2019 LOWER COOK INLET

3D SEISMIC SURVEY

ENVIRONMENTAL EVALUATION DOCUMENT

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Submitted:

September 2018

Amended October 18, 2018

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ACRONYMS

°C	Degrees Celsius
3D	three-dimensional
4MP	Marine Mammal Monitoring and Mitigation Plan
AAAQS	Alaska Ambient Air Quality Standards
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AQCP	air quality control plan
AQCR	Air Quality Control Region
BIA	Biologically Important Areas
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CetMap	Cetacean Density and Distribution Mapping Working Group
CFR	Code of Federal Regulations
cm	centimeter
CO	carbon monoxide
COA	corresponding onshore area
CWA	Clean Water Act
dB	Decibel
dB re 1 µPA rms	Decibels relative to 1 microPascal root mean square
DPS	distinct population segment
EED	Environmental Evaluation Document
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENP	Eastern North Pacific
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EZ	Exclusion Zone
ft	feet
FR	Federal Register
G&G	geological and geophysical
Hilcorp	Hilcorp Alaska, LLC
hr	hour
Hz	Hertz
IBA	Important Bird Area

ACRONYMS (CONTINUED)

in^3	cubic inch
ITR	Incidental Take Regulations
kHz	kiloHertz
km	kilometer
km^2	square kilometer
LOA	Letter of Authorization
m	meter
m/s	meter per second
mi^2	square miles
mm/day	millimeter per day
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
mph	miles per hour
ms	millisecond
N/A	not available
NAAQS	National Ambient Air Quality Standards
NCDC	National Climate Data Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NTLs	Notices to Lessees and Operators
O_3	ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
$PM_{2.5}$ and PM_{10}	particulate matter
PSD	Prevention of Significant Deterioration
psi	per square inch
PSO	protected species observers
PTS	permanent threshold shift
SAE	SAExploration, Inc.
SHARC	Subsistence Halibut Registration Certificate

ACRONYMS (CONTINUED)

SIP	State Implementation Plan
SO_2	sulfur dioxide
SSB	state seaward boundary
SSV	sound source verification
SZ	Safety Zone
TS	threshold shift
TTS	temporary threshold shifts
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WDPS	Western DPS

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1. INTRODUCTION

Hilcorp Alaska, LLC (Hilcorp) plans to conduct a 3D seismic survey in the lower Cook Inlet, Alaska, during the 2019 open-water season. The survey will be conducted in Federal Outer Continental Shelf (OCS) waters of the Bureau of Ocean Energy Management (BOEM) Cook Inlet Planning Area.

Hilcorp acquired 14 lease blocks in the BOEM OCS Lease Sale 244 held on June 21, 2017. An airborne gravity and magnetic survey was conducted over all 14 lease blocks in the summer of 2018. Hilcorp proposes to conduct a three-dimensional (3D) seismic survey over 8 of the lease blocks to determine the location of possible oil and gas prospects during the 2019 open-water season.

1.1 PURPOSE AND ORGANIZATION OF THE ENVIRONMENTAL EVALUATION DOCUMENT

This Environmental Evaluation Document (EED) was developed to provide information specific to resources that may be impacted as a result of the proposed seismic survey; to describe the potential adverse environmental effects of the proposed activity; to identify mitigation measures proposed to eliminate these effects on the marine, coastal, and human environment as required by Title 30 of the Code of Federal Regulations (CFR) 550.208(a)(4); and to assist BOEM in their review and approval process as required by the National Environmental Policy Act (NEPA).

The following elements are included in this EED:

- Project description, including vessel information, description of operations, location and timing of operations
- Baseline information about the physical, biological, and socioeconomic environment in the project area
- Potential effects from the proposed survey project
- Cumulative effects for resources where the proposed project is anticipated to have an effect
- Mitigation measures proposed by the applicant
- References

1.2 REGULATORY FRAMEWORK

Federal, state, and local government regulatory approvals are necessary to operate in Alaska. In general, the two major regulatory drivers for activities in the OCS are the Outer Continental Shelf Lands Act (OCSLA) and NEPA, which are outlined below.

1.2.1 U.S. Regulatory Framework

1.2.1.1 Outer Continental Shelf Lands Act

The OCSLA establishes the framework for the federal OCS oil and gas leasing process. It authorizes the Department of the Interior to grant leases for the exploration, development and production of oil and gas contained within the OCS. Each lease covers an area that is no more than 5,760 acres, and is generally a square measuring three miles by three miles (lease block). Under a lease, a company has the right to apply for permits to explore and develop

the mineral resources within that area. Before approving the permits, BOEM reviews the proposed activities to ensure that the activities will be conducted in a safe and environmentally sound manner and that the interests of key stakeholders are effectively addressed.

1.2.1.2 National Environmental Policy Act

As part of the review, BOEM conducts an analysis in accordance with NEPA, which requires federal agencies to consider impacts to the environment (physical, biological, and socioeconomic) of their proposed action and any reasonable alternatives to the proposed action, and provides a process for implementing these goals. Any project that requires a permit from a federal agency must adhere to NEPA requirements.

This EED is designed to assist BOEM in conducting the required NEPA analysis.

1.2.1.3 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) are important aspects of the proposed project. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters. Marine mammals are under the jurisdiction of the National Marine Fisheries Service (NMFS) for whales and seals, and U.S. Fish and Wildlife Service (USFWS) for walrus, polar bears, and otters.

Within the lower Cook Inlet area, the Cook Inlet beluga whale is the species of highest concern because of its limited numbers. Cook Inlet beluga whale stock may once have numbered as many as 1,300 individuals; however, annual population abundance surveys from 1999 to 2014 estimated abundance ranging between 278 and 435 belugas, with a 2016 estimated abundance of 328 individual beluga whales. Cook Inlet beluga whales have protected status under the MMPA and are listed as endangered under the ESA. The sea otter is the species of secondary concern because they occur in high densities in the project area. The southwest stock of sea otters have protected status under the MMPA and are listed as threatened under the ESA.

1.2.1.4 Endangered Species Act

The ESA provides a program to conserve endangered and threatened species and to conserve the ecosystems upon which endangered and threatened species depend. Section 7 of the ESA requires that federal agencies consult with USFWS or NMFS to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat, unless such agency has been granted an exemption for the action.

Many marine mammals protected under the MMPA are also listed as threatened or endangered under the ESA (e.g., Cook Inlet beluga whales, northern sea otters). In addition, many other bird and animal species are listed under the ESA.

1.3 PERMITS

The primary permits that Hilcorp is required to obtain to perform the proposed 3D seismic survey are listed below.

BOEM Approval – Seismic surveys are considered geological and geophysical (G&G) activities that require BOEM approval. Lessees seeking to conduct G&G activities on unleased lands or on lands under lease to a third party

must submit a BOEM permit application form (Form BOEM-0327) and obtain approval from BOEM prior to conducting the activity (30 CFR 551). The information required includes:

- Provide information about the vessel(s) including the vessel name, operator, and the person(s) in charge; the specific type(s) of operations you will conduct; and the instrumentation/ techniques and vessel navigation system that will be used
- Provide expected start and completion dates and the location of the activity
- Describe the potential adverse environmental effects of the proposed activity and any mitigation to eliminate or minimize these effects on the marine, coastal, and human environment.

MMPA Letters of Authorization – The MMPA allows, upon request, the incidental take of small numbers of marine mammals by US citizens who engage in a specified activity within a specified geographic region. Takes may be authorized by an Incidental Harassment Authorization or a Letter of Authorization (LOA). To be authorized, takes must be:

- be of small numbers;
- 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 or "subsistence" uses.

Separate petitions for Incidental Take Regulations (ITRs) have been submitted to the NMFS and USFWS. Hilcorp will request that NMFS and USFWS issue LOAs under the ITRs for the proposed survey program.

Table 1 Permits Required for 2019 Lower Cook Inlet Seismic Survey

Agency	Permit	Status
BOEM	Permit for Geophysical Exploration	G&G application submitted with EED
NMFS	ITR Petition/LOA	ITR Petition submitted April 2018, revised June 2018
USFWS	ITR Petition/LOA	ITR Petition submitted May 2018, revised June 2018

1.4 LEASE STIPULATIONS

Hilcorp must adhere to relevant BOEM lease stipulations that apply to Hilcorp's OCS leases. The following are the lease stipulations which apply to Hilcorp's planned seismic and geohazard surveys:

- Lease Stipulation 6 (Protection of Beluga Whale Nearshore Feeding Areas) prohibits on-lease marine seismic surveys between July 1 and September 30 to protect beluga whales when they are migrating to and from summer feeding areas. The only blocks that Lease Stipulation 6 applies to, within Hilcorp's survey area, are blocks 6304 and 6354.
- Lease Stipulation 7 (Protection of Beluga Whales) applies to all blocks within the lease sale, including Hilcorp's lease blocks 6357, 6405, 6406, 6407, 6455, 6456, 6457, and 6458. Lease Stipulation 7 prohibits seismic surveys between November 1 and April 1.

