Alaska, but recently have been observed off Cape Starichkof and Anchor Point year-round (Muto et al., 2017).

California Sea Lion

California sea lions are distributed along the north Pacific waters from central Mexico to southeast Alaska, with breeding areas restricted primarily to island areas off southern California (the Channel Islands), Baja California, and in the Gulf of California (Wright et al., 2010). The population is comprised of five genetically distinct populations: the United States population that breeds on offshore islands in California; the western Baja California population that breeds offshore along the west coast of Baja California, Mexico; and three populations (southern, central, and northern) that breed in the Gulf of California, Mexico. Males migrate long distances from the colonies during the winter whereas females and juveniles remain close to the breeding areas. The approximate growth rate for this species is 5.4 percent annually (Caretta *et al.*, 2004).

California sea lions are very rare in Cook Inlet and typically are not observed farther north than southeast Alaska. However, NMFS' anecdotal sighting database contains four California sea lion sightings in Seward and Kachemak Bay. In addition, an industry survey report contains a sighting of two California sea lions in lower Cook Inlet; however, it is unclear if these animals were indeed California sea lions or mis-identified Steller sea lions (SAE, 2012).

Pacific White-Sided Dolphin

Pacific white-sided dolphins are a pelagic species. They are found throughout the temperate North Pacific Ocean, north of the coasts of Japan and Baja California, Mexico (Muto et al., 2018). They are most common between the latitudes of 38° North and 47° North (from California to Washington). The distribution and abundance of Pacific white-sided dolphins may be affected by large-scale oceanographic occurrences, such as El Niño, and by underwater acoustic deterrent devices (NPS 2018a).

Scientific studies and data are lacking relative to the presence or abundance of Pacific white-sided dolphins in or near Cook Inlet, Alaska. Most observations of Pacific white-sided dolphins occur off the outer coast or in inland waterways near entrances to the open ocean. A report of acoustic monitoring efforts during Hilcorp's 3D seismic survey in 2020 concluded that Pacific white-sided dolphins were briefly detected near Iniskin Bay in Cook Inlet. Detections of vocalizations typically lasted on the order of minutes, suggesting the animals did not remain in the area and/or continue vocalizing for extended durations. These observational data, combined with anecdotal information, indicate that there is a small potential for Pacific white-sided dolphins to occur in the Project area. On May 7, 2014, Apache Alaska observed three Pacific white-sided dolphins during an aerial survey near Kenai. This is one of the only recorded visual observations of Pacific white-sided dolphins in Cook Inlet; they have not been reported in groups as large as those estimated in other parts of Alaska (e.g. 92 animals in NMFS' IHAs for Tongass Narrows).

3.3 Socioeconomic Environment

3.3.1 Subsistence

Subsistence communities identified as project stakeholders near Hilcorp's middle Cook Inlet and Trading

Bay activities include the Village of Salamatof and the Native Village of Tyonek. ADF&G Community Subsistence Information System harvest data is not available for Salamatof, so we assume that the subsistence harvest patterns are similar to other communities along the road system on the southern Kenai Peninsula, namely Kenai. Tyonek is the closest community to Hilcorp's tugs towing jack-up rig routes, at 3.5 km from the closest approach. Tyonek, on the western side of lower Cook Inlet, has a subsistence harvest area that extends from the Susitna River south to Tuxedni Bay (BOEM, 2016). In Tyonek, harbor seals were harvested between June and September by 6 percent of the households (Jones et al., 2015). Seals were harvested in several areas, encompassing an area stretching 32.2 km (20 mi) along the Cook Inlet coastline from the McArthur Flats north to the Beluga River. Seals were searched for or harvested in the Trading Bay areas, as well as from the beach adjacent to Tyonek (Jones et al., 2015).

Currently, whale hunts are not known to occur in Cook Inlet. Hilcorp's tug towing jack-up rig activities may overlap temporally with subsistence hunting areas for other marine mammals such as seals, because they will occur during summer and fall months. However, subsistence harvests typically occur close to shore and are concentrated near communities and mouths of rivers, as opposed to offshore near areas along Hilcorp's tug towing jack-up rig transit routes. The closest community to Hilcorp's planned rig move routes, is Tyonek. Salamatof is also in the vicinity of the southernmost platforms and the dock facilities in Nikiski.

Native hunters historically have hunted beluga whales and harbor seals for food. The subsistence harvest of beluga transcends nutritional and economic value of the whale, as the harvest is an integral part of the cultural identity of the region's Alaska Native communities. Inedible parts of the whale provide Native artisans with materials for cultural handicrafts, and the hunting perpetuates Native traditions by transmitting traditional skills and knowledge to younger generations. However, due to dramatic declines in the Cook Inlet beluga whale population, on May 21, 1999, legislation was passed to temporarily prohibit (until October 1, 2000) the taking of Cook Inlet belugas under the subsistence harvest exemption in section 101(b) of the MMPA without a cooperative agreement between NMFS and the affected Alaska Native Organizations (ANOs) (Public Law No. 106-31, section 3022, 113 Stat. 57,100). That prohibition was extended indefinitely on December 21, 2000 (Public Law No. 106-553, section 1(a)(2), 114 Stat. 2762). NMFS subsequently entered into six annual co-management agreements (2000-2003, 2005-2006) with the Cook Inlet Marine Mammal Council, an Alaska Native Organization (ANO) representing Cook Inlet beluga hunters, which allowed for the harvest of one to two beluga whales.

On October 15, 2008, NMFS published a final rule that established long-term harvest limits on Cook Inlet beluga whales that may be taken by Alaska Natives for subsistence purposes (73 FR 60976). That rule prohibits harvest for a 5-year interval period if the average stock abundance of Cook Inlet beluga whales over the prior 5-year interval is below 350 whales. Based on the average abundance over the 2002-2007 period, no hunts occurred between 2008 and 2012 (NMFS, 2008a, b). Harvest levels for the current 5-year planning interval (2018-2022) are zero because the average stock abundance for the previous 5-year period (2012-2017) was below 350 whales (Muto et al, 2019). The Cook Inlet Marine Mammal Council, which managed the Alaska Native Subsistence fishery with NMFS, was disbanded by a unanimous vote of the Tribes' representatives on June 20, 2012. No harvest has been documented in recent years and it is unlikely the hunt will resume within the timeframe of Hilcorp's activity.

Although marine mammals remain an important subsistence resource in Cook Inlet, the number of animals annually harvested is low, and are primarily harbor seals. Much of the harbor seal harvest occurs incidental to other fishing and hunting activities, and at areas outside of the project area such as the Susitna Delta or the west side of lower Cook Inlet.

Chapter 4 Environmental Consequences

NMFS reviewed all possible direct, indirect, cumulative, short-term, and long-term impacts to the biological, physical, and socioeconomic environment associated with NMFS' action and alternatives. This chapter describes the potential environmental consequences for the affected resources described in Chapter 3 for each alternative.

4.1 Effects of Alternative 1 – Issuance of Authorizations with Mitigation Measures

Alternative 1 is the Preferred Alternative where NMFS would issue two IHAs to Hilcorp allowing the incidental take, by Level B harassment, of 11 species of marine mammals, subject to the mandatory mitigation and monitoring measures and reporting requirements set forth in the IHAs (see Section 2.3.1), if issued.

4.1.1. Impacts to Marine Mammal Habitat

The activities would not result in substantial damage to ocean and coastal habitats that might constitute marine mammal habitat. Tugs towing the jack-up rig would minimally and briefly (limited to when work is occurring at a particular location) impact physical habitat features, such as substrates and/or water quality, during the process of tying down the rig. The wells that the jack-up rig would be servicing are pre-existing wells, so no additional disturbance to the substrate from well boring is anticipated. Vessels used for the project would originate from the Alaska area; therefore, the potential for ballast water to contain non-indigenous species that may be introduced or spread into the marine environment, is low.

4.1.2. Impacts to Marine Mammals

In general, NMFS uses several quantitative and qualitative methodologies for assessing impacts to marine mammal stocks and their habitats. NMFS evaluates impact through its negligible impact determinations; small numbers analyses; consideration of the number of takes of marine mammals by Level A and Level B harassment; status of stocks; how animals are using habitat when potentially harassed; geospatial consideration of habitat area where takes could occur; known impacts from the stressor being analyzed, and, among other things; qualitative reviews of mitigation measures and effectiveness at reducing impacts. NMFS relied on and incorporated information from Hilcorp's application and the notice of the proposed IHAs, when considering potential effects to marine mammals resulting from the tug activities. Hilcorp's application and the IHAs are available for review on NOAA Fisheries website at https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-oil-and-gas#authorizations-in-process.

The primary impact to marine mammals is exposure to noise from tugging of the jack-up rig. Acoustic stimuli generated by tugs towing and positioning the rig may result in one or more of the following marine mammal reactions: avoidance, masking, tolerance, and behavioral disturbance (Richardson et al., 1995). For reasons described below, we do not anticipate hearing impairment. The potential effects on marine mammals resulting from Hilcorp's tug activities is described in detail in the notice of the proposed IHAs and is incorporated by reference and summarized in this section and the following subsections.

With exposure to noise, there is a risk of hearing threshold shift that NMFS defines as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2016). There are two types of threshold shift: permanent (PTS) and temporary (TTS). The potential for PTS from exposure to Hilcorp's tugging activities is discountable. Using NMFS Technical Guidance (NMFS, 2018), a high-frequency cetacean would have to remain within 679 m of a noise source (e.g., tug) for 5 hours of stationary positioning, or within 8 m during mobile tug use, for there to be the potential for PTS onset. Belugas are expected to be headed to, or later in the season, away from, the concentrated foraging areas near the Beluga River, Susitna Delta, and Knik and Turnigan Arms. Similarly, most other large cetaceans and Steller sea lions are not expected to remain in the area. Harbor seals, Dall's porpoises, and harbor porpoises are more commonly sighted in the area but they are not known to have any particular affinity for the well sites along the route of the work.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall et al., 2007). Currently NMFS uses a received level of 160 dB re 1 micro Pascal (μPa) root mean square (rms) to predict the onset of behavioral harassment from impulse noises (such as impact pile driving), and 120 dB re 1 μPa (rms) for continuous noises (such as operating dynamic positioning (DP) thrusters). No impulsive noise will be used for Hilcorp's jack-up rig mobilization; therefore, only the 120 dB re 1 μPa (rms) threshold is considered. Given most marine mammals are likely transiting through the area, exposure is expected to be brief, but in combination with the actual presence of tugs, may result in avoidance; changing durations of surfacing and dives, number of blows per surfacing,direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding), visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into water from haul-out). NMFS does not expect any abandonment of the transiting route for belugas, as supported by data indicating belugas regularly pass by industrialized areas such as the Port of Anchorage. The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Richardson et al., 1995; Southall et al., 2007).

Masking is the obscuring of sounds of interest, by other sounds, often at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other noise is important in communication, predator and prey detection, and, in the case of toothed whales, echolocation. Although some degree of masking is inevitable when high levels of manmade broadband sounds are introduced into the sea, marine mammals have evolved systems and behavior that function to reduce the impacts of masking. Structured signals, such as the echolocation click sequences of small toothed whales, may be readily detected even in the presence of strong background noise, because their frequency content and temporal features usually differ strongly from those of the background noise (Au and Moore, 1988; 1990). The components of background noise that are similar in frequency to the sound signal in question, primarily determine the degree of masking of that signal.