Hilcorp has requested a variance to Lease Stipulation 6 to allow Hilcorp to conduct survey activities limited to turn-around activities in lease blocks 6304 and 6354 until October 31, 2019. Hilcorp has also requested a variance to Lease Stipulation 7 to begin on-lease activities approximately one week prior to April 1st, on March 23, 2019.

1.5 NOTICES TO LESSEES AND OPERATORS

Notices to Lessees and Operators (NTLs) are documents from BOEM that provide guidance or interpretation of a regulation, OCS standard, special lease stipulation, or regional requirement. There are three Alaska-specific NTLs (2005-A01, 2005-A02, and 2005-A03), however none apply to the proposed project.

2. PROJECT DESCRIPTION

The scope of this EED evaluates the potential impacts of the 3D seismic survey. This survey will occur within the Hilcorp project area (Figure 2-1) in lower Cook Inlet, which is the area south of the Forelands and west to southwest of Homer.

Operators collect 3D seismic data to determine the location of possible oil and gas prospects. The purpose of the 2019 Lower Cook Inlet 3D Seismic Survey program is to expand upon existing seismic data, which are now approximately 40 years old. Generally, 3D survey lines are spaced in a grid pattern concentrated on a specific area of interest. These surveys provide the resolution needed for detailed geological evaluation and data resolution for placement of drill rigs or platforms.

2.1 SEISMIC SURVEY SCHEDULE

The survey program is anticipated to last for approximately 45 to 60 days. Hilcorp anticipates active data collection will take approximately 30 days; however, the length of the survey will depend on weather, equipment, and marine mammal delays. The survey is proposed to start as soon as possible (e.g., April 1, although Hilcorp is requesting a variance to begin March 23rd), which would allow completion in early summer. It is possible that survey activities could extend through October 31st in compliance with BOEM Lease Stipulation 7 described in Sections 1.4 and 4.2.

2.2 DESCRIPTION OF THE 3D SEISMIC SURVEY PROGRAM

Hilcorp plans to collect 3D seismic data over 8 of the Hilcorp-owned 14 OCS lease blocks in lower Cook Inlet. The 3D seismic survey is comprised of an area of approximately 969 square kilometers (km^2; 374 square miles [mi^2]), which includes a 3D survey area of 451 km^2 (174 mi^2) through Hilcorp's lease blocks 6357, 6405, 6406, 6407, 6455, 6456, 6457, and 6458.

2.2.1 3D Seismic Survey Design

Polarcus is the recommended seismic contractor and the general seismic survey design is provided below. The 3D seismic data will be acquired using a specially designed marine seismic vessel towing 8-10 approximately 2,400 m (1.5 mi) recording cables (i.e., streamers) with a dual airgun array. The survey will involve one source vessel, one support vessel, and one or two chase vessels. The seismic (source) vessel will be equipped with a Kongsberg EA 600 echosounder to collect bathymetry data to ensure it remains in waters of sufficient ocean depth during the survey. Crew changes are expected to occur every four to six weeks using a helicopter or support vessel from shore bases in lower Cook Inlet.

The proposed seismic survey will be active 24 hours (hrs) per day. The array will be towed at a speed of approximately 7.41 km/hr (4 knots), with seismic data collected continuously. Data acquisition would occur for approximately 3-5 hrs, followed by a 1.5-hr period to turn and reposition the vessel for another pass. The turn radius on the seismic vessel is approximately 4,828 m (3 mi), which includes a run-out area where guns are active, but outside the full-fold data acquisition area. The total area of airgun operations will be approximately 528 km^2 (204 mi^2).

The data will be shot parallel to the Cook Inlet shorelines in a north/south direction. This operational direction will keep recording equipment/streamers in line with Cook Inlet currents and tides and keep the equipment away from shallow waters on the east and west sides. The program may be modified if the survey cannot be conducted as a result of noise conditions onsite (i.e., ambient noise). The airguns will typically be turned off during the turns; however, depending on the daylight hours and length of the turn, Hilcorp may use the smallest gun in the array (45 cubic inch [in^3]) as a mitigation airgun where needed. The vessel will turn into the tides to ensure the recording cables/streamers remain in line behind the vessel.

Figure 2-1 shows the seismic project area, which includes the data acquisition area and vessel use area (i.e., area where vessel may be turning or waiting for next tidal cycle, but operating airguns only in a maintenance or low power mode). A diagram showing the relative positions of the source and streamer cables is provided in Figure 2-2.