Masking effects of underwater sounds from Hilcorp's activities on marine mammal calls and other natural sounds are expected to be limited. For example, beluga whales primarily use high-frequency sounds to communicate and locate prey; therefore, masking by low-frequency sounds associated with operations is not expected to occur (Gales, 1982). There is evidence of other marine mammal species continuing to call in the presence of industrial activity. Annual acoustical monitoring near British Petroleum's Northstar production facility during the fall bowhead migration westward through the Beaufort Sea, has recorded thousands of calls each year (e.g., Richardson et al., 2007; Aerts and Richardson, 2008). Construction, maintenance, and operational activities have been occurring from this facility for over 10 years. To compensate and reduce masking, some mysticetes may alter the frequencies of their communication sounds (Richardson et al., 1995; Parks et al., 2007).

Based on received levels and spatial and temporal prevalence of anthropogenic sound in Cook Inlet, Castelotte et al. (2016) suggest that human-induced noise has the potential to mask beluga communication and hearing in most of the locations sampled. This masking may result in a range reduction of effective communication and echolocation. However, masking from the tugging is expected to be low because frequencies of noise produced during operations is low, and belugas typically go silent when in the presence of anthropogenic sound. Lastly, marine mammals are likely transiting through the area; therefore, no impacts to important behaviors such as foraging or mating are expected.

In summary, NMFS has determined that these effects on all marine mammals fall within the MMPA definition of Level B (behavioral) harassment. NMFS expects impacts to be minor because measurable changes to the population or impacts to rookeries, mating grounds, and other areas of similar significance are not anticipated. Under the Preferred Alternative, NMFS would authorize incidental take, by Level B harassment only, of 12 species of marine mammals, based on the activity. NMFS does not expect any long-term or substantial adverse effects on marine mammals, their habitats, or their role in the environment.

Hilcorp will implement a number of monitoring and mitigation measures for marine mammals. In consideration of the potential effects of the action, NMFS determined that the mitigation and monitoring measures described in Section 2.3.1 of this EA would be appropriate for the preferred alternative to meet the Purpose and Need.

4.1.3. Estimated Take of Marine Mammals by Level B Incidental Harassment

NMFS estimated take by considering: 1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; 2) the area of water that will be ensonified above these levels in a day; 3) the density or occurrence of marine mammals within these ensonified areas; and, 4) the number of days of activities. Using the best available science, NMFS used acoustic thresholds to identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

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 threshold as well as the extent of the PTS threshold for their activity. Rather than applying practical spreading loss, SLR created a more detailed propagation loss model in an attempt 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). Modeling was conducted using dBSea software. 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.

Stationary - For stationary activity, two representative locations where the tugs would be stationary for jack-up rig positioning, 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 5-hour exposure to a broadband spectrum of 185 dB as described above. A 5-hour exposure duration was chosen to account for the up to 5-hour positioning attempts on individual days, as well as events wherein the tugs need to hold the jack-up rig while waiting for a following tide.

Mobile – For the mobile portion of the activity, a representative route was used beginning at the Rig Tender's dock in Nikiski to the Tyonek platform, the northernmost platform in Cook Inlet (representing Middle Cook Inlet), to the Tyonek Platform to the Dolly Varden platform in lower Trading Bay, and to the Dolly Varden platform and finally 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 as the order in which platforms will be drilled with the jack-up rig is not yet known. The lowest threshold for the onset of PTS is for high frequency cetaceans at 173 dB. Based on a source level of 185 dB, and assuming practical spreading, a received level of 173 dB would be reached at 6.3 m away from the source. The mobile source modeling assumed a transit speed of 2.06 meter per second (m/s) for the tug configuration. With an assumed vessel speed of 2.06 m/s, it would take the vessel 6.11 seconds (s) to traverse a distance of two times the radius (with two times the radius used because the source is omnidirectional and the ship is moving in a straight line). A source level of 185 dB incorporates the use of three tugs simultaneously, because the three tugs will likely not be perfectly aligned in space (e.g., one could lag slightly behind the forward two). Three separate six second exposures were summed (one for each tug passing in space) to arrive at a total duration of exposure of 18 s. While it is possible the duration of exposure could be as short as 6 s if all tugs were perfectly aligned, separate exposures for each tug were considered as the exact formation of the tugging vessels at any given time is unknown.

Take estimates were generated in consideration of species density in the action area (Table 4), the number of days stationary and mobile activities would occur, the extent of ensonified area, and group size and frequency of assumed occurrence. The two latter parameters were considered if the calculated take estimate based on density was not representative of group size. For example, if calculated take was one animal but that species is typically observed in groups of five animals,the number of take was increased to represent a certain number of groups. Calculated take is the product of daily ensonified area, number of project days, and the density of a species, absent mitigation measures or other requirements and limiting factors. More details on how takes were derived can be found in our notice of issued IHAs. The take authorized by Level B harassment is shown in Table 5.

Table 4. Density Estimates for Marine Mammals Potentially Present within the Action Area based on Cook Inlet-wide NMFS aerial surveys 2001-2016.

Species	**Density (indiv/km^2)**
Humpback whale	0.001770
Minke whale	0.000009
Gray whale	0.000075
Fin whale	0.000311
Killer whale	0.000601
Beluga whale (MML lower CI)	0.000023
Beluga whale (MML middle CI)	0.001110
Goetz beluga - LCI	0.011106
Goetz beluga - NCI	0.001664
Goetz beluga - TB	0.015053
Dall's porpoise	0.000154
Harbor porpoise	0.004386
Pacific white-sided dolphin	0.000000
Harbor seal	0.241401
Steller sea lion	0.007609
California sea lion	0.000000

Table 5. Quantitative Assessment of Take Authorized, by Level B harassment.

	Year 1 Calculated	Year 1 Authorized	Year 2 Calculated	Year 2 Authorized
Humpback whale	3.065	5	4.058	6
Minke whale	0.016	6	0.021	6
Gray whale	0.129	2	0.171	2
Fin whale	0.538	4	0.712	4
Killer whale	1.041	10	1.379	10
Beluga whale	1.922 (MML) 9.411 (Goetz)	11	2.545 (MML) 11.651 (Goetz)	22
Pacific white-	0	3	0	3

sided dolphin				
Dall's porpoise	0.266	6	0.353	6
Harbor porpoise	7.595	44	10.057	44
Harbor seal	418.051	418	553.565	554
Steller sea lion	13.176	13	17.448	17
California sea lion	0	2	0	2

4.1.3. Impacts on Subsistence

Under Alternative 1 (the Preferred Alternative), Hilcorp's tugging activities in Cook Inlet are not expected to affect subsistence uses of wildlife and marine mammals in the area because subsistence use is limited to a small number of marine mammals. The background and additional information about subsistence users within or near Cook Inlet is summarized below.

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.

The only data available for subsistence harvest of harbor seals, harbor porpoises, and killer whales in Alaska are in the marine mammal stock assessments. However, these numbers are for the entire Gulf of Alaska, not just Cook Inlet, and they are not indicative of the harvest in Cook Inlet. The number harvested is expected to be extremely low. For example, there is a low level of subsistence hunting for harbor seals in Cook Inlet. Seal hunting occurs opportunistically among Alaska Natives who may be fishing or traveling in the upper Inlet near the mouths of the Susitna River, Beluga River, and Little Susitna River.

Hilcorp concluded in its application, and NMFS agrees, that the size of the affected area, mitigation measures, and consideration of subsistence use, should result in the action having no unmitigable adverse impact on the availability of marine mammals for subsistence uses. Hilcorp and NMFS recognize the importance of ensuring that ANOs and federally-recognized tribes are informed, engaged, and involved during the permitting process and will continue to work with the ANOs and tribes to discuss their operations and activities.

In summary, NMFS anticipates that any effects from Hilcorp's activities on marine mammals would be short-term, site specific, and limited to inconsequential changes in behavior. NMFS does not anticipate that authorizing take of affected species or stocks would reduce the availability of the species to a level insufficient for a subsistence harvest by: (1) forcing marine mammals to abandon or avoid hunting areas; (2) directly displacing subsistence users; or (3) placing physical barriers between the marine mammals and the subsistence users, because mitigation and other measures will be implemented to ensure subsistence needs are met..

4.2. Effects of Alternative 2 – No Action Alternative

Under the No Action Alternative, NMFS would not issue the IHAs authorizing take of marine mammals to Hilcorp. As a result, the exceptions to the prohibition on take of marine mammals per the MMPA, would not apply and NMFS assumes that Hilcorp would not conduct the tugging activities as described in the application. There would be no direct or indirect impacts to marine mammals or their habitat. The marine mammal species and their habitat conditions would remain substantially similar to the condition described in Chapter 3, "Affected Environment".

4.3. Cumulative Effects

Cumulative effects includes the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over time.

For purposes of this analysis, the range of past, present, and reasonably foreseeable activities that result in cumulative impacts to marine mammal populations in the project area include the following: subsistence hunting, marine pollution, fisheries interactions, vessel traffic; oil and gas development; coastal zone development, marine mammal research, and climate change.

4.3.1. Subsistence Hunting

In Cook Inlet, Native hunters historically have hunted beluga whales and harbor seals for food. The subsistence harvest of beluga transcends nutritional and economic value of the whale as the harvest is an integral part of the cultural identity of the region's Alaska Native communities. Inedible parts of the whale provide Native artisans with materials for cultural handicrafts, and the hunting perpetuates Native traditions by transmitting traditional skills and knowledge to younger generations.

There is a low level of subsistence hunting for harbor seals in Cook Inlet. Seal hunting occurs opportunistically among Alaska Natives who may be fishing or traveling in the upper Inlet near the mouths of the Susitna River, Beluga River, and Little Susitna. Some detailed information on the subsistence harvest of harbor seals is available from past studies conducted by the Alaska Department of Fish & Game (Wolfe et al., 2009). In 2008, 33 harbor seals were taken for harvest in the Upper Kenai-Cook Inlet area. In the same study, reports from hunters stated that harbor seal populations in the area were increasing (28.6 percent) or remaining stable (71.4 percent). The specific hunting regions identified were Anchorage, Homer, Kenai, and Tyonek, and hunting generally peaks in March, September, and November (Wolfe et al., 2009). The timing and location of subsistence harvest of Cook Inlet harbor seals would not directly overlap with Hilcorp's tugging activity in the middle of the Inlet and this subsistence hunt is conducted opportunistically and at low levels (NMFS, 2013c). Therefore, no cumulative effects from subsistence hunting are anticipated.

4.3.2. Pollution

The amount of pollutants that enter Cook Inlet is likely to increase as populations in urban areas continue to grow. Sources of pollutants in urban areas include runoff from streets and discharge from wastewater treatment facilities. Gas, oil, and coastal zone development projects also contribute to pollutants that enter Cook Inlet through discharge. These sources of pollutants are expected to continue in Cook Inlet; therefore, it would be anticipated that pollutants could increase in the area. However, the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation will continue to regulate the levelof pollutants entering Cook Inlet from point and non-point sources through Alaska Pollutant Discharge Elimination System permits. As a result, permit holders will be required to renew their permits, verify that they meet permit standards, and upgrade facilities if necessary. Additionally, the extreme tides and strong currents in Cook Inlet may contribute to a reduction in the amount of pollutants found there. No changes in pollution sources or regulation are known to have occurred since July 2021.

Potential sources of pollution which could affect marine mammals in Cook Inlet include: offshore oil and gas development; municipal waste and bilge discharge; marine oil spills; runoff from roads, airport, military sites, mines, construction sites, and farms; terrestrial and marine spills of contaminants other than oil; resuspension of contaminants through dredging; ship ballast discharge; watercraft exhaust and effluent; coal transportation and burning; auto exhaust; antifouling paint; and trash. Possible contaminants marine mammals in Cook Inlet could be exposed to include: persistent organic pollutants; aromatic hydrocarbons; chlorinated hydrocarbons; heavy metals; endocrine disruptors; pharmaceuticals; antibiotics; sanitizers; disinfectants; detergents; insecticides; fungicides; and de-icers. While NMFS has some data about levels of traditionally studied contaminants in Cook Inlet belugas (e.g., Dichlorodiphenyltrichloroethane [DDT], polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons [PAHs], etc.), very little is known about other emerging pollutants of concern and their effects on marine mammals. The emerging pollutants of concern include endocrine disruptors (substances that interfere with the functions of hormones), pharmaceuticals, personal care products (chemicals such as soaps, fragrances, insect repellants, etc.), prions (infectious proteins that cause neurodegenerative disease), and other bacterial and viral agents that are found in wastewater and biosolids.

Exposure to contaminants found in pollution may be the result of marine mammals’ direct contact with contaminants found in the water; inhalation of contaminants in the air; or ingestion of contaminants found in prey, mud, or silt. There is little information on the potentially deleterious effects of contaminants on marine mammals; but it is likely that chronic exposure to contaminants may compromise an individual whale’s health, with the potential for population-level impacts. A recent study of Cook Inlet beluga whales, the species most at risk in the action area, suggests a potential link between gastrointestinal cancer in belugas to environmental PAH contamination (Poirier et al, 2019). There is also preliminary evidence of female marine mammals passing contaminant loads to offspring (Peterson et al, 2018; Andvik et al, 2021), although the effects of repeated transfer of contaminant loads to offspring repeatedly across generations is unclear.

4.3.3. Fisheries Interaction

Fishing is a major industry in Alaska. If fish stocks are sustainable, subsistence, personal use, and recreational and commercial fishing would continue in Cook Inlet. As a result, there would be continued prey competition, risk of ship strikes, potential harassment, potential for entanglement in fishing gear, and potential displacement from important foraging habitat for beluga whales and other marine mammals.

In August 2021, NMFS Office of Protected Resources issued a Letter of Concurrence (LOC) for a action to implement Amendment 14 to the Fishery Management Plan for the Salmon Fisheries in the Exclusive Economic Zone (EEZ) off Alaska to optimize conservation and management of the Cook Inlet Salmon Fishery (Salmon FMP) (86 FR 60568). The Final Rule prohibits commercial salmon fishing in the EEZ of Cook Inlet. The measure will be in place for the 2022 Cook Inlet EEZ commercial salmon fishery. The rule does not close salmon fishing in state waters. The rule will change fishing patterns and will likely result in increased vessel presence and fishing in nearshore areas. The LOC concluded an informal ESA section 7 consultation, and it determined the action may affect, but is not likely to adversely affect, Western DPS Steller sea lions, Mexico and western North Pacific DPS humpback whales, fin whales, or Cook Inlet DPS beluga whales or their critical habitat. NMFS stated it does not expect the action to result in additional prey competition between the salmon drift gillnet fishery and the ESA-listed marine mammal species in Cook Inlet. The State of Alaska will continue to manage Cook Inlet salmon fishery sectors within state waters and may choose to modify management policies in future seasons in response to this federal action.

The 2021 List of Fisheries identifies Cook Inlet DPS beluga whales, humpback whales, Dall’s porpoise, harbor porpoise, harbor seal, and Steller sea lion as species likely to interact with this fishery (86 FR 3028; January 14, 2021). Manly (2006) reported that a minke whale was observed entangled in the Upper Cook Inlet drift gillnet fishery in 2000. In July 2021, a gray whale became entangled in salmon drift gillnet gear in Cook Inlet. These incidents indicate that although large whale entanglements in salmon drift gillnet gear may be rare in Cook Inlet, they do occur.

Steller sea lion entanglements are rare in any Alaska commercial fishery, with the exception of the salmon troll fishery where they target the bait. Similar to other listed species, there have been no documented takes of Steller sea lions in the salmon drift gillnet fishery to date, suggesting that either this is a very rare occurrence or does not occur, the detection of the occurrence is rare or does not occur, or rare occurrences of entanglement are not reported. Additionally, Cook Inlet is not an important foraging area for Steller sea lions and they are not usually present in the action area in large numbers. Humpback whales are known to become entangled in gillnet fisheries in Alaska, but the majority of gillnet entanglements occur outside the action area in Southeast Alaska, which is a major summer feeding area for humpbacks (Muto et al. 2020). Documented fin whale entanglements in any Alaska commercial fisheries are extremely uncommon. Both species are rare in the upper inlet, making entanglement in this fishery extremely unlikely.

Between 2005 and 2017, McGuire et al. documented 14 instances of scars on Cook Inlet belugas, based on stranding and dual-side photo identification, that could be from entanglement. Of these, 11 observations were possible entanglement scars that may have involved monofilament line, netting, or rope/line, and three were confirmed scars from a net injury, a heavy braided line, and a gillnet. However, as mentioned previously, AMMOP did not observe any serious injuries or mortalities of Cook Inlet beluga whales in salmon drift gillnet gear and none have been reported through the MMAP. It is uncertain where or in which fisheries these entanglements may have occurred.

Although there may be an increase in the amount of drift gillnet gear in state waters as a result of the action, there is limited overlap between Cook Inlet belugas and the area where fishing occurs during the fishing season. Any overlap that may occur between the fishery and Cook Inlet belugas would be at the end of the fishing season from mid-August to mid-September when belugas start to return to the mouth of the Kenai River. Drift gillnet fishery interactions with Cook Inlet beluga whales during this period of potential overlap are unlikely for several reasons. First, 98 percent of the harvest is usually complete by mid-August and only an estimated 10 vessels remain fishing during the late season. Second, at all times during the season, drift gillnet vessels are restricted from fishing within 1.5 miles (2.4 km) of the mouths of the Kenai and Kasilof rivers, where belugas have been spotted in early September (AKBMP, 2021). Finally, after August 15, the drift gillnet fleet is restricted to the extreme west side of Cook Inlet where belugas have not been documented in late summer. The potential increase in drift gillnet gear in state waters as a result of this action is therefore unlikely to increase the risk of entanglement of Cook Inlet DPS beluga whales.

The proposed permanent closure of the EEZ nearly eliminates the possibility of entanglement of any listed marine mammals in those waters. The overall amount of drift gillnet gear deployed by the fishery in Cook Inlet is likely to remain the same or decrease slightly; however, it will be concentrated into a smaller area in state waters during the fishing season, possibly increasing entanglement potential in state waters. Because Steller sea lions, humpback whales, fin whales, and Cook Inlet beluga whales are uncommon or rare in the area of the fishery during the fishing season, any increase in the risk of entanglement potential is likely to be insignificant and entanglements associated with the action are extremely unlikely to occur.

4.3.4. Vessel Traffic

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% 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. Eighty percent of large ship operations were made by only 15 vessels that regularly called at Homer, Nikiski, or Anchorage (Eley, 2012). 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 USCG 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.

Major contributors to vessel traffic throughout Cook Inlet include port facilities, oil and gas development, and commercial and recreational fishing. The Port of Anchorage (POA) is a major Alaskan port located adjacent to Anchorage in upper Cook Inlet. The POA provides 90 percent of the consumer goods for 85 percent of the state of Alaska. The POA handles the majority of Alaska's refined petroleum products and the bulk of jet fuel for Joint Base Elmendorf-Richardson and the Ted Stevens Anchorage International Airport (100 and 60 percent respectively; POA, 2014). Major vessels calling to the POA include cargo ships, barges, tankers, dredgers, military ships and tugboats (POA, 2009). Based on data from 1998-2011, an average of approximately 450 vessels call to the POA annually (POA, 2014). The POA is outside the area in which Hilcorp is planning to conduct tugging activities; however, the POA yields a high volume of vessel traffic, some of which may pass through or near where Hilcorp's tugging activity would take place. In addition, the POA is currently under construction and expanding its facilities. As a result, vessel traffic would increase once the project is complete.

Port MacKenzie is located in upper Cook Inlet and contributes to vessel traffic, some of which may pass through the area that Hilcorp's tug towing activity would take place. It receives about two large ships annually (i.e., a landing craft or barge), which is substantially less than the POA. However, the number of ships calling to port at Port MacKenzie is expected to increase over the next 5 years.

Other smaller port facilities that contribute to vessel traffic in the action area include Nikiski, the City of Kenai, Kasilof, Ninilchik, Anchor River, Tyonek, and Drift River. Vessels ranging from tankers to fishing boats, call to these ports (Kenai Peninsula Borough, 2003). Increases in gas and oil development could also contribute to increased vessel traffic in the project area, as well as commercial and recreational fishing vessels.

The project would increase small vessel and helicopter presence and operation in the project area; however, the number of supply trips is only expected to increase by two trips per day, which is a negligible increase in a developed area near an active shipping lane. The project would not result in any long-term use of the area (e.g., it does not involve building a dock, port, or new wells) and any vessel use in the future would be limited to maintenance and repair.

Effects of vessel traffic on marine mammals in the area is largely unknown. Vessel traffic, especially large vessels, are channeled through dedicated shipping lanes so as to limit the footprint of the large vessel traffic, leaving large portions of the Inlet free of large vessels and available for marine mammal use. However, small vessel use (e.g. personal watercraft) is much more difficult to characterize. Increased vessel traffic may contribute to increased pollution, increase in ambient noise vessel, as well as increased risk of vessel strike. Increased pollution and increased ambient noise level may have long-term sub-lethal effects such as increased contaminant load or masking of communication between marine mammals (Duarte et al, 2021). Vessel strike has the potential to result in serious injury or mortality to marine mammals but rarely occurs and when it does occur is usually injurious to a singular marine mammal, limiting the potential of a population-level effect due to rare instances of vessel strike.

4.3.5. Gas and Oil Development

Cook Inlet is estimated to have 500 million barrels of oil and over 19 trillion cubic feet 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 feet 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. 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.

The Alaska Department of Natural Resources' Division of Oil and Gas has issued a preliminary best interest finding for proposed Cook Inlet area-wide oil and gas lease sales, 2019–2028. The lease sales could lead to increased oil and gas development in Cook Inlet; however, it is uncertain if oil and gas companies will be interested in acquiring these leases given the commodity prices, the state's tax structure, and the sustainable investment required to explore and develop offshore leases. Currently, there are 18 existing oil and gas drilling platforms within Cook Inlet, 15 of which are active.

In 2017, BOEM held Lease Sale #244 in Cook Inlet. 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, including seismic surveys, and other exploration activities within these blocks. 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. NMFS has not yet received any requests for ITAs associated with exploration or production from these sales.

NMFS has received applications requesting takes of marine mammals incidental to seismic surveys and drilling operations in this area. NMFS issued Incidental Take Regulations to the Alaska Gasline Development Corporation for take of marine mammals, by harassment, incidental to construction of a marine terminal near Nikiski and installation of a pipeline in Cook Inlet. NMFS issued the Letter of Authorization (LOA) on September 21, 2020, and it will be valid from January 1, 2021 through December 31, 2025 (85 FR 59291). Mitigation and monitoring measures include ramp-ups, shutdown zones, and PSO monitoring for the Project, known as the Alaska Liquefied Natural Gas Project.