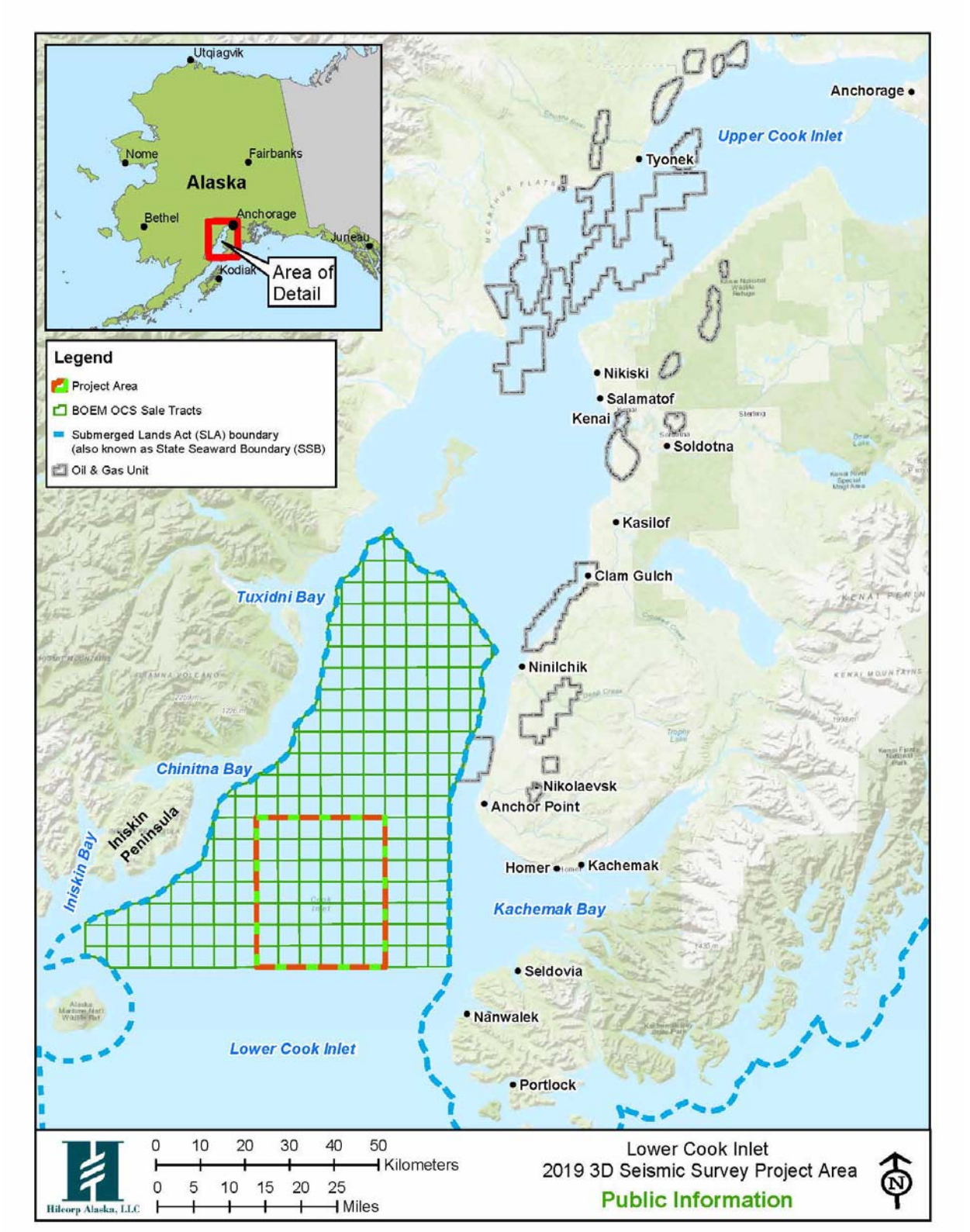


Figure 2-1 Hilcorp Cook Inlet Project Area

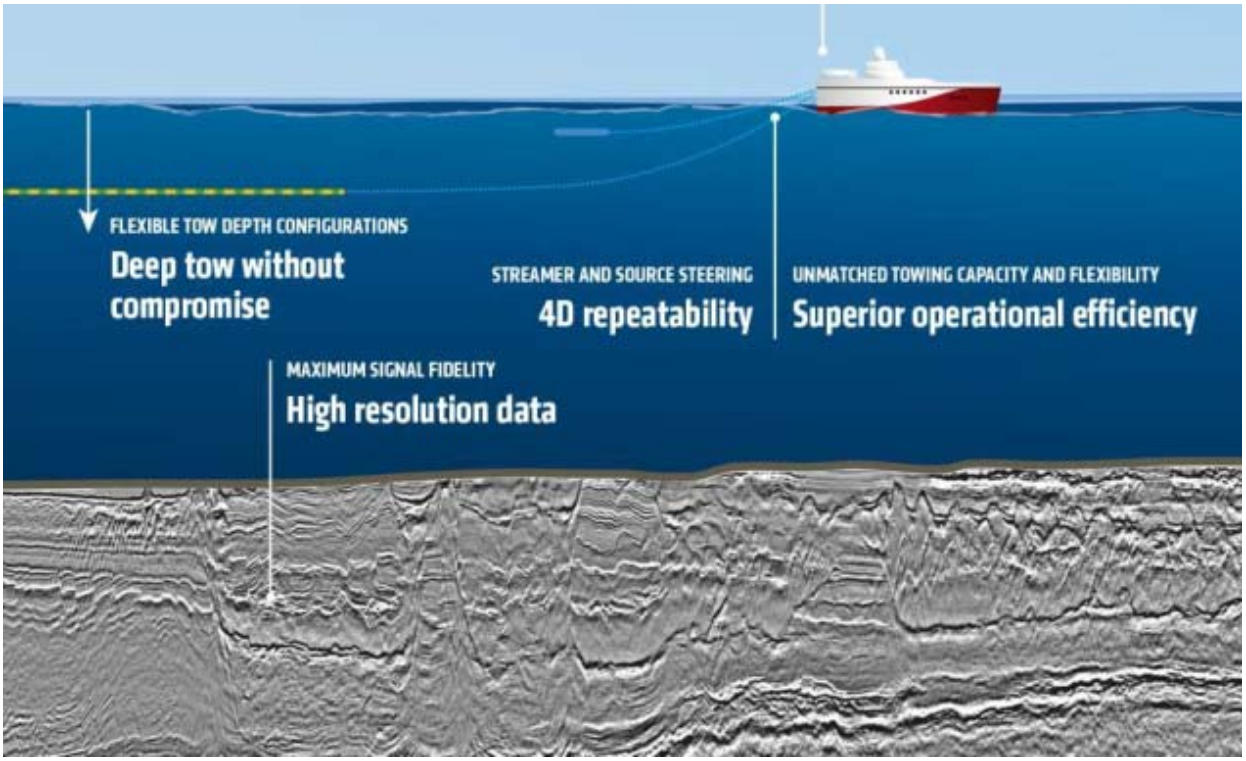


Figure 2-2 Diagram of typical seismic vessel with streamers and source

2.2.2 Airguns

Hilcorp proposes to use an array that provides for the lowest possible sound source to collect the target data. The proposed array is a Bolt 1900 LLXT dual gun array. The airguns would likely be configured as two linear arrays or "strings," with each string having 7 airguns shooting in a "flip-flop" configuration for a total of 14 airguns. The airguns would range in volume from 45 to 290 in^3 for a total of 1,945 in^3, as shown in the configuration provided in Figure 2-3. The first and last guns would be spaced approximately 14 m (45.9 ft) apart, and the strings would be separated by approximately 10 m (32.8 ft). The two airgun strings would be distributed across an approximate area of 30 by 14 m (98.4 by 45.9 ft) behind the source vessel and towed 300 to 400 m (984.2 to 1,312.3 ft) behind the stern of the vessel, at a depth of approximately 5 m (16.4 ft). The firing pressure of the array would be approximately 2,000 pounds per square inch (psi). The airgun would fire on a time basis approximately every 2.5 to 6 seconds, depending on the exact speed of the vessel. When fired, a brief (25 milliseconds [ms] to 140 ms) pulse of sound would be emitted by all airguns nearly simultaneously.

Hilcorp proposes to use a single 45 in^3 airgun, the smallest airgun in the array, for mitigation purposes.

Hilcorp will perform a sound source verification (SSV) survey at the beginning of the 3D seismic survey program to characterize the levels of sound and propagation, and to verify the monitoring zones (Exclusion Zone [EZ] and Safety Zone [SZ]), as discussed in Section 4.3.2.

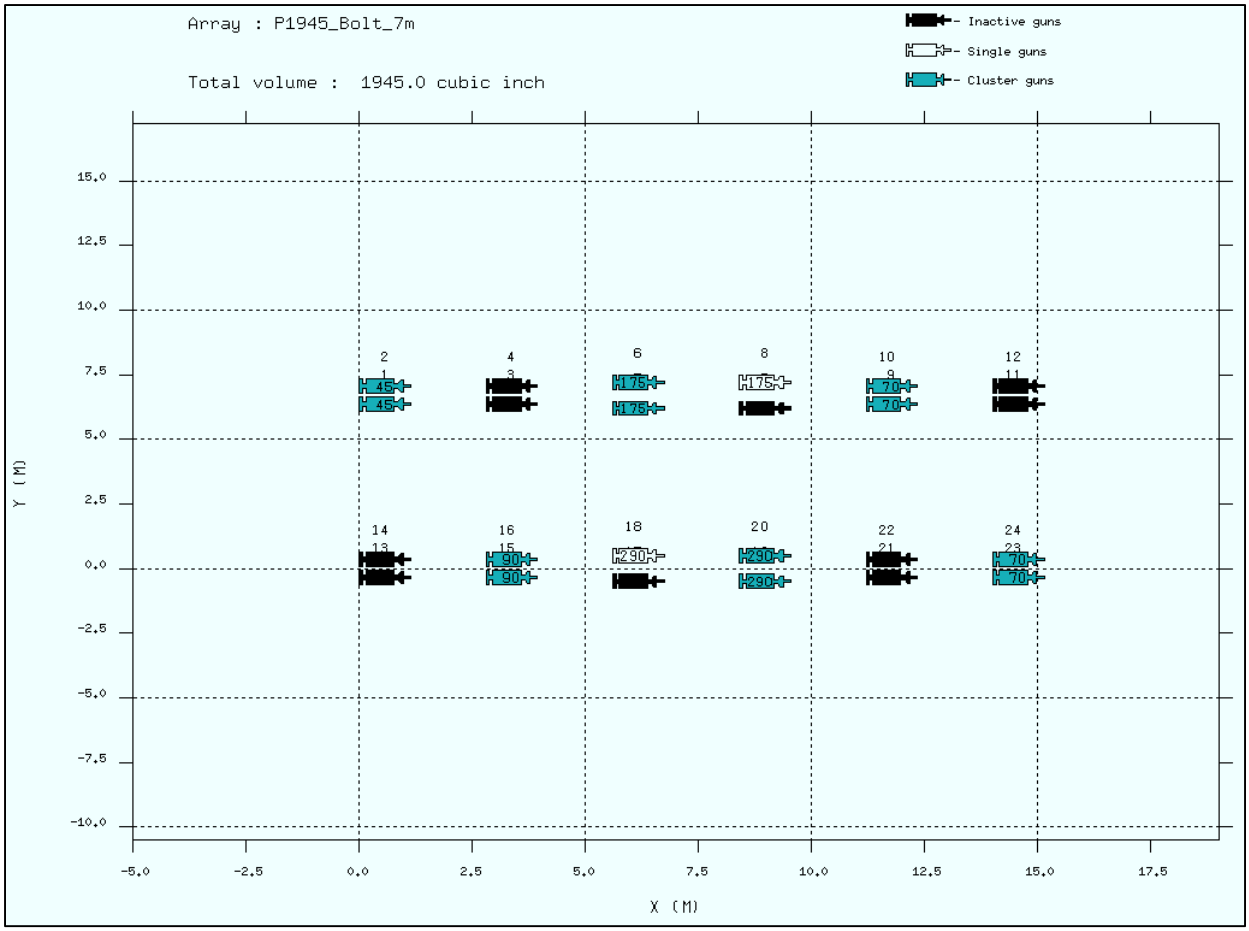


Figure 2-3 Layout of a 1,945-in^3 airgun array. Tow direction is to the left.

2.2.3 Streamers

Hilcorp intends to use 8-10 Sercel Sentinel solid streamers, for recording the seismic data (Figure 2-2). Each streamer will be approximately 2,400 m (1.5 mi) in length and will be towed approximately 8 m (26.2 ft) to 15 m (49.2 ft) below the surface of the water. The streamers will be placed approximately 50 m (165 ft) apart to provide a total streamer spread of 400-500 m (1,312-1,640 ft). Solid streamers are now recognized as best in class for marine data acquisition because of unmatched reliability, signal to noise ratio, low frequency content, and noise immunity.

Acoustic units and lateral birds will be used to position the streamers and ensure that they move through the water parallel to each other, in-line with the vessel, and are towed as closely and uniformly together as possible to improve image quality. Polarcus uses lateral towed control and positioning units (DigiFIN) equipped with an acoustic ranging system streamer mount (DigiRANGE II CMX) on the streamers that emit a very small pulse for positioning the streamers.

2.2.4 Vessels

The survey will involve one seismic acquisition vessel, one support vessel, and one or two chase vessels. The seismic acquisition vessel will tow the airgun array and the streamers. The support vessel will provide general support for the source vessel, including supplies, crew changes, etc. The chase vessel(s) will monitor the in-water equipment and maintain a security perimeter around the streamers. Details of anticipated vessels are provided in Table 2. Figures 2-4 and 2-5 show a typical, modern seismic acquisition vessel.