Impacts from cumulative effects of oil- and gas-related activities in Cook Inlet include increased exposure to loud noises, disturbances, and habitat alteration occurring from seismic surveys, pile-driving, drilling, installation of platforms and pipelines, and vessel and aircraft operations. These activities may impact marine mammals by introducing manmade noise into the environment, disturbing marine mammals with the presence of people and transportation, altering marine mammal habitat, and potentially injuring or killing individual marine mammals. All activities involving workers in marine environments have potential to temporarily disturb marine mammals; however, the only activities that could alter habitat are those that physically change parts of the marine environment or introduce chronic disturbances from noise or the presence of workers. Activities such as vessel traffic and well as accidental oil spills have occasionally resulted in marine mammal fatalities. The loudest of these oil and gas related activities typically are seismic surveying, pile-driving and other construction activities, and dredging; all of which have potential to compromise a marine mammal's ability to hear and properly interact with their natural environment. Typically, the noise levels from these activities are loud enough to permanently injure marine mammal hearing, but usually only at close range and over extended periods of time.

Some Cook Inlet marine mammal habitat has already been altered, primarily by the construction and use of oil and gas facilities in coastal areas, production platforms, and laying pipelines on the seafloor. To a lesser extent the release of drill cuttings and muds, the establishment of consistently used vessel routes to ship oil and gas, oil and gas spills, and release of contaminants into Cook Inlet have also modified marine mammal habitats. Though some habitat has been altered and alterations are expected to continue into the future due to these developments, practices, and accidents, collectively they constitute a small fraction of marine mammal habitats in Cook Inlet. Within a matter of years or perhaps a decade or more, disturbed habitats often return to a state similar to that of unaffected areas (Henry et al., 2017; Manoukian et al., 2010).

Accidental oil and gas releases have occurred in Cook Inlet and are likely to occur in the future, mostly when transporting oil or gas during lease development in state waters, and from infrastructure projects such as port developments. Since oil and gas development began in Cook Inlet, large spills have occasionally occurred. Impacts from contacting oil spills could include elevated stress and physiological reactions to inhalation or ingestion of hydrocarbon toxins and fouling of baleen or fur. The existence of spill response infrastructure, protocols and an active spill response would help minimize effects from large oil spills on marine mammal populations. The overall cumulative effects of an oil spill would include temporary physiological effects among marine mammals and potential mortality depending on the location, size of the spill, and adequacy of response.

4.3.6. Coastal Zone Development

Coastal zone development in Cook Inlet may result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated with construction and activities of the projects after construction. Potential projects in Cook Inlet include mining projects, renewable energy projects (Fire Island Wind Project and Turnagain Arm Tidal Energy Project), and coastal construction (e.g., port expansions and maintenance, roadway construction; see Figure 4). Figure 4 shows a representation of the types of projects occurring in Cook Inlet, which remains relevant today.

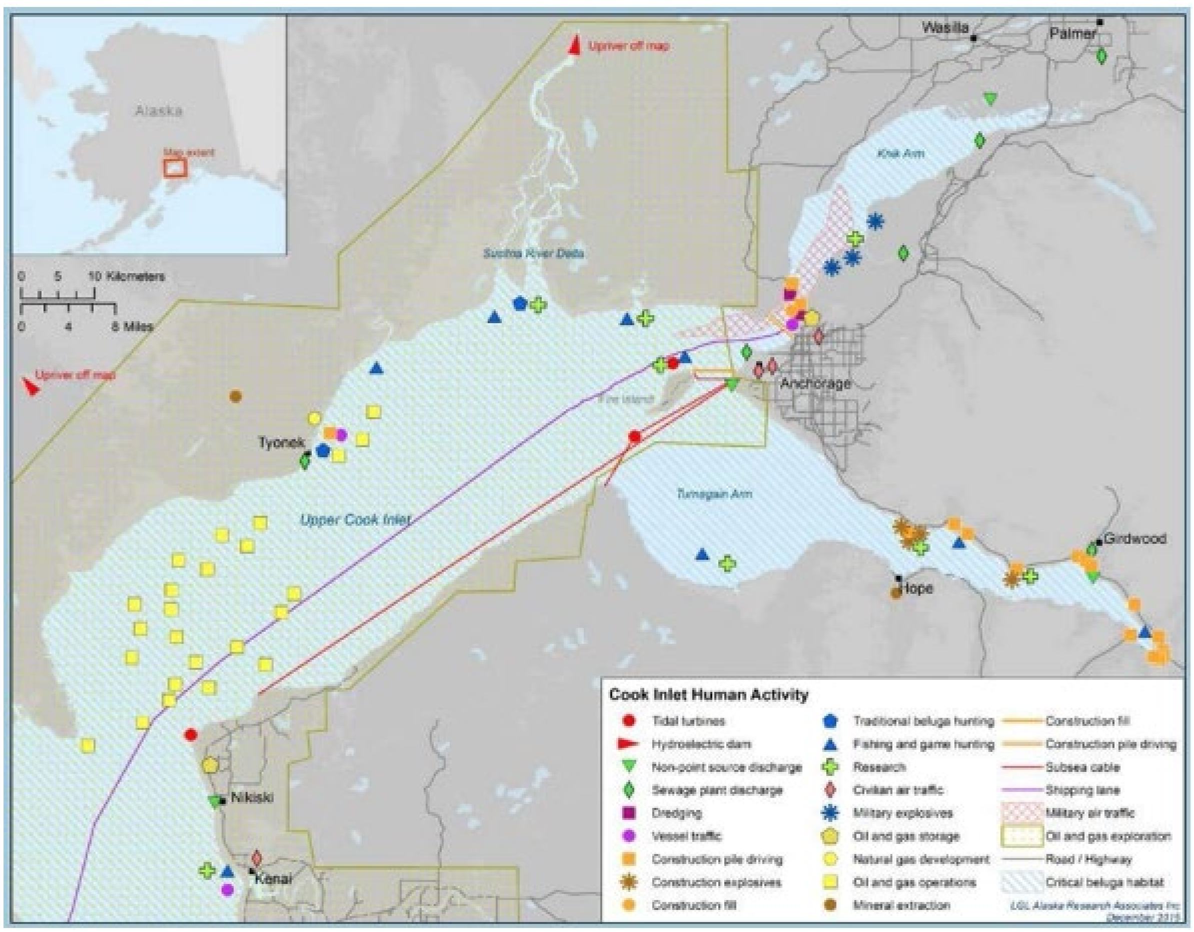

Figure 4. Example Activities in Cook Inlet

(LGL unpublished data 2015)

Anthropogenic activities related to coastal development may detrimentally affect Cook Inlet beluga critical habitat through loss or degradation of habitat and alterations in the availability of prey in critical habitat areas. Anthropogenic activities in the vicinity of Cook Inlet beluga critical 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 designated as Cook Inlet beluga whale critical 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).

Port of Anchorage/Port of Alaska

The POA is consistently undertaking expansion and improvement activities to modernize the port's infrastructure.

In 2018, NMFS issued an LOC for ESA section 7 consultation for the POA Fender Pile and Replacement Repair Project. This Project included pile installation of forty-four 22-in round piles.
On March 31, 2020, NMFS issued two successive IHAs (85 FR 19294) to the POA for construction of the Petroleum and Cement Terminal (PCT). Construction of the PCT was planned and permitted as two distinct construction seasons, with PCT Phase 1 permitted under an IHA valid from April 1, 2020 through March 31, 2021 (NMFS 2020b), and work on PCT Phase 2 permitted under the successive IHA valid from April 1, 2021 through March 31, 2022 (NMFS, 2020c). The PCT has requested two modifications to the PCT Phase 2 IHA and that process has been approved and the IHAs are approaching expiration.

In 2020, the POA applied for concurrence from the USACE that the POA Fender Pile Replacement and Repair Project qualifies under Nationwide Permit 3, Maintenance. Informal ESA section 7 consultation for this work was initiated on September 25, 2020 (POA, 2020). The purpose of the Project is to replace 180 corroding and failing 22-inch pin piles within the POA's existing fendering system. Pre- and post-earthquake (2018) inspections have shown that these pin piles are in a state of imminent failure and require emergency repair. It has been determined through engineering evaluation that these piles are currently providing only 10 percent of the required resistance for safely berthing ships at the POA, presenting a substantial safety hazard and potential threat to commerce in Alaska. The fendering system is comprised of 107 fender assemblies, each supported by two pin piles. A total of 23 fender assemblies were replaced in 2015 and 2019. It is anticipated that approximately sixty-eight 22-inch fender piles comprising 34 fender assemblies will be installed in 2022, with one or two replacements occurring each week from May through October. It is estimated that future repairs will take up to 5 years to complete, including 1 contingency year.

After completion of the PCT, the POA plans to replace Terminals 1 and 2. Terminals 1 and 2 are the existing container and general cargo terminals and are the only deepwater marine cargo terminals in Anchorage. POA cargo services supply goods for 85 percent of Alaska's population. Preliminary plans for these terminal replacements are currently in a state of reevaluation due to early estimates of high costs and current lack of adequate funding. The schedule for replacement of Terminals 1 and 2 is currently estimated to begin in 2025. Other than Hilcorp, the Port of Alaska is the only other entity that has an active ITA from NMFS for Cook Inlet beluga whales.

Port MacKenzie

Port MacKenzie also has the potential to expand its facilities, depending on future needs associated with large resource development projects. The expansion project is in the process of obtaining funding, and no specific plans have been formalized to begin construction at this time. Without specifics about development at this port, it is difficult to characterize potential effects of this construction in concert with other activities ongoing in Cook Inlet.

Mining

The Pebble Limited Partnership proposes to develop the Pebble copper-gold-molybdenum porphyry deposit (Pebble Deposit) as a surface mine in Southwest Alaska near Iliamna Lake, approximately 200 mi southwest of Anchorage and 60 mi west of Cook Inlet. The Project would include development of the open pit mine, with associated infrastructure to include a 270-megawatt power generating plant. A 166-mi natural gas pipeline from the Kenai Peninsula across Cook Inlet to the mine site is proposed as the energy source for the mine. The USACE identified the Northern Route as the preferred transportation corridor for the mine in the final EIS for the Project published in July 2020. The transportation corridor includes mine and port access roads, including an 82-mi gravel access road along the northern edge of Iliamna Lake and an Amakdedori port facility at Diamond Point in Iliamna Bay, approximately 165 mi southwest of Anchorage. The construction could contribute increased vessel traffic to the mine loading site as well as increased short-term construction projects to construct any additional pipeline. These activities could increase the noise levels in certain areas of Cook Inlet and an increase in vessel traffic has the potential to increase risk of vessel strike of marine mammals. Construction method and plans are currently unknown. It is possible that pile installation may not occur. On November 25, 2020, the USACE issued a Record of Decision that denied The Pebble Limited Partnership a permit to construct the mine. The Pebble Limited Partnership filed an appeal of the USACE's decision in January 2021 (Pebble Limited Partnership, 2021). In January 2022, the EPA announced its intent to issue a revised version of a Clean Water Act 404(c) Proposed Determination regarding the Pebble deposit by May 31, 2022. Available public information does not indicate additional proposed mining projects since July 2021.

Department of Defense Projects

Live-fire weapons training which takes place at the Eagle River Flats (ERF) contributes to noise pollution in the upper Cook Inlet. ERF is a 2,483-acre explosive munitions impact area situated along the northern boundary of Joint Base Elmendorf-Richardson (JBER), a military installation encompassing

73,013 acres located in south-central Alaska adjacent to Anchorage and the town of Eagle River. Weapons training includes up to 5,608 high explosive rounds and up to 7,428 full-range training rounds annually. This activity occurs farther north in Cook Inlet than Hilcorp's activities so they are not expected to overlap spatially. Additionally this activity is likely to contribute to airborne noise, which may disturb pinnipeds in the area, but does not compound the effects of the underwater noise produced by Hilcorp in an area removed from Eagle River.

4.3.7. Marine Mammal Research

Because many important aspects of marine mammal biology remain unknown, or are incompletely studied, and because management of these species and stocks requires knowledge of their distribution, abundance, migration, population, ecology, physiology, genetics, behavior, and health, free-ranging marine mammal species are frequently targeted for scientific research and studies. Research activities normally include close approach by vessel and aircraft for line-transect surveys; behavioral observation; photo-identification and photo-video-grammetry; passive acoustic recording; attachment of scientific instruments (tagging), both by implantable and suction cup tags; biopsy sampling, including skin and blubber biopsy and swabbing; land-based surveys; live capture for health assessments, and blood and tissue sampling, pinniped tooth extraction, and related pinniped anesthesia procedures. All researchers are required to obtain a scientific research permit from NMFS Office of Protected Resources under the MMPA and/or ESA (if an ESA-listed species is involved).

At the time of preparation of this EA, there are eight active scientific research and/or enhancement permits that authorize take of Cook Inlet beluga whales. Two of those permits are for research on one captive individual Cook Inlet beluga whale that was not releasable to the wild after rehabilitation efforts. This means there are six scientific research permits that authorize take of free-ranging Cook Inlet beluga whales. Migura and Bollini (2022), assert that an increase in the authorized number of takes of Cook Inlet belugas when 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. 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. 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. NMFS will continue to closely analyze the number of takes requested and used by researchers each year.

Currently, the permits authorizing research on beluga whales in Cook Inlet, as well as permits authorizing research on other marine mammal species in Alaskan waters may have cumulative effects on these species and stocks but are likely not significant. Mitigation measures in these research permits require applicants to report to NMFS when take numbers are reached or if the effect of their research is found to be more severe than originally anticipated. Effects of research must also be minimized such that they do not impede necessary biological functions such as feeding and breeding. NMFS anticipates that scientific research on marine mammals in Cook Inlet will continue, and possibly expand, due to the increasing need to better understand distribution and abundance relative to temporal (seasonal, diel, or tidal) and spatial (geographic or bathymetric) parameters. The NMFS Alaska Regional Office is responsible for regional coordination of research efforts and works to avoid duplication of effort on marine mammals in Hilcorp's project area.

4.3.8. Climate Change

Climate change is a reasonably foreseeable condition that may result in cumulative effects to marine mammals in Cook Inlet (BOEM, 2016). The 2014 Intergovernmental Panel on Climate Change (IPCC) concluded that they are "95 percent certain that humans are the main cause of current global warming" and that increased anthropogenic greenhouse gas emissions, together with other anthropogenic drivers, are "extremely likely" to have been the dominant cause of the observed global warming since the mid-twentieth century (IPCC, 2014). IPCC is in the process of preparing an updated 2022 synthesis report; however, it is not yet available. A recent special report indicates that human activities are estimated to have caused approximately 1.0 degree Celsius (°C) of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (IPCC, 2018). This study involved numerous models to predict changes in temperature, sea level, ice pack dynamics, and other parameters under a variety of future conditions, including different scenarios for how human populations respond to the implications of the study. There has not been an update to this Special Report since 2018.

Evidence of climate change in the past few decades has accumulated from a variety of geophysical, biological, oceanographic, and atmospheric sources. The scientific evidence indicates that average air, land, and sea temperatures are increasing at an accelerating rate. Although climate changes have been documented over large areas of the world, the changes are not uniform, and they affect different areas in different ways and at differing intensities. Arctic regions have experienced some of the greatest changes, with major implications for the marine environment as well as for coastal communities. In its 2016 EIS for Lease Sale #244 (BOEM, 2016), BOEM used the analysis in the Third National Climate Change Assessment to assist in its analysis of future projected climate change trends. Average annual temperatures in Alaska are expected to rise by an additional 2°F to 4°F by 2050. If global emissions continue to increase throughout this century, temperatures can be expected to rise 10°F to 12°F in the northern part of Alaska, 8°F to 10°F in the interior, and 6°F to 8°F in the rest of the state. Even with substantial emissions reductions, Alaska is projected to warm by 6°F to 8°F in the north and 4°F to 6°F in the rest of the state by 2100 (Chapin et al., 2014). Average annual precipitation in the Cook Inlet area is anticipated to increase about three to four percent over the life of the Lease Sale #244 project as a result of climate change (USACE, 2015). Most of the increased precipitation at the Cook Inlet locations is predicted to occur as snowfall in winter months (November through January) and during breakup in May. These increases would be balanced in part by drier weather in early summer (e.g., June precipitation decreases). In southcentral Alaska, adjacent to the Sale Area, permafrost exposure is less than 10% for both roads and communities, but isolated permafrost patches in southcentral Alaska do exist and will degrade as temperatures increase (Pastick et al., 2015; Smith and Levasseur, 2002).

More specifically, BOEM evaluated lifecycle GHG emissions for Lease Sale #244, and estimated that 129,208,568 total metric tons of CO_{2e} may be produced as a result of Lease Sale 244. Of this total, BOEM estimated 98,530,000 metric tons would result from oil resources, and gas resources would contribute 30,678,000 metric tons of CO2e (Psarianos, Personal Communication, 10/24/16). NMFS is not aware of comparable calculations conducted for oil and gas activity permitted farther north in Cook Inlet by the State of Alaska or its state agencies.

Marine mammals are classified as sentinel species because they are good indicators of environmental change. Arctic marine mammals are ideal indicator species for climate change, due to their circumpolar distribution and close association with ice formation. NMFS recognizes that warming of the Arctic, which results in diminishing ice thickness and spatial extent, could be a cause for concern for marine mammals. In Cook Inlet, marine mammal distribution is dependent upon ice formation and prey availability, among other factors. For example, beluga whales often travel just along the ice pack and feed on prey beneath it (Richardson et al., 1990; 1991). Research permits discussed in the section above are a helpful tool to understand the uncertainty surrounding the effect of a changing climate on marine mammal species. NMFS' current marine mammal stock assessment reports identified climate change as a threat to marine mammal stocks occurring in Cook Inlet (Muto et al., 2021). Models predict that the climate changes observed in the past 30 years will continue at the same or increasing rates for at least 20 years.

Cook Inlet beluga whales likely rely on the combined 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 noise, pollution, and risk of ship strike. 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.

As described in Gulland et al. (2022), predictions about the impacts of climate change on marine mammal demography and health are unclear at best. For certain species, indirect effects of climate change may exacerbate existing problems or escalate potential problems. However, in other species where climate change is predicted to be detrimental (e.g. bowhead whales) the population appears to be stable and potentially increasing. More targeted research is necessary to further explore and characterize the effects of climate change on marine mammals.

4.3.9. Conclusion

Based on the summation of activity in the area provided in this section, NMFS determined that the impact of issuing two IHAs for sequential one year periods for Hilcorp's tug towing jack-up rig activity in Cook Inlet would not be expected to result in a cumulative significant impact to the human environment when added to past, present, and future activities. The potential impacts to marine mammals, their habitats, and the human environment from issuing the IHAs, combined with the past, present, and reasonable foreseeable future actions in the area, are expected to be minimal based due to the limited and temporary noise footprint of the action and the implementation of mitigation and monitoring requirements of the IHAs.

Chapter 5 List of Preparers

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Chapter 6 Literature Cited

AFSC, 2019: AFSC/RACE/GAP/Zimmermann: Cook Inlet Bathymetry Features from 2010-06-15 to 2010-08-15. NOAA National Centers for Environmental Information, https://inport.nmfs.noaa.gov/inport/item/22167.
Alaska Department of Natural Resources. 2014. Division of Oil and Gas: 2014 Annual Report, Juneau, AK.

Allen, B.M. and R.P. Angliss. 2013. Alaska Marine Mammal Stock Assessments, 2012. Tech. Memo. NMFS AFSC-245. USDOC, NOAA, NMFS AFSC. 291 pp.

Andvik, C., Jourdain, E., Lyche, J.L., Karoliussen, R. and Borgå, K., 2021. High levels of legacy and emerging contaminants in killer whales (Orcinus orca) from Norway, 2015 to 2017. Environmental Toxicology and Chemistry, 40(7), pp.1848-1858.

ANSI (American National Standards Institute). 2013. Standard for Performance and Calibration of Reference Sound Sources. New York: Acoustical Society of America.

ANSI (American National Standards Institute). 1995. Bioacoustical Terminology (ANSI S3.20-1995).New York: Acoustical Society of America.

Atkinson, S., D. P. DeMaster, and D. G. Calkins. 2008. Anthropogenic causes of the western Steller sea lion Eumetopias jubatus population decline and their threat to recovery. Mammal Rev. 38(1):1-18.

Au, W.W. and Hastings, M.C. 2008. Principles of marine bioacoustics (pp. 121-174). New York: Springer.

Austin, M., A. McCrodan, C. O'Neill, Z. Li, and A. MacGillivray. 2013. Underwater Sound Measurements. (Chapter 3) In: Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort seas, July–November 2012: Draft 90-Day Report.

Awbrey, F.T., J.A Thomas, and R.A. Kastelein. 1988. Low-frequency underwater hearing sensitivity in belugas, Delphinapterus leucas. Journal of the Acoustical Society of America. 84:2273-2275.

Bassett, C., Polagye, B., Holt, M. and Thomson, J., 2012. A vessel noise budget for Admiralty Inlet, Puget Sound, Washington (USA). The Journal of the Acoustical Society of America, 132(6), pp. 3706-3719.

Beckmen, K. B., M. J. Keogh, K. A. Burek-Huntington, G. M. Ylitalo, B. S. Fadely, and K. W Pitcher. 2016. Organochlorine contaminant concentrations in multiple tissues of free-ranging Steller sea lions (Eumetopias jubatus) in Alaska. Science of the Total Environment 542:441-452. DOI: dx.doi.org/10.1016/j.scitotenv.2015.10.119

BOEM 2016. Cook Inlet Planning Area Oil and Gas Lease Sale 244 In the Cook Inlet, Alaska Final Environmental Impact Statement Volume 1. Chapters 1-5. Section 3.3.3: Subsistence Harvest Patterns. https://www.boem.gov/Cook-Inlet-Lease-Sale-244-Final-EIS-Volume-1/

BOEM. 2015. Environmental Assessment for SA Exploration, Inc., 3D Cook Inlet 2015 Geological and Geophysical Seismic Survey, Lower Cook Inlet, Alaska. OCS EIS/EA

BOEM 2015-007. 98 pp. Anchorage, AK: USDOI, BOEM, Alaska Outer Continental Shelf Region. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Environment/Environmental_Analysis/2015_0205_Final_2014_SAE_GG%20Permit%2015-01_EA.pdf.

Boveng, P.L., J.M. London, and J.M. VerHoef. 2012. Distribution and abundance of harbor seals in Cook Inlet, Alaska. Task III: Movements, marine habitat use, diving behavior, and population structure, 2004-2006. Final Report. BOEM Report 2012-065. BOEM, Alaska OCS Region, Anchorage, AK. 58 pp.

Boyd, C., R. C. Hobbs, A. E. Punt, K. E. W. Shelden, C. L. Sims, and P. R. Wade. 2019. Bayesian estimation of group sizes for a coastal cetacean using aerial survey data. Mar. Mammal Sci. 35(4):1322-1346. doi: 10/1111/mms.12592.