Table 2 Description of Seismic Survey Vessels

Name	Primary Activity	Specifications
M/V *Naila, Asima, Adira, or Alima* (or similar)	Source/streamer/Recording Vessel	92.0 m length x 21.0 m breadth 7.5 m draft 7,420 to 7,894 gross tonnage Built in 2010 Bahamas flag
M/V *Maria-G or Victory-G* (or similar)	Support vessel Supports crew changes, supplies, etc.	53.80 m length x 13.80 m breadth 3.80 m draft 1,081 gross tonnage Built in 2009 Panama Flag
TBD (1 or 2)	Chase vessel(s) Maintains security around streamers	TBD

TBD – to be determined

Figure 2-4 Photos of typical marine source/streamer vessel (left) and support vessel (right)

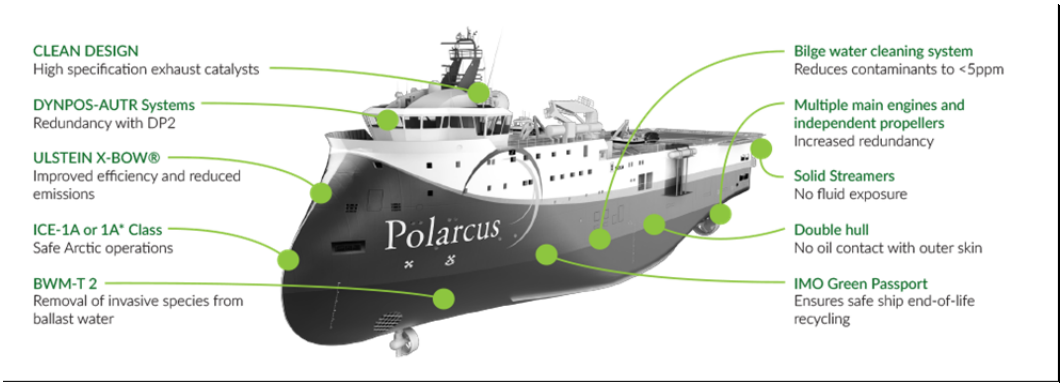


Figure 2-5 Polarcus Environmental Capabilities

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes potentially affected physical, biological, and social environments in the proposed project area and potential impacts to these environments associated with Hilcorp's proposed 3D seismic survey. Resource descriptions and potential impact analyses are based, in part, on information presented in various documents, including *Cook Inlet Planning Area Oil and Gas Lease Sale 244 Environmental Impact Statement* (EIS) (BOEM, 2016), *Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017, Final Programmatic EIS* (BOEM, 2012), and *Cook Inlet Areawide Oil and Gas Lease Sale, Final Finding of the Director* (ADNR, 2009).

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate and Meteorology

The survey project area is located within the continental subarctic climate. This climatological zone is characterized by cold temperatures in winter and cool temperatures in summer (BOEM, 2016). Hourly surface meteorological data from the following four sources are used to characterize the climate and meteorology of the region for the project. Terrestrial areas bordering the Cook Inlet are classified as "Dsc" and "Dfc" under the Köppen-Geiger Climate Classification System (Peel, Finlayson, and McMahon, 2007). The Köppen-Geiger Climate Classification System delineates climate zones based on a combination of native vegetation, average annual and monthly temperatures and precipitation, and the seasonality of precipitation. Areas classified as "Dsc" are those that exhibit cold climates, with a dry summer season. Areas classified as "Dfc" have cold climates, with no dry season and short, cool summers.

Climate in the Cook Inlet is influenced by the regulating effect of nearby ocean waters, and the seasonal distribution of sea ice. Locations under the predominant influence of the sea are characterized by relatively small seasonal temperature variability, with high humidity. Annual and seasonal average temperatures in Cook Inlet and surrounding coastal area are shown in Table 3. Temperatures are typically coldest in January and warmest in July, with freezing temperatures recorded every month of the year (NCDC, 2015).

3.1.1.1 Wind

Wind speeds and wind directions in the Cook Inlet vary by season and are influenced highly by extreme variability in local topography in the Cook Inlet area (Olsson and Liu, 2009; NCDC, 2015; BOEM, 2016). Prevailing winds in Cook Inlet are from the south in summer months, and are otherwise from the north and northeast. Mean monthly wind speed in Kenai, which is located northeast of the project area, is lowest in August (7 knots; 8.1 miles per hour [mph]), and increases slightly through the following months to a maximum of 8 knots (9.2 mph) in June. Extreme maximum wind in Kenai of 62 knots (71.3 mph) in November may constitute a violent storm on the Beaufort Scale (BOEM, 2016). The extreme maximum wind in Homer, near the project area to the east, has occurred in December when hurricane force winds of 68 knots (78.3 mph) were recorded. Monthly winds in Homer average 1.2 mph in July, and reach an average annual maximum in November of 24 knots (27.6 mph).

Table 3 Cook Inlet Meteorology

Parameter	Time Period	Alaska LNG – Nikiski, Alaska[2]
Mean Temperature (°C)	Annual	4.3
Mean Temperature (°C)	January	-4.4
Mean Temperature (°C)	July	13.6
Maximum Temperature (°C)	Annual	28.4
Maximum Temperature (°C)	January	8.4
Maximum Temperature (°C)	July	20.2
Minimum Temperature (°C)	Annual	-17.9
Minimum Temperature (°C)	January	-17.9
Minimum Temperature (°C)	July	8.0
Maximum Daily Precipitation (mm/day)	Annual	37.9
Maximum Daily Precipitation (mm/day)	January	13.5
Maximum Daily Precipitation (mm/day)	July	18.5

Key:
°C – degrees Celsius
mm/day – millimeter per day
Source: SLR, 2015

When deep synoptic-scale, low pressure systems interact with the varied terrain of Cook Inlet, fast-moving air in the lower level of the atmosphere can gust to 95 knots (109.3 mph). The wind may flow "down inlet" from the upper Cook Inlet, while cross-channel east winds occur in the lower Cook Inlet, causing convergent winds. Conversely, "up inlet" winds combine with cross-channel winds to produce divergent wind conditions. Mountain-gap winds create williwaws (sudden and violent blasts of wind descending from a mountainous coast to the sea), and waterspouts that can create hazardous conditions for mariners and aviators. Mountain-gap winds are most prevalent in winter and can reach nearly 100 knots (115.1 mph). (BOEM, 2016)

3.1.1.2 Precipitation

The inlet experiences annual precipitation averaging 42 centimeters (16.6 inches) in the north, to an annual average of approximately 2 m (78.0 inches) in Kodiak (BOEM, 2016). Cook Inlet is a region of meteorological extremes due to the proximity of the Shelikof Strait and the Gulf of Alaska, which are subject to forceful marine extratropical cyclones. These storms move east along the Aleutian Islands from the western Pacific and are impeded by mountainous terrain, which causes dangerous wind conditions (NOAA, 2012). These conditions are possible in Cook Inlet due to the "maritime-continental gradient," an area of transition from strictly marine climate characteristics (south and east coastal rainforests), and a continental climate (north and west to the Alaskan interior). In the north, precipitation is lowest in the spring and highest in August and September. In the south, precipitation is lighter than in the north, with least amounts falling in May through August, and much larger amounts falling in November through January. Snowfall typically occurs from October through April, but may occur as early as September and as late as May. The majority of snowfall occurs from November through February.

3.1.1.3 Storms

Storm-surge development is unlikely in most of lower Cook Inlet due to the rugged topography and steeply sloping seafloor (Wise, Comiskey, and Becker, 1981; BOEM 2016). However, the open-water stretch from Shelikof Strait to lower Cook Inlet can develop storm surges with west-southwest winds during the fall and winter when wind strength is sufficient, and many of the storms crossing the North Pacific end up crossing the Aleutian chain and move into the coastal area of the Gulf of Alaska. Storms with wind speeds greater than 45 meters per second (m/s; 100.6 mph) are observed occasionally in mountainous coastal areas due to the change in atmospheric pressure between interior Alaska and the Gulf of Alaska. Wind speeds can be further increased as winds funnel through narrow mountain passes (BOEM, 2012). Severe weather events (e.g., floods, hail, high winds) and winter events (e.g., heavy snow, ice storms, winter storms, and blizzards) have been reported in the area surrounding Cook Inlet (NCDC, 2015).

3.1.1.4 Potential Effects on Climate and Meteorology

The 3D seismic survey program is proposed to be completed by the end of June, prior to fall and winter storm activities. No impacts to climate and meteorology are expected as part of the proposed project.

3.1.2 Physical Oceanography and Bathymetry

Cook Inlet is an approximately 210-mile-long extension of the Gulf of Alaska (LGL, 2000). It is characterized by its shallow depth, complex circulation associated with variability at tidal, seasonal, annual and interannual time scales, and extreme tides (Musgrave and Statscewich, 2006). In general, water depth increases from north to south, with average depths of 18.3 m in the upper Cook Inlet, 27.4 m in central Cook Inlet, and 36.6 m at the mouth of Cook Inlet (LGL, 2000), as shown in Figure 3-1.

The Cook Inlet region has the fourth largest tidal range in the world, the circulation is dominated by tidally driven flows, with current speeds of up to 300 cm s-1 (6 knots) (Musgrave and Statscewich, 2006). The general circulation pattern of lower and middle Cook Inlet is that denser, saltier water flows northward along the east shore, and fresher, silty outflowing water flows southward along the west shore (BOEM 2016; Wapora Inc., 1979 in LGL, 2000).

The amount of sea ice in Cook Inlet varies annually and may consist of pack ice, shorefast ice, stamukhi (i.e., layered ice cakes formed by stacking of ice floes on shorefast ice over multiple high tides), and estuarine/river ice. Sea ice is most prevalent in the Cook Inlet OCS area during winter. It typically begins to form in October or November, reaches maximum extent in February, and recedes as it melts in March to April. Tidal action and tidal currents often shatter sea ice in Cook Inlet to the extent that there is seldom uniform cover (BOEM, 2016). The proposed survey program is scheduled to occur outside of the typical sea ice timeframe.

<u>Potential Effects on Oceanography and Bathymetry</u>

The 3D seismic survey program is proposed to begin in April, after sea ice has receded in the region. There will be no seafloor disturbing activities, and marine vessel use is limited due to the number of vessels required and the short duration of the seismic activities. No impacts to oceanography or bathymetry are expected as part of the proposed project. No impacts to the survey are expected as a result of oceanographic or geologic hazards.

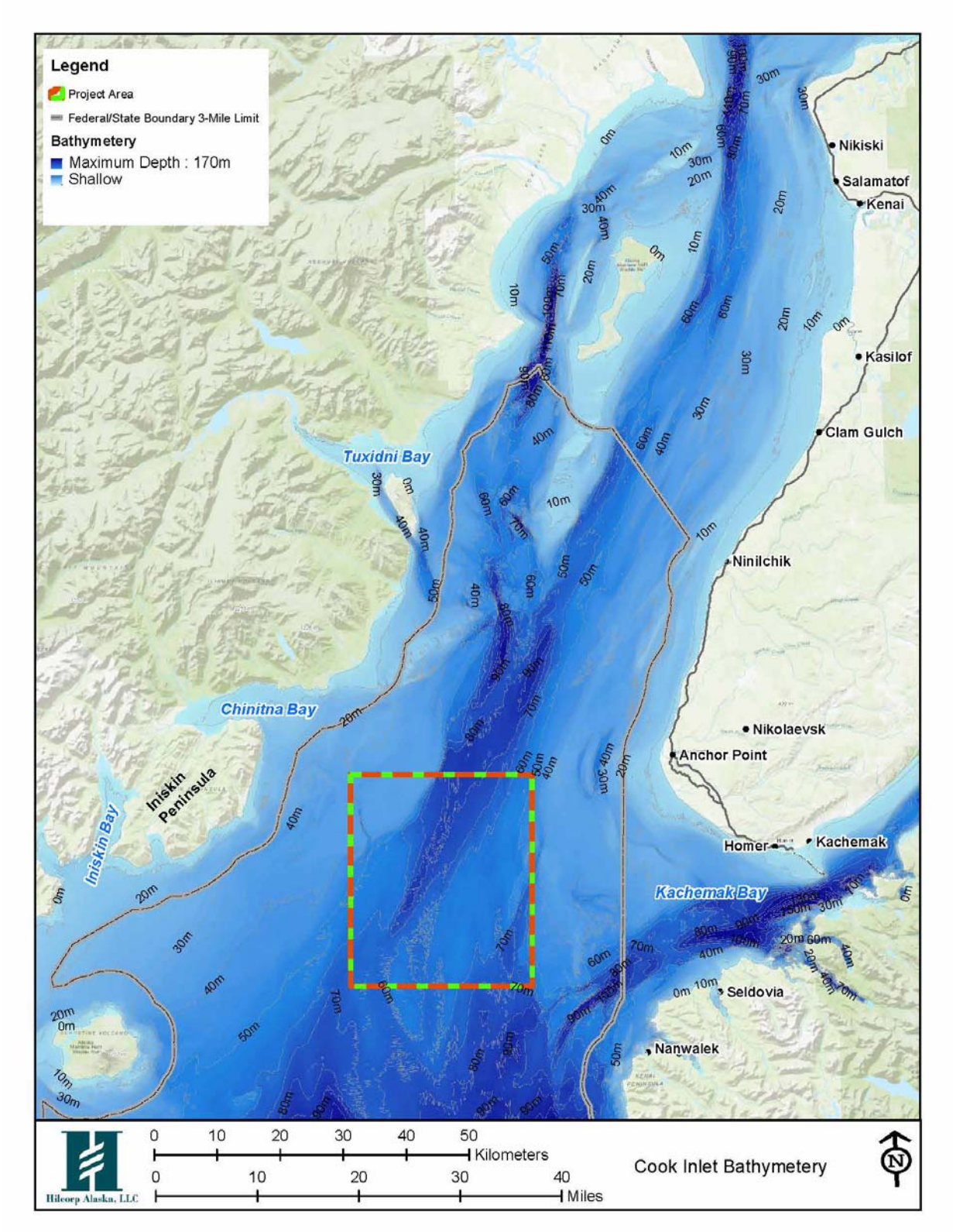


Figure 3-1 Cook Inlet Bathymetry

3.1.3 Air Quality

The nation's air quality is regulated under the Clean Air Act (CAA), as amended. The State of Alaska, the U.S. Environmental Protection Agency (EPA), and BOEM implement air quality programs in Alaska that are designed to carry out the goals of the CAA over land and water. The Alaska Department of Environmental Conservation (ADEC) is responsible for administering the state's air programs where they have jurisdiction on state land and on waters within the state seaward boundary (SSB) extending 3 nautical miles offshore. In areas over the OCS for the Cook Inlet region where the proposed project is located, EPA maintains jurisdiction to control air pollution from OCS sources located within 25 nautical miles of the SSB [CAA Sec. 328(a) and 43 U.S.C. 7627]. Within this area of water, EPA must attain and maintain federal and state ambient air quality standards and comply with the provisions of Sec. 328 of the CAA (Title 42 of the U.S. Code [U.S.C.] 7627). Further, such requirements must be the same as would be applicable if the source were located in the corresponding onshore area (COA) (40 CFR 55.2) and must include state and local air quality requirements.

The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS). The NAAQS set limits, or criteria, for ambient air concentrations of six "criteria" pollutants. The NAAQS reflect the concentrations of criteria pollutants that are the legal definition of healthy outside (ambient) air. EPA has identified two types of NAAQS. Primary standards have been set to protect public health with attention given to protecting sensitive populations, such as the elderly, children, or asthmatics. Secondary standards focus on public welfare protection and include reducing visibility impairment and preventing damage to crops, livestock, and vegetation. The six EPA NAAQS are called the criteria pollutants and are listed below (EPA, 2018):

- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Particulate Matter ($PM_{2.5}$ and PM_{10})
- Sulfur Dioxide (SO_2)
- Ozone (O_3)
- Lead

The ADEC enforces regulations within state boundaries to maintain ambient air quality standards and is the primary agency responsible for implementing the state's air quality control plan (AQCP). The State of Alaska's AQCP is approved by EPA and is included within the State Implementation Plan (SIP) for Alaska, which addresses the requirements of the CAA. The AQCP, including the SIP, has been adopted by reference into Title 18, Chapter 50, of the Alaska Administrative Code (AAC).

Under the 2018 version of 18 AAC 50 (as amended), the ADEC has established its own ambient air quality standards and does not adopt the NAAQS by reference, nor does it identify separate primary and secondary standards. Therefore, the standards established in the AAC are presumed to be primary. The State of Alaska has adopted the NAAQS under the EPA-approved SIP as Alaska Ambient Air Quality Standards (AAAQS) for the six criteria pollutants and has established state ambient standards for two other air pollutants, reduced sulfur compounds and ammonia.

The EPA designates areas considered to have air quality as good as or better than the NAAQS as attainment areas. Areas in which air quality does not meet the NAAQS are designated by EPA as nonattainment areas. The project is

located on the OCS with the nearest COA in the Cook Inlet Interstate Air Quality Control Region (AQCR) that is classified as a Class II region, that is in attainment or unclassifiable with the NAAQS. The Cook Inlet AQCR includes all of the Greater Anchorage Area Borough, the Kenai Peninsula Borough, and the Matanuska-Susitna Borough. Thus, the EPA regulations applicable to the COA refer to the attainment status of the Cook Inlet AQCR and are also relevant to the proposed project area. The closest non-attainment area is a portion of the Fairbanks and North Pole urban area, which is classified as a nonattainment area under the NAAQS $PM_{2.5}$ standard, located approximately 380 miles northeast from the proposed project area.

The CAA establishes a number of permitting programs that the State of Alaska and EPA implement depending on the jurisdictional geographic location of the stationary source. Permits are issued under these programs and are divided into Title I construction and minor air permits and Title V operating permits. The Title I permit program regulates air emissions associated with construction of new or modified major stationary sources. Under Article 3 of 18 AAC 50, the State of Alaska issues construction permits under the Prevention of Significant Deterioration (PSD) regulations codified in 40 CFR 52.21. These regulations apply to major new stationary sources or major modifications of existing stationary sources within an attainment or unclassified area. The PSD regulations provide standards that limit the total increase in ambient air pollution levels above established baseline levels for NO_2, PM_{10}, $PM_{2.5}$, and SO_2. These limits are most stringent in Class I areas. The nearest PSD Class I area is the Tuxedni National Wildlife Refuge, neighboring the project area. The Title I air permitting program for Alaska also includes a minor source program under 18 AAC 50, Article 5, that is designed to regulate those smaller stationary sources of emissions that are not subject to a Title I major source construction permit.