Brodie, E.C.; Gulland, F.M. D.; Greig, D.J.; Hunter, M.; Jaakola, J.; Leger, J.S.; Leighfield, T.A.; Van Dolah, F.M. 2006. Domoic acid causes reproductive failure in California sea lions (Zalophus californianus). Mar. Mam. Sci., 22(3), 700-707.

Burns, J.J. and G.A. Seaman. 1986. Investigations of belukha whales in coastal waters of western and northern Alaska. II. Biology and ecology. USDOC, NOAA, OCSEAP Final Rep. 56(1988):221-357.

Calkins, D.G. 1989. Status of belukha whales in Cook Inlet. Pages 109-112 in Gulf of Alaska, Cook Inlet, and North Aleutian Basin information update meeting. L.E. Jarvela and L.K. Thorsteinson (eds.). Anchorage, AK, Feb. 7-8, 1989. USDOC, NOAA, OCSEAP.

Carretta, J., Oleson, E. M., Forney, K. A., Muto, M., Weller, D. W., Lang, A., Baker, J., Hanson, B., Orr, A. J., Barlow, J., Moore, J. and Brownell Jr., R. L. (2021). Final U.S. Pacific Marine Mammals Stock Assessments: 2020. National Marine Fisheries Service. 394 pp.

Carretta, J.V., L. Enriquez, and Charles Villafana. 2014. Marine mammal, sea turtle, and seabird bycatch in California gillnet fisheries in 2012. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-526, 16 p.

Castellote, M., B. Thayre, M. Mahone. J. Mondragon, M. Lammers, R. Small. 2019. Anthropogenic Noise and the Endangered Cook Inlet Beluga Whale, Delphinapterus leucas: Acoustic Considerations for Management. Marine Fisheries Review 80(3):63.

Castellote, M., B. Thayre, M. Mahoney, J. Mondragon, C. Schmale, and R. J. Small. 2016. Anthropogenic noise in Cook Inlet beluga habitat: sources, acoustic characteristics, and frequency of occurrence. Alaska Department of Fish and Game, Final Wildlife Research Report, ADF&G/DWC/WRR-2016-4, Juneau. https://alaskafisheries.

Castellote, M., T. A. Mooney, L. Quakenbush, R. Hobbs, C. Goertz, and E. Gaglione. 2014. Baseline hearing abilities and variability in wild beluga whales (Delphinapterus leucas). J. Exp. Biol. 217:1,682–1,691.

Clark, C.W., Ellison, W.T., Southall, B.L., Hatch, L., Van Parijs, S.M., Frankel, A. and Ponirakis, D., 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series, 395, pp.201-222.

Consiglieri, L.D., H.W. Braham, M.E. Dalheim, C. Fiscus, P.D. McGuire, C.E. Peterson, and D.A.

Pippenger. 1982. Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska. OCS Study, MMS 89-0026. Outer Continental Shelf Environmental Assessment Program Final Reports of the Principal Investigators, Vol. 61 (June 1989). Anchorage, AK: USDOC, NOAA and USDOI, MMS, pp. 191-343.

Committee on Taxonomy. 2021. List of marine mammal species and subspecies. Society for Marine Mammalogy. https://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/, updated June 2021.

Dahlheim ME, White PA, Waite JM. Cetaceans of Southeast Alaska: distribution and seasonal occurrence. Journal of Biogeography. 2009 Mar;36(3):410-26.

Dahlheim, M., A. Schulman-Janiger, N. Black, R. Tenullo, D. Ellifrit, K.C. Balcomb, III. 2008. Eastern Temperate North Pacific Offshore Killer Whales (Orcinus orca): Occurrence, Movements, and Insights into Feeding Ecology. Mar. Mamm. Sci. 24(3):719-729.

Dahlheim, M., A. York, R. Towell, J. Waite, and J. Breiwick. 2000. Harbor porpoise (Phocoena phocoena) abundance in Alaska: Bristol Bay to southeast Alaska, 1991–1993. Mar. Mamm. Sci. 16:28–45.

Delarue, J., B. Martin, D. Hannay, and C. Berchok. 2013. Acoustic occurrence and affiliation of fin whales detected in the northeastern Chukchi Sea, July to October 2007–2010. Arctic 66(2):159-172.

Duarte, C.M., Chapuis, L., Collin, S.P., Costa, D.P., Devassy, R.P., Eguiluz, V.M., Erbe, C., Gordon, T.A., Halpern, B.S., Harding, H.R. and Havlik, M.N., 2021. The soundscape of the Anthropocene ocean. Science, 371(6529), p.eaba4658.

Durham 2021, pers. comm.

Eley, W.D., 2012. Cook Inlet vessel traffic study. Report to Cook Inlet Risk Assessment Advisory Panel. Cape International, Juneau, AK.

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

Erbe, C. 2008. Critical ratios of beluga whales (Delphinapterus leucas) and masked signal duration. J. Acoust. Soc. Am. 124(4):2,216–2,223.

Ezer, T., J.R. Ashford, C.M. Jones, B.A. Mahoney, and R.C. Hobbs. 2013. Physical-biological interactions in a subarctic estuary: How do environmental and physical factors impact the movement and survival of beluga whales in Cook Inlet, Alaska? J. Mar. Sys., Vol. 111-112, 120-129, doi: 10.1016/j.jmarsys.2012.10.007.

Fairweather Science, LLC. 2020. 2019 Hilcorp Alaska Lower Cook Inlet Seismic Survey Marine Mammal Monitoring and Mitigation Report. Prepared for Hilcorp Alaska, LLC, 3800 Centerpoint Drive, Suite 1400, Anchorage, Alaska 99503 Submitted to National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, and United States Fish and Wildlife Service, 1011 East Tudor Road, #200, Anchorage, Alaska 99503. Prepared by Fairweather Science, 301 Calista Court, Anchorage, AK 99518. January 2020.

Ferguson, M.C., C. Curtis, and J. Harrison. 2015. Biologically important areas for cetaceans within U.S. waters – Gulf of Alaska region. Aquatic Mammals 41(1):65-78.

Finneran, J.J. 2015. Noise-induced hearing loss in marine mammals: a review of temporary threshold shift studies from 1996 to 2015. Journal of the Acoustical Society of America 138: 1702-1726.

Finneran, J.J., D.A. Carder, R. Dear, T. Belting, J. McBain, L. Dalton, and S.H. Ridgway. 2005. Pure tone audiograms and possible aminoglycoside-induced hearing loss in belugas (Delphinapterus leucas). Journal of the Acoustical Society of America 117:3936–3943.

Finneran, J. J., Schlundt, C. E., Carder, D. A., Clark, J. A., Young, J. A., Gaspin, J. B., and Ridgway, S. H. 2000. Auditory and behavioral responses of bottlenose dolphins (Tursiops truncatus) and a beluga whale (Delphinapterus leucas) to impulsive sounds resembling distant signatures of underwater explosions. Journal of the Acoustical Society of America 108:417 431.

Goetz, K.T., P.W. Robinson, R.C. Hobbs, K.L. Laidre, L.A. Huckstadt, and K.E.W. Shelden. 2012a. Movement and dive behavior of beluga whales in Cook I

Gulland, F.M., Baker, J., Howe, M., LaBrecque, E., Leach, L., Moore, S.E., Reeves, R.R. and Thomas, P.O., 2022. A Review of Climate Change Effects on Marine Mammals in United States Waters: Past Predictions, Observed Impacts, Current Research and Conservation Imperatives. Climate Change Ecology, p.100054.

Hatch LT, Clark CW, Van Parijs SM, Frankel AS, Ponirakis DW. Quantifying loss of acoustic communication space for right whales in and around a US National Marine Sanctuary. Conservation Biology. 2012 Dec;26(6):983-94.

Heide-Jørgensen, M.P. and J. Teilmann. 1994. Growth, reproduction, age structure and feeding habits of white whales (Delphinapterus leucas) in West Greenland waters. Meddeleleser om Grønland, Bioscience 39:195–212.

Hemilä S, Nummela S, Berta A, Reuter T. High-frequency hearing in phocid and otariid pinnipeds: an interpretation based on inertial and cochlear constraints. The Journal of the Acoustical Society of America. 2006 Dec;120(6):3463-6.

Henry, Lea-Anne, Dan Harries, Paul Kingston, and J. Murray Roberts. 2017. Historic Scale and Persistence of Drill Cuttings Impacts on North Sea Benthos. Marine Environmental Research 129: 219-228. http://dx.doi.org/10.1016/j.marenvres.2017.05.008.

Hobbs, R. C., P. R. Wade, and K. E. W. Shelden. 2015. Viability of a small, geographically-isolated population of beluga whales, Delphinapterus leucas: effects of hunting, predation, and mortality events in Cook Inlet, Alaska. Mar. Fish. Rev. 77(2):59-88. DOI: dx.doi.org/10.7755/MFR.77.2.4

Hobbs, R.C., K.L. Laidre, D.J. Vos, B.A. Mahoney, and M. Eagleton. 2005. Movements and area use of belugas, Delphinapterus leucas, in a subarctic Alaskan estuary. Arctic 58(4):331-340.

Hobbs, R. C., K. E. W. Shelden, D. J. Rugh, and S. A. Norman. 2008. 2008 status review and extinction risk assessment of Cook Inlet belugas. AFSC Processed Report 2008-02, 116 p. Alaska Fisheries Science Center, NOAA, National Marine Fisheries Service. 7600 Sand Point Way NE, Seattle, WA 98115.

Holt MM, Noren DP, Veirs V, Emmons CK, Veirs S. Speaking up: Killer whales (Orcinus orca) increase their call amplitude in response to vessel noise. The Journal of the Acoustical Society of America. 2009 Jan 22;125(1):EL27-32.

Johnson, C.S., M.W. McManus, and D. Skaar. 1989. Masked tonal hearing thresholds in the beluga whale. Journal of the Acoustical Society of America. 85:2651-2654.

Jones, B., D. Holen, and D. S. Koster. 2015. The Harvest and Use of Wild Resources in Tyonek, Alaska, 2013. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 404. Anchorage.

Jones ML, Swartz SL. 2009. Gray whale Eschrichtius robustus. In: Perrin WF, Würsig B, Thewissen HGM, editors. Encyclopedia of Marine Mammals 2nd ed., Academic Press, San Diego, CA. 1316 pp.

Jones, M.L. and S.L. Swartz. 1984. Demography and Phenology of Gray Whales and Evaluation of Whale-Watching Activities in Laguna San Ignacio, Baja California Sur, Mexico. In: The Gray Whale, S.L. Swartz, M.L. Jones, and S. Leatherwood, eds. New York: Academic Press, pp. 309- 372.

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

Kastelein, R.A., Wensveen, P., Hoek, L. and Terhune, J.M., 2009. Underwater hearing sensitivity of harbor seals (Phoca vitulina) for narrow noise bands between 0.2 and 80 kHz. The Journal of the Acoustical Society of America, 126(1), pp.476-483.

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

Kendall, L.S. and L.A. Cornick. 2015. Behavior and distribution of Cook Inlet beluga whales, Delphinapterus leucas, before and driving pile driving activity. Marine Fisheries Review 77:106-114.

Keogh, M. J., B. Taras, K. B. Beckmen, K. A. Burek-Huntington, G. M. Ylitalo, B. S. Fadely, L. D. Rea, and K. W. Pitcher. 2020. Organochlorine contaminant concentrations in blubber of young Steller sea lion (Eumetopias jubatus) are influenced by region, age, sex, and lipid stores. Science of the Total Environment 698:134183. DOI: dx.doi.org/10.1016/j.scitotenv.2019.134183

Klishin, V. O., V. V. Popov, A. Y. Supin. 2000. Hearing capabilities of a beluga whale, Delphinapterus leucas. Aquat. Mamm. 26:212–228.