The State of Alaska Title V air permitting program is designed to standardize air quality permits and the permitting process for stationary sources of emissions by containing all requirements in one permit document. It requires that the source submit periodic reports identifying the extent to which it has complied with those obligations. Title V operating permits are issued to air pollution sources after the stationary source has begun to operate.

Title I and Title V permits are legally binding documents that include applicable requirements for demonstrating compliance with emission limits and standards. Monitoring, recordkeeping, and reporting provisions are also included within air permits that ensure stationary sources follow the assumptions provided under a permit application and maintain compliance with all applicable elements of the CAA, including the NAAQS and/or AAAQS. Under 40 CFR 55, EPA is required to implement the air quality requirements of the COA for the OCS in the Lower Cook Inlet OCS Region, which include the ADEC air quality requirements of 18 AAC 50.

Potential Effects on Air Quality

The seismic survey will be performed from on-water vessels operating over a large geographic area and will occur during a relatively short period. Any impacts to air quality are associated with combustion emissions from engines associated with propelling the on-water vessels. These emissions will be well dispersed over the area and will have a short intensity during the project. Therefore, the impacts to air quality associated with the project are considered to have a negligible impact.

3.1.4 Water Quality

The water quality of lower Cook Inlet generally is good, with water quality meeting Alaska Water Quality Standards criteria for all marine water uses and the criteria for the protection of marine life according to Section 403 of the Clean Water Act (CWA). No waterbodies directly draining into the lower Cook Inlet area are identified as impaired

by the State of Alaska (ADEC, 2013). Turbulence, associated mainly with tidal currents, and winds result in strong vertical mixing. While contaminants have been reported, many are attributed to erosion of the local soils, rocks, and ores. Concentrations of hydrocarbons are comparable to background hydrocarbons in other coastal Alaska waters (BOEM, 2016). Additional information on water quality in Cook Inlet can be found in BOEM, 2016.

Potential Effects on Water Quality

The seismic survey will be performed from on-water vessels, which will adhere to state, federal, and international requirements regarding vessel discharges. The project will occur over a large area and during a relatively short period of time, resulting in discharges being well dispersed over the area. Therefore, the impacts to water quality associated with the project are considered to have a negligible impact.

3.1.5 Acoustic Environment

Both natural and anthropogenic activities contribute to the acoustic environment of Cook Inlet. The dominant natural sound sources are typically physical mechanisms from wind and wave activity at or near the ocean surface, geological noise from earthquakes and volcanic activity, and noise from sea ice movement (BOEM, 2016). Cook Inlet is a high-energy, dynamic environment with large tides, strong currents, natural seismic activity, and seasonal sea ice cover, which contributes to a generally high-noise environment when compared to open-ocean habitats. Biological noise, sounds created by animals, such as marine mammals, crustaceans, and fish can generate noise that effectively changes the dominant characteristics of an acoustic environment. (BOEM, 2016)

Cook Inlet has several active ports and harbors, as well as commercial and recreational fishing activities, and an on-water tourism industry. Anthropogenic sound sources in Cook Inlet include noise from vessel traffic, aircraft (sea planes and traffic at airports with runways near coastal waters of Cook Inlet), and oil and gas activities (BOEM, 2016). Other sources of anthropogenic noise include ships using dynamic positioning, dredging, and pile driving. Due to the seasonal nature of activity in Cook Inlet and the inflow of ice into the region during winter, there is a seasonal intensity of anthropogenic noise during the summer months from all sources. In addition, ice interaction during extreme tidal fluctuations may produce high-intensity, broadband sounds throughout Cook Inlet but only during specific winter conditions (BOEM, 2016). Table 4 provides a summary of sounds in Cook Inlet.

Table 4 Summary of Received Sound Levels, the Distance to the Noise and the Frequency of Various Noise Sources in Cook Inlet

Source	Received Level (dB re 1 µPA)	Distance	Frequency (kHZ)
AMBIENT NOISE[1]			
Mouth of Little Susitna River	100	-	-
Between Fire Island and the mouth of Susitna River	113	-	-
Birchwood (Knik Arm outside project area)	95	-	-
Mouth of Eagle River (Knik Arm outside project area)	118	-	-
North of Point Possession	120	-	-
Anchorage Airport	105	-	-
Joint Base Elmendorf-Richardson	119	-	-
Port of Anchorage	113	-	-
VESSEL NOISE[1]			
Cargo-freight – Northern Lights (docked)	126	100-400 m	Generally < 1 kHz
Cargo-bulk carrier – Emerald Bulker (with 2 tugs)	134	>200 m	
Tug – Leo (pushing gravel barge Katie II)	149	100 m	
Small boat – Boston Whaler (drive by)	138	13 m	
Small rubber boat - Avon (drive by)	142	8.5 m	
AIRCRAFT NOISE[1]			
Anchorage Airport	118.4 ± 5.72	-	Generally < 2 kHz
Joint Base Elmendorf-Richardson	128.0 ± 9.0	-	
DC-10	1243	-	
Landing Military Jet	134	-	
OIL AND GAS DRILLING NOISE[1]			
Phillip A Oil Platform	119 3	1.2 km	< 10 kHz

Key:
dB re 1 µPA -- Decibels relative to 1 microPascal

Source:
[1]Blackwell and Greene, 2002
[2]Mean and standard deviation
[3]Maximum values

Potential Effects on the Acoustic Environment

The proposed 3D seismic survey is focused on Hilcorp's leases and will last approximately two months. It is expected that this will result in an increase in noise in the area of the surveys during survey activities. Impacts from the active sound source will cease as soon as the survey is complete and full recovery of the acoustic environment to pre-survey conditions is expected (BOEM, 2016). The greatest impact from the proposed seismic survey is expected to occur through the loss of acoustic habitat availability due to noise (BOEM, 2016). Impacts to individual biological and sociocultural environments are discussed in the applicable portions of Sections 3.2 and 3.3.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Invertebrates and Lower Trophic Organisms

Invertebrates occupy multiple habitat types from the intertidal zone to the deep sea. Invertebrates can occupy benthic (bottom) or pelagic (water column) habitats. Benthic invertebrates include predators, scavengers, scrapers, suspension (filter) feeders, and deposit feeders, which consume surface or subsurface sediment organic matter. Pelagic invertebrates may drift with the current (zooplankton) or actively swim.

The invertebrates found in Cook Inlet are composed of a mix of oceanic and coastal species. Benthic invertebrates are important as prey for other species in Cook Inlet such as crabs, flatfishes, and cod. There are differences in the composition of benthic species in Cook Inlet as a result of differences in ice formation, substrate type, and tidal zone (BOEM, 2012). Physical factors, such as currents, salinity, and temperature, are the primary influences on variation in zooplankton and phytoplankton in the Cook Inlet region (BOEM, 2016).

3.2.1.1 Plankton Communities

Phytoplankton blooms peak in the spring within the highly productive pelagic habitat of Cook Inlet. In the summer, tidal flux and strong winds resuspend nutrient-rich bottom sediments, allowing productivity to remain high. However, productivity is lower on the western side of Cook Inlet versus the eastern side due to greater sediment input on the eastern side. Diatoms and microflagellates dominate the phytoplankton assemblage of Cook Inlet (BOEM, 2016).

Coastal waters throughout the Gulf of Alaska, including Cook Inlet, contain similar zooplankton communities due to the influence of the Alaska Coastal Current, which also influences the mix of oceanic and coastal species found in Cook Inlet. Several species of copepods dominate the water column, with other taxa depending on the location; barnacle nauplii and crab zoea are prevalent in Kachemak Bay and the lower Cook Inlet from April to August (BOEM, 2016).

3.2.1.2 Benthic Communities

The infaunal and epifaunal invertebrates within the intertidal and subtidal habitats of Cook Inlet are trophic links connecting primary producers to higher trophic level organisms; the latter are often of commercial importance and include shellfish, herring, crabs, salmon, rockfish, and cod (BOEM, 2016). The distribution of species within Cook Inlet is largely due to the presence of ice; the western side of lower Cook Inlet is composed of more Arctic species due to seasonal ice scour, while the ice-free eastern side is comprised of more temperate species (BOEM, 2016). The dominant benthic taxa on the west side of Cook Inlet have been identified as prosobranch gastropods (snails), bivalves, ascophoran and anascan bryozoans, and decapod crustaceans. In Kachemak Bay on the east side of lower Cook Inlet and in Prince William Sound, the prosobranch gastropods strongly dominate, followed by bivalves and decapods (crabs) (BOEM, 2016).