Lefebvre, K. A., L. Quakenbush, E. Frame, K. Burek Huntington, G. Sheffield, R. Stimmelmayr, A. Bryan, P. Kendrick, H. Ziel, T. Goldstein, J. A. Snyder, T. Gelatt, F. Gulland, B. Dickerson, and V. Gil. 2016. Prevalence of algal toxins in Alaskan marine mammals foraging in a changing arctic and subarctic environment. Harmful Algae 55:13-24. DOI: dx.doi.org/10.1016/j.hal.2016.01.007.

Linnenschmidt, M., J. Teilmann, T. Akamatsu, R. Dietz, and L. A. Miller. 2013. Biosonar, dive, and foraging activity of satellite tracked harbor porpoises (Phocoena phocoena). Mar. Mammal Sci. 29(2):77-97.

Lomac-MacNair, K., M.A. Smultea and G. Campbell. 2014. Draft NMFS 90-Day Report for Marine Mammal Monitoring and Mitigation during Apache's Cook Inlet 2014 Seismic Survey, 2 April – 27 June 2014. Prepared for Apache Alaska Corporation, 510 L Street #310, Anchorage AK 99501. Prepared by Smultea Environmental Sciences (SES), P.O. Box 256, Preston, WA 98050.

Lomac-MacNair, K.S., L.S. Kendall, and S. Wisdom. 2013. Marine Mammal Monitoring and Manoukian, S., A. Spagnolo, G. Scarcella, E. Punzo, R. Angelini, and G. Fabi. 2010. Effects of Two Offshore Gas Platforms on Soft-Bottom Benthic Communities (Northwestern Adriatic Sea, Italy). Marine Environmental Research 70(5): 402-410. http://dx.doi.org/10.1016/j.marenvres.2010.08.004

Mitigation, 90-Day Report, May 6- September 30, 2012, Alaska Apache Corporation 3D Seismic Program, Cook Inlet, Alaska. Prepared by SAExploration 8240 Sandlewood Pl. Suite 102 Anchorage, AK and Fairweather Science 9525 King Street, Anchorage, AK. Prepared for Apache Alaska Corporation and National Marine Fisheries Service. 87 p.

Loughlin, T. R. 1997. Using the phylogeographic method to identify Steller sea lion stocks, p. 329-341. In A. Dizon, S. J. Chivers, and W. Perrin (eds.), Molecular genetics of marine mammals, incorporating the proceedings of a workshop on the analysis of genetic data to address problems of stock identity as related to management of marine mammals. Soc. Mar. Mammal., Spec. Rep. No. 3.

Maniscalco, J.M., K. Wynne, K.W. Pitcher, M.B. Hanson, S.R. Melin, and S. Atkinson. 2004. The occurrence of California sea lions in Alaska. Aquatic Mammals 30(3):427-433.

Marine Acoustics Inc. 2011. Underwater acoustic measurement of the Spartan 151 jack-up drilling rig in the Cook Inlet beluga critical habitat. Prepared for Furie Operating Alaska, LLC by Marine Acoustics, Inc.:40.

McGuire, T., J. McClung and A. Stephens. 2021. Photo-identification of Beluga Whales in Cook Inlet, Alaska. Summary of Field Activities and Whales Identified in 2019. Report prepared by the Cook Inlet Beluga Whale Photo-ID Project for National Marine Fisheries Service, Alaska Region. 130 pp.

McGuire, T., and A. Stephens. 2017. Photo-identification of Beluga Whales in Cook Inlet, Alaska: summary and synthesis of 2005-2015 data. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for National Marine Fisheries Service, Alaska Region. 189 p. https://docs.wixstatic.com/ugd/af2fcb_4a6dbde631be4de685f764a73cf16908.pdf.

Marine Mammal Laboratory (MML). 2003. Cetacean Assessment and Ecology Program: Cetacean Survey. http://www.afsc.noaa.gov/Quarterly/jas2003/divrptsNMML2.htm

Montgomery, R., J. Ver Hoef, and P. Boveng. 2007. Spatial Modeling of Haul-Out Site use by Harbor Seals in Cook Inlet, Alaska. Marine Ecology Progress Series. 341: 257-264. http://www.int-res.com/articles/meps2007/341/m341p257.pdf

Moore, S.E., K.M. Wynne, J.C. Kinney, J.M. Grebmeier. 2007. Gray Whale Occurrence and Forage Southeast of Kodiak, Island, Alaska. Mar. Mammal Sci. 23 (2):419–428.

Moore, S.E., K.E.W. Shelden, L.L. Litzky, B.A. Mahoney, and D.J. Rugh. 2000. Beluga, Delphinapterus leucas, habitat associations in Cook Inlet, Alaska. Marine Fisheries Review 62:60-80.

Musgrave, D, and H. Statscewich. 2006. CODAR in Alaska. Final Report. OCS Study MMS 2006-032, University of Alaska Coastal Marine Institute, University of Alaska Fairbanks and USDOI, MMS, Alaska OCS Region, 23 p.

Muto, M.M., V.T. Helker, B.J. Delean, N.C. Young, J.C. Freed R.P. Angliss, P.L. Boveng, J.M. Breiwick, B.M. Brost, M.F. Cameron, P.J. Clapham, J.L. Crance, S.P. Dahle, M.E. Dahlheim, B.S. Fadely, M.C. Ferguson, L.W. Fritz, K.T. Goetz, R.C. Hobbs, Y.V. Ivashchenko, A.S. Kennedy, J.M. London, S.A. Mizroch, R.R. Ream, E.L. Richmond, K.E.W. Shelden, K.L. Sweeney, R.G. Towell, P.R. Wade, J.M. Waite, and Alexandre N. Zerbini. 2021. Alaska Marine Mammal Stock Assessments 2020. U.S. Department of Commerce, NOAA Tech. Memo. NMFS– AFSC–421. 398 p.

Muto, M. M.;Helker, V. T.;Delean, B. J.;Angliss, R. P.;Boveng, P. L.;Breiwick, J. M.;Brost, B. M.;Cameron, M. F.;Clapham, P. J.;Dahle, S. P.;Dahlheim, M. E.;Fadely, B. S.;Ferguson, M. C.;Fritz, L. W.;Hobbs, R. C.;Ivashchenko, Y. V.;A. S. Kennedy,;London, J. M.;Mizroch, S. A.;Ream, R. R.;Richmond, E. L.;Shelden, K. E. W.;Sweeney, K. L.;Towell, R. G.;Wade, P. R.;Waite, J. M.;Zerbini, A. N. 2020. Alaska Marine Mammal Stock Assessments, 2019. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-AFSC ; 404 p.

Muto, M. M., V. T. Helker, R. P. Angliss, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M.E. D Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, K. L. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2019. Alaska marine mammal stock assessments, 2018. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-393, 390 p.

Muto, M. M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J.M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M.E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y.V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2018. Alaska marine mammal stock assessments, 2017. U.S. Dep. Commer., NOAA Tech.Memo. NMFS-AFSC-378, 382 p

Muto, M.M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2017. Alaska marine mammal stock assessments, 2016. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-355, 366 p. doi:10.7289/V5/TM-AFSC-355.

Muto, M. M.;Helker, V. T.;Angliss, Robyn P.;Allen, Brian A.;Boveng, Peter Laurens;Breiwick, Jeffrey Mark, 1945-;Cameron, Michael Foley;Clapham, Phil;Dahle, Shawn Patrick;Dahlheim, Marilyn E.;Fadely, Brian S.;Ferguson, Megan Caton;Fritz, Lowell W.;Hobbs, Roderick C.;Ivashchenko, Y. V.;Kennedy, Amy S.;London, Josh M.;Mizroch, Sally A.;Ream, R. R. (Rolf R.);Richmond, E. L. (Erin Leslie);Shelden, Kim E. W.;Towell, Rodney G.;Wade, Paul R., 1958-;Waite, Janice M.;Zerbini, Alexandre N. Alaska marine mammal stock assessments, 2016. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC ; 355 p.

Nemeth, M.J., C.C. Kaplan, A.P. Ramos, G.D. Wade, D.M. Savarese, and C.D. Lyons. 2007.

Baseline Studies of Marine Fish and Mammals in Upper Cook Inlet, April through October 2006. Final report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK for DRven Corporation, Anchorage, AK.

NMFS. 2018. 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

NMFS. 2016b. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFSOPR-55, 178 p.

NMFS. 2010a. Recovery plan for the fin whale (Balaenoptera physalus). National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2008a. Recovery Plan for the Steller sea lion (Eumetopias jubatus). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 p.

NMFS. 2008b. Recovery Plan for the Steller sea lion (Eumetopias jubatus). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 p. https://alaskafisheries.noaa.gov/sites/default/files/sslrpfinalrev030408.pdf

NMFS. 2003. Subsistence Harvest Management of Cook Inlet Beluga Whales Final Environmental Impact Statement. July

NOAA. 2022b. Killer Whale. Species Directory. Accessed online at Killer Whale | NOAA Fisheries. On 2/17/2022.

NOAA. 2022c. Dall’s Porpoise. Species Directory. Accessed online at Dall’s Porpoise | NOAA Fisheries. On 2/17/2022.NOAA 2019

NRC (National Research Council). 2003. Ocean Noise and Marine Mammals. Washington, D.C.:National Academies Press.

O'Corry-Crowe, G.M., R.S. Suydam, A. Rosenberg, K.J. Frost, and A.E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale Delphinapterus leucas in the western Nearctic revealed by mitochondrial DNA. Molecular Ecology 6:955-970.

Owl Ridge NRC. 2014. Cosmopolitan State 2013 Drilling Program Marine Mammal Monitoring and Mitigation 90-day Report. Prepared for BlueCrest Alaska Operating LLC. 74 pp.

Perrin WF, Brownell RL Jr. 2009. Minke whales Balaenoptera acutorostrata and B. bonaerensis. In: Perrin WF, Würsig B, Thewissen HGM, editors. Encyclopedia of Marine Mammals. 2nd ed. Academic Press, San Diego, CA. 1316 pp.

Peterson, S.H., Ackerman, J.T., Crocker, D.E. and Costa, D.P., 2018. Foraging and fasting can influence contaminant concentrations in animals: an example with mercury contamination in a free-ranging marine mammal. Proceedings of the Royal Society B: Biological Sciences, 285(1872), p.20172782.

Poirier, M. C., Lair, S., Michaud, R., Hernández-Ramon, E. E., Divi, K. V., Dwyer, J. E., Ester, C. D., Si, N. N., Ali, M., Loseto, L. L., Raverty, S. A., St. Leger, J. A., Van Bonn, W. G., Colegrove, K., Burek-Huntington, K. A., Suydam, R., Stimmelmayr, R., Wise, J. P., Wise, S. S., ... Martineau, D. (2019). Intestinal polycyclic aromatic hydrocarbon-DNA adducts in a population of beluga whales with high levels of gastrointestinal cancers. Environmental and Molecular Mutagenesis, 60(1), 29-41. https://doi.org/10.1002/em.22251

Ramsdell, J.S. and Zabka T.S. 2008. In Utero Domoic Acid Toxicity: A Fetal Basis to Adult Disease in the California Sea Lion (Zalophus californianus). Marine Drugs. 2008; 6(2):262-290

Rea, L. D., J. M. Castellini, L. Correa, B. S. Fadely, and T. M. O'Hara. 2013. Maternal Steller sea lion diets elevate fetal mercury concentrations in an area of population decline. Science of the Total Environment 454- 455:277-282. DOI: dx.doi.org/10.1016/j.scitotenv.2013.02.095.