Algal assemblages are more diverse and productive on the east coast of Cook Inlet than the west coast, and algal production declines sharply on both coasts moving north towards the upper inlet. Multiple species of brown algae dominate the rocky intertidal and shallow subtidal zones of Cook Inlet, while a single genus, Fucus, dominates the mid-intertidal zones. Kelp beds dominate the lower intertidal areas (BOEM, 2016).

Dominant invertebrate species within intertidal and shallow subtidal communities include herbivores (e.g., sea urchins, chitons, and limpets), suspension feeders (mussels, clams, polychaetes, bryozoans, and sponges), and predators/scavengers (e.g., sea stars, snails, and crabs) (BOEM, 2016).

3.2.1.3 Deep Subtidal Communities

The deep subtidal benthic infaunal invertebrate community primarily consists of mollusks, polychaetes, and bryozoans, which are important trophic links for crabs, flatfishes, and other common Cook Inlet organisms. Subtidal epifaunal organisms are primarily crustaceans (crabs, pandalid, and shrimp) and echinoderms (sea cucumbers and sea urchins) (BOEM, 2016).

3.2.1.4 Potential Effects on Invertebrates and Lower Tropic Communities

Overall, any impacts from the proposed seismic survey program to invertebrates and lower trophic communities are expected to result from vessel transit and be localized and temporary. The survey program is expected to have minimal impacts to invertebrates and lower trophic organisms.

3.2.2 Fish and Shellfish

Fish and shellfish are important components of the food web in Cook Inlet, as well as important for subsistence and the commercial economy (both commercial fishing and recreational/tourism markets). Various species of fish and shellfish are present in Cook Inlet. Fish species found in Cook Inlet include pelagic fish (e.g., smelt, Pacific herring, hooligan, and capelin), all five species of Pacific salmon (i.e., Chinook [King], coho [silver], pink, chum, and sockeye [red]), Dolly Varden, and various groundfish (e.g., Pacific cod, Pacific halibut, sablefish). Shellfish species found in Cook Inlet include various species of crab, shrimp, scallop, and clam.

The information provided in Sections 3.2.2.1 through 3.2.2.5 are from BOEM, 2016 unless otherwise indicated.

3.2.2.1 Pelagic Fish

Pelagic fish inhabit the water column (not near the bottom or the shore) of coasts, open oceans, and lakes, and include forage fish which are a critical food source to multiple marine mammal, seabird, and larger fish species (NOAA, 2018a). Forage fish that occur throughout Cook Inlet include longfin smelt, Pacific herring, sand lance, hooligan (eulachon), and capelin, with fish densities generally being greatest during early summer. Longfin smelt are seasonally abundant in several drainage basins in Cook Inlet, and Pacific herring occur in large schools in the Cook Inlet in early April, and possibly through early fall. Sand lance are most common at depths less than 50 m (164 ft), but are found at depths nearshore ranging from 6 m (20 ft) to 100 m (328 ft).

Hooligan are anadromous, spawning and hatching in freshwater; marine mammals feed on them in abundance when hooligan gather in large schools off the mouths of spawning streams and rivers. Hooligan are seasonally abundant in most major watershed drainages in Cook Inlet and in a subsistence fishery. The capelin is a major forage fish in the Cook Inlet region; although they have no economic value to Alaska, they are prey for other fish, marine mammals, and seabirds. Capelin are mainly filter feeders, and populations are large and range extensively in Alaskan waters, spawning on beaches and in deeper waters. Eggs adhere to the beach and bottom gravels.

3.2.2.2 Salmonids

Cook Inlet is a migratory corridor and early life rearing area for anadromous salmonids, including all five species of Pacific salmon, Dolly Varden, and steelhead trout. Spawning Chinook salmon enter the Cook Inlet area in early May, while juvenile Chinook migrate downstream in the area during the same period. Coho salmon begin entering the Cook Inlet area in late July and enter spawning streams from July to November. Spawning pink and chum salmon reach the Cook Inlet region in early July. Pink salmon are seasonally distributed over most of Cook Inlet, spawning in small streams and intertidal zones and are a primary target species for commercial fishing in lower Cook Inlet. Generally regarded as one of the less desirable species of salmon, chum salmon are commercially harvested in Cook Inlet in modest numbers.

Sockeye salmon support one of the most important commercial fisheries on the Pacific coast of North America and are important to recreational fisheries and subsistence users as well. They remain an important mainstay of many subsistence users. Mature sockeye salmon travel thousands of miles from ocean-feeding areas to spawn in the same freshwater system where they hatched. Adult sockeye return annually in late June to the freshwater system where they hatched in the Cook Inlet and the Shelikof Strait region. Runs continue through early August.

Steelhead trout may be found in coastal streams of Alaska north and west to the Cold Bay area on the Alaska Peninsula, but are unevenly distributed throughout the Cook Inlet region. Dolly Varden are locally abundant in all coastal waters of Alaska.

3.2.2.3 Groundfish

Groundfish are finfishes that, for much of their time, remain near the seafloor, although spawning and early life may be in pelagic waters. There are a number of groundfishes present in the Cook Inlet region, with the commercially valuable species being Pacific halibut, Pacific cod, Pacific hake, Pacific Ocean perch, sablefish, and walleye pollock. Additional groundfish species include Atka mackerel, arrowtooth flounder, black rockfish, lingcod, yellowfin sole, starry flounder, sculpins, and flatfish. Halibut is the major commercial groundfish fishery in the Cook Inlet area, the dominant marine sport fishery, and is also an important subsistence species (BOEM, 2016; ADF&G, 2017).

3.2.2.4 Shellfish

There are three commercial king crab species in Alaska (red, blue, and golden). Red and golden king crab may occur in Cook Inlet, while blue king crab typically do not. Red king crabs inhabit the intertidal zone to depths greater than 183 m (600 ft), while golden crabs live mostly at depths between 183 and 732 m (600 and 1,312 ft) but may occur in depths up to 914 m (3,000 ft).

The Dungeness crab inhabits bays, estuaries, and nearshore waters of Alaska, including Cook Inlet, and supports a commercial and personal-use fishery in Alaska. These crabs generally inhabit waters shallower than 27 m (88 ft), but they have been found in depths to 183 m (600 ft). Tanner crabs (snow and Tanner) also support a commercial fishery from southeastern Alaska north through the Bering Sea. They are consumed by groundfish, pelagic fish, and humans.

Two species of pandalid shrimp are found within Cook Inlet. Northern shrimp are circumpolar in distribution, though the greatest concentrations occur in the Gulf of Alaska and are the basis of the commercial trawl shrimp fishery in Alaska. Spot shrimp can be found in lower Cook Inlet and is highly valued by commercial and subsistence

users alike. Shrimp inhabit varying depths and habitat types; spot shrimp are generally associated with debris-covered seafloor at depths ranging from 4 to 457 m (13 to 1,500 ft), whereas Northern shrimp typically occur over muddy seafloor at depths ranging from 18 to 1,463 m (60 to 4,800 ft).

In lower Cook Inlet, the Pacific weathervane scallop are commercially harvested in Kamishak Bay, southwest of the project area. Weathervane scallops supports a sporadic but important commercial fishery in Alaskan waters from Yakutat to the eastern Aleutians. Weathervane scallops are found on seafloors of sand, gravel, and rock from 45 to 183 m (150 to 600 ft) depth and are sensitive to changes in water quality.

The razor clam is an important bivalve mollusk, harvested extensively by commercial and sport fisheries. The Arctic razor clam is found in southern Cook Inlet and westward to the Bering Sea and Siberia, while the Pacific razor clam is more common and widely distributed (from Pismo, California, north to the Aleutian Islands). Razor clams live in surf-swept and somewhat protected sandy beaches. Large assemblages of razor clams occur in waters near Augustine Island in western Cook Inlet and in Kachemak Bay.

Additional bivalve mollusks found in Cook Inlet include littleneck and butter clams, which are commonly found in commercial fisheries and are harvested for personal use. Preferred habitat of littleneck clams includes beaches along rocky shorelines that have coarse sand or fine gravel mixed with mud, while butter clams are found in sandy locations. Clam populations are stable throughout Alaska, but bivalve mollusks are sensitive to poor water quality.

3.2.2.5 Essential Fish Habitat

NMFS is required to designate and conserve Essential Fish Habitat (EFH) for species managed under an existing Fishery Management Plan under the Magnuson-Stevens Fishery Conservation and Management Act of 1976. The term “essential fish habitat” means those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity (16 USC 1801-1884). This includes aquatic habitat where fish spawn, breed, feed, or grow to maturity. A number of fish and shellfish have designated EFH in the lower Cook Inlet as provided in Table 5.