Reeves, R.R., S. Leatherwood, S.A. Karl, and E.R. Yohe. 1985. Whaling results at Akutan (1912-39) and Port Hobron (1926-37), Alaska. Rep. Int. Whal. Commn. 35:441-457.

Reichmuth C, Holt MM, Mulsow J, Sills JM, Southall BL. Comparative assessment of amphibious hearing in pinnipeds. Journal of Comparative Physiology A. 2013 Jun;199(6):491-507.

Rice, D.W. and A.A. Wolman. 1971. The Life History and Ecology of the Gray Whale (Eschrichtius robustus). Special Publication 3. Seattle, WA: Amer. Soc. Mammal. 142 pp.

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

Ridgway, S.H., D.A. Carder, T. Kamolnick, R.R. Smith, R.R., C.E. Schlundt, and W.R. Elsberry. 2001. Hearing and whistling in the deep sea: depth influences whistle spectra but does not attenuate hearing by white whales (Delphinapterus leucas) (Odontoceti, Cetacea). J. Exp. Biol. 204:3829-3841.

Roberts Bank Terminal 2 Technical Report. 2014. Underwater Noise Ship Sound Signature Analysis Study. Prepared for Port Metro Vancouver. Prepared by Hemmera Envirochem Inc., SMRU Canada Ltd. and JASCO Applied Sciences (Canada) Ltd.

Rugh, D.J. K.E.W. Shelden, R.C. Hobbs. 2010. Range contraction in a beluga whale population. Endangered Species Research 12: 69-75.

Rugh, D.J., K.T. Goetz, J.A. Mocklin, B.A. Mahoney, and B.K. Smith. 2007. Aerial surveys of belugas in Cook Inlet, Alaska, June 2007. Unpublished Document. NMFS report. 16 pp.

Rugh, D.J., K.T. Goetz, C.L. Sims, and B.K. Smith. 2006. Aerial surveys of belugas in Cook Inlet, Alaska, August 2006. Unpubl. NMFS report. 9 pp.

Rugh, D.J., K.E. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, L. Litzky, and R.C. Hobbs. 2005. Aerial Surveys of Belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. NOAA Tech. Memo. NMFS-AFSC-149. Anchorage, AK: USDOC, NOAA, NMFS, Natl. Mar. Mamm. Lab., AK Fish. Sci. Ctr.

Rugh, D.J., B.A. Mahoney, and B. K. Smith. 2004a. Aerial surveys of beluga whales in Cook Inlet, Alaska, between June 2001 and June 2002. U.S. Dep. Commer. NOAA Tech. Memo. NMFSAFSC-

145.

Rugh, D.J., B.A. Mahoney, C.L. Sims, B.A. Mahoney, B.K. Smith, and R.C. Hobbs. 2004b. Aerial Surveys of Belugas in Cook Inlet, Alaska, June 2004. <http://www.fakr.noaa.gov/protected resources/whales/beluga/survey/2004.pdf

Rugh, D.J., K.E.W. Shelden, and B. A. Mahoney. 2000. Distribution of belugas, Delphinapterus leucas, in Cook Inlet, Alaska, during June/July, 1993-2000. Marine Fisheries Review 62: 6-21.

Schenk, C. J. 2015. Assessment of unconventional (tight) gas resources in Upper Cook Inlet Basin, South-central Alaska. U.S. Dept. of Interior, U.S. Geological Survey, Reston, VA. U.S. Geological Survey Digital Data Series DDS–69–AA.

Schlundt, C.E., J.J. Finneran, D.A. Carder, and S.H. Ridgway. 2000. Temporary shift in masking hearing thresholds of bottlenose dolphins, Tursiops truncatus, and white whales, Delphinapterus leucas, after exposure to intense tones. Journal of the Acoustical Society of America 107(6):3496-3508.

Scholin CA, Gulland F, Boucette GJ, Benson S, Busman M, Chavez FP, Cordaro J, DeLong R, De Vogelaere A, Harvey J, Haulena M, Lefebvre K, Lipscomb T, Loscutoff S, Lowenstine LJ, Marin R III, Miller PE, McLellan WA, Moeller PDR, Powell CL, Rowles T, Silvagni P, Lilver M, Spraker T, Trainer V, Van Dolah FM. 2000. Mortality of sea lions along the central California coast linked to a toxic diatom bloom. Nature 304:80–84.

Shelden, K. E. W., and P. R. Wade (editors). 2019. Aerial surveys, distribution, abundance, and trend of belugas (Delphinapterus leucas) in Cook Inlet, Alaska, June 2018. AFSC Processed Rep. 2019-09, 93 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Shelden, K. E. W., C. Boyd, C. L. Sims, V. A. Gill, and B. A. Mahoney. 2019. Chapter 1: Field report for the June 2018 Cook Inlet beluga aerial abundance and distribution survey. In K. E. W. Shelden and P. R. Wade (eds.), Aerial surveys, distribution, abundance, and trend of belugas (Delphinapterus leucas) in Cook Inlet, Alaska, June 2018. AFSC Processed Rep. 2019-09, 93 p. Alaska Fisheries Science Center, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

Shelden, K.E.W., R.C. Hobbs, C.L. Sims, L. Vate Brattström, J.A. Mocklin, C. Boyd, and B.A. Mahoney, 2017. Aerial surveys, abundance, and distribution of beluga whales (Delphinapterus leucas) in Cook Inlet, Alaska, June 2016.

Shelden, K.E.W., and B.A. Mahoney. 2016. Aerial surveys of beluga whales in Cook Inlet, Alaska, June 1991. AFSC Processed Rep. 2016-02, 22 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Shelden, K.E.W., C.L. Sims, L. Vate Brattström, K.T. Goetz, and R.C. Hobbs. 2015. Aerial surveys of beluga whales (Delphinapterus leucas) in Cook Inlet, Alaska, June 2014.

Shelden, K.E., B.A. Aglerr, J.J. Brueggeman, L.A. Cornick, S.G. Speckman, and A. Prevel-Ramos. 2014. Harbor porpoise, Phocoena phocoena vomerine, in Cook Inlet, Alaska. Marine Fisheries Review 76: 22-50.

Shelden, K. E. W., D. J. Rugh, K. T. Goetz, C. L. Sims, L. Vate Brattström, J. A. Mocklin, B. A. Mahoney, B. K. Smith, and R. C. Hobbs. 2013. Aerial surveys of beluga whales, Delphinapterus leucas, in Cook Inlet, Alaska, June 2005 to 2012. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-263, 122 p.

Shelden, K.E., D.J. Rugh, B. Mahoney, and M.E. Dahlheim. 2003. Killer Whale Predation on Belugas in Cook Inlet, Alaska: Implications for a Depleted Population. Mar. Mamm. Sci. 19(3):529-544.

Sinclair, E. H., and T. K. Zeppelin. 2002. Seasonal and spatial differences in diet in the Western Stock of Steller sea lions (Eumetopias jubatus). J. Mamm. 83(4):973-990.

Sitkiewicz, S., Hetrick. W., Leonard, K., and Wisdom, S. 2018. 2018 Harvest Alaska Cook Inlet Pipeline Project Monitoring Program Marine Mammal Monitoring and Mitigation Report. Prepared for Harvest Alaska, LLC, 3800 Centerpoint Drive, Suite 1400, Anchorage, Alaska 99503 Submitted to National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910. Prepared by Fairweather Science, 301 Calista Court, Anchorage, AK 99518. November 26, 2018.

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

Stafford, K. M., S. E. Moore, P. J. Stabeno, D. V. Holliday, J. M. Napp, and D. K. Mellinger. 2010. Biophysical Ocean observation in the southeastern Bering Sea. Geophys. Res. Lett. 37:L02606. DOI: 10.1029/2009GL040724.

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

Suydam, R.S. 2009. Age, growth, reproduction, and movements of beluga whales (Delphinapterus leucas) from the eastern Chukchi Sea. Ph.D. dissertation, University of Washington. 170 p.

Thorson, P., and J. A. Reyff. 2006. San Francisco-Oakland Bay Bridge East Span Seismic Safety Project: marine mammal and acoustic monitoring for the marine foundations at piers E2 and T1, JanuarySeptember 2006. Prepared by SRS Technologies and Illingworth & Rodkin, Inc. for the California Department of Transportation, 51 pp.

Tyack PL. Implications for marine mammals of large-scale changes in the marine acoustic environment. Journal of Mammalogy. 2008 Jun 5;89(3):549-58.

VanWormer, E., J. A. K. Mazet, A. Hall, V. A. Gill, P. L. Boveng, J. M. London, T. Gelatt, B. S. Fadely, M. E. Lander, J. Sterling, V. N. Burkanov, R. R. Ream, P. M. Brock, L. D. Rea, B. R. Smith, A. Jeffers, M. Henstock, M. J. Rehberg, K. A. Burek-Huntington, S. L. Cosby, J. A. Hammond, and T. Goldstein. 2019. Viral emergence in marine mammals in the North Pacific may be linked to Arctic sea ice reduction. Scientific Reports 9, 15569. DOI: dx.doi.org/10.1038/s41598-019-51699-4.

Wade PR, Oleson EM, Young NC. 2021. Evaluation of Hawai ‘i distinct population segment of humpback whales as units under the Marine Mammal Protection Act.

Wade, P. R., C. Boyd, K. E. W. Shelden, and C. L. Sims. 2019. Chapter 2: Group size estimates and revised abundance estimates and trend for the Cook Inlet beluga population. In K. E. W. Shelden and P. R. Wade (eds.), Aerial surveys, distribution, abundance, and trend of belugas (Delphinapterus leucas) in Cook Inlet, Alaska, June 2018. AFSC Processed Rep. 2019-09, 93 p. Alaska Fisheries Science Center, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

Wartzok, D., A.N. Popper, J. Gordon, and J. Merrill. 2004. Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal 37:4-13.

Wartzok, D. and D.R. Ketten. 1999. Marine mammal sensory systems. Pages 117-148 in J.E. Reynolds III and S.A. Rommel (eds), Biology of Marine Mammals. Washington D.C.: Smithsonian Institution Press.

Watkins, W. A., M. A. Daher, G. M. Reppucci, J. E. George, D. L. Martin, N. A. DiMarzio, and D. P. Gannon. 2000. Seasonality and distribution of whale calls in the North Pacific. Oceanography 13(1):62-67.

White, M.J., J. Norris, D.K. Ljungblad, K. Baron, and G.N. di Sciara. 1978. Auditory thresholds of two beluga whales (Delphinapterus leucas). San Diego: Hubbs Sea World Research Institute.

Wiggin, M. 2017. Alaska's Oil and Gas Industry: Overview and Activity Update, Commonwealth North. Alaska Department of Natural Resources.

Witteveen, B.H., K.M. Wynne, and T.J. Quinn II. 2007. A Feeding Aggregation of Humpback Whales (Megaptera novaeangliae) near Kodiak Island, Alaska: Current and Historic Abundance Estimation. Alaska Fisheries Research Bulletin, 12(2):187-196.

Yost, W.A. 2007. Fundamentals of Hearing: An Introduction. New York: Academic Press.

Zerbini, A.N., J.M. Waite, J.L. Laake, and P.R. Wade. 2006. Abundance, Trends and Distribution of Baleen Whales off Western Alaska and the Central Aleutian Islands. Deep Sea Res. Part I: Ocean. Res. Papers. 53(11):1772-1790.