Table 5 Essential Fish Habitat in Project Area

Type	Species	Development Level
Groundfish	Arrowtooth Flounder (*Atheresthes stomias*)	Late Juvenile & Mature
Groundfish	Pacific Cod (*Gadus microcephalus*)	Late Juvenile, Mature
Groundfish	Rock Sole (*Lepidopsetta bilineata*)	Late Juvenile, Mature
Groundfish	Slimy Sculpin (*Cottus cognatus*)	Late Juvenile, Mature
Groundfish	Skate (big skates, longnose skates, and other skates)	Mature
Groundfish	Walleye Pollock (*Gadus chalcogrammus*)	Late Juvenile, Mature
Salmon	Chinook Salmon (*Oncorhynchus tshawytscha*)	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Chum Salmon (*Oncorhynchus keta*)	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Coho Salmon (*Oncorhynchus kisutch*)	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Pink Salmon (*Oncorhynchus gorbuscha*)	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Sockeye Salmon (*Oncorhynchus nerka*)	Marine Immature, Maturing Adults, Marine Juvenile
Scallops	Weathervane Scallop (*Patinopecten caurinus*)	Late Juvenile, Mature

Source: NMFS, 2017a; McConnaughey et al., 2017

3.2.2.6 Summary of Effects on Fish and Shellfish

Some of the activities related to the planned survey program may adversely affect fish, shellfish, and EFH; however, any effects are expected to be localized and temporary. Potential vessel discharges and deck runoff from seismic and support vessels may cause temporary water quality degradation at localized sites, some eggs and larvae may be exposed to detrimental but non-lethal sound levels from seismic activities, and fish may be temporarily displaced from the area where airguns are used. Overall, effects on fish and shellfish are expected to be minor due to the small area to be surveyed, the widespread nature of fish and shellfish in Cook Inlet, and the highly localized and temporary nature of the activities.

3.2.3 Marine Mammals

The following sections are from Hilcorp's ITR Petitions (Hilcorp, 2018a, 2018b), unless otherwise noted, and are limited to those marine mammals that may be within the project area. A number of marine mammals are listed as endangered or threatened under the ESA. The marine mammal species known to occur in the Hilcorp geophysical project area, including their ESA status, are listed in Table 6 and described below.

Table 6 Marine Mammals in Project Area

Species	Conservation Status	Stock	Minimum Population Estimate
Fin whale (*Balaenoptera physalus*)	ESA – Endangered	Northeast Pacific Stock	14,620[1]
Humpback whale (*Megaptera novaeangliae*)	ESA – Endangered	Western North Pacific Stock	865
Minke whale (*Balaenoptera acutorostrata*)	ESA – Not Listed	Alaska Stock	1,233
Gray whale (*Eschrichtius robustus*)	ESA – Not Listed	Eastern Pacific Stock	20,125
Beluga whale (*Delphinapterus leucas*)	ESA – Endangered	Cook Inlet Stock	328
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Resident Stock	2,347
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Transient Stock	587
Harbor porpoise (*Phocoena phocoena*)	ESA – Not Listed	Gulf of Alaska Stock	31,046
Dall's porpoise (*Phocoenoides dalli*)	ESA – Not Listed	Alaska Stock	83,400
Harbor seal (*Phoca vitulina*)	ESA – Not Listed	Cook Inlet/Shelikof Stock	27,386[2]
Steller sea lion (*Eumetopias jubatus*)	ESA – Endangered	Western U.S. Stock	50,983[2]
California sea lion (*Zalophus californianus*)	ESA – Not Listed	Pacific Temperate Population	296,750
Northern sea otter (*Enhydra lutris kenyoni)*	ESA – Threatened	Southwest Alaska Stock	45,064
	ESA – Not Listed	Southcentral Alaska Stock	18,327

[1]Minimum population estimate of entire North Pacific Stock in 1991 (BOEM, 2016).

[2]NEST is the best estimate of pup and non-pup counts, which have not been corrected to account for animals at sea during abundance surveys.

3.2.3.1 Fin Whales

Fin whales were listed as endangered in 1970 (35 FR 18319) and protected under the MMPA in 1973. Subsistence hunts continue in Greenland under the aboriginal subsistence whaling scheme managed by the International Whaling Commission, but do not occur in Alaska.

For management purposes, three stocks of fin whales are currently recognized in U.S. Pacific waters: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii. Much of the North Pacific range has not been surveyed, and reliable abundance estimates for the entire stock are not available. No critical habitat has been designated or proposed for fin whales in the North Pacific.

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. Surveys conducted in coastal waters of the Aleutians and the Alaska Peninsula found that fin whales occurred primarily from the Kenai Peninsula to the Shumagin Islands and were abundant near the Semidi Islands and Kodiak Island.

Fin whales are rarely observed in Cook Inlet and most sightings occur near the entrance of the inlet.

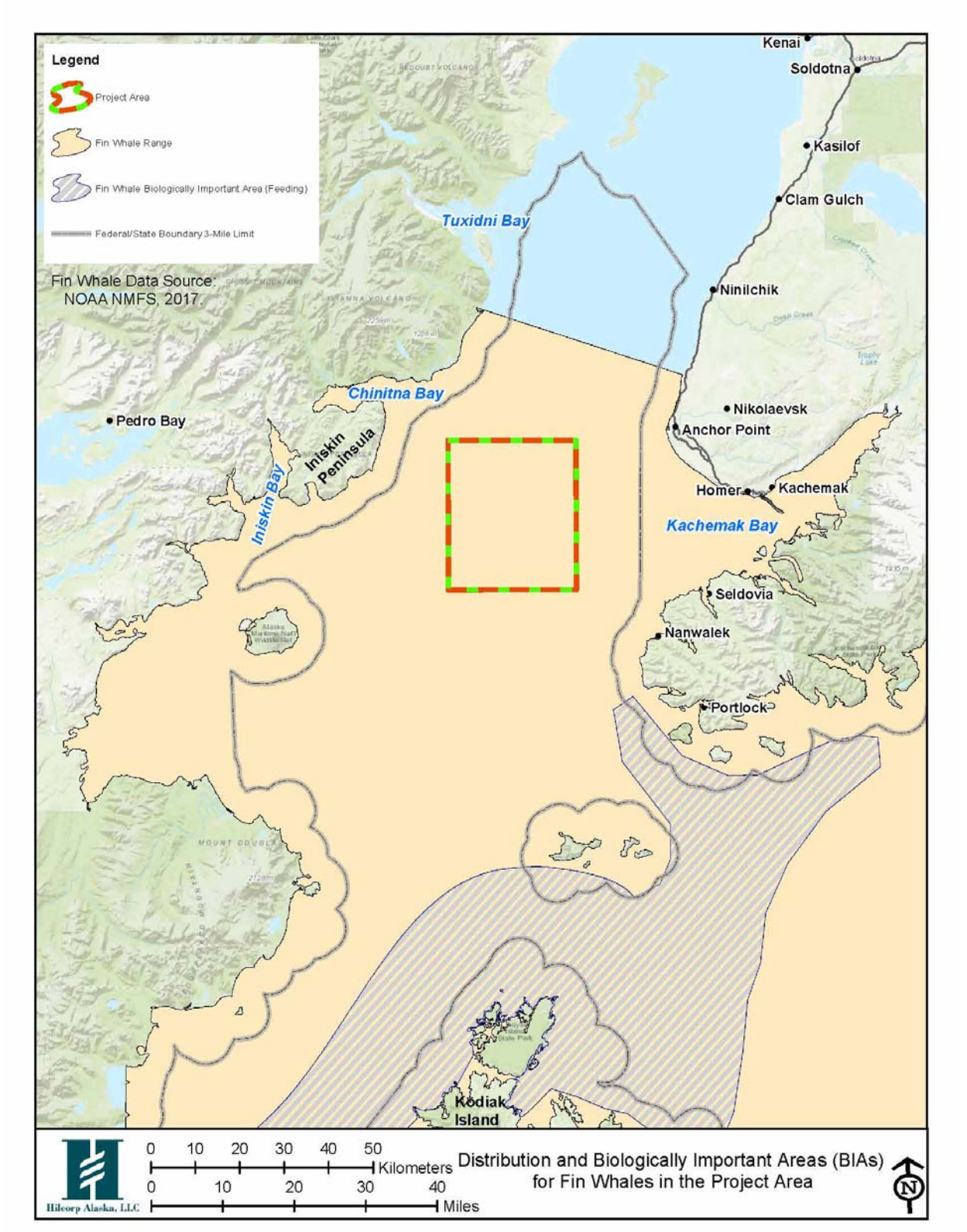


Figure 3-2 Distribution and BIAs for fin whales in the project area

3.2.3.2 Humpback Whale

To date, three management units (populations) of humpback whales are recognized in the North Pacific, migrating between their respective summer/fall feeding areas and winter/spring calving and mating areas. Although there is considerable distributional overlap in the humpback whale stocks in Alaska, the whales seasonally found in lower Cook Inlet are probably of the Central North Pacific stock. Listed as endangered under the ESA, this stock has recently been estimated at 7,890 animals. The Central North Pacific Stock winters in Hawaii and summers from British Columbia to the Aleutian Islands, including Cook Inlet.

Humpback whales were listed as endangered under the ESA of 1973 (16 USC 1531 et seq.) due to the reduced population levels resulting from harvest pressure that occurred in the 20th Century. Humpback whales are listed as depleted under the MMPA in 1973. In 1991, NMFS published a final recovery plan for Humpback Whales (NMFS, 1991).

In 2013, NMFS published a 90-day finding to identify the Central North Pacific population of Humpback whales as a distinct population segment (DPS) under the ESA and recommended that this DPS be delisted from the ESA based on population abundance (78 Federal Register [FR] 53391). On September 8, 2016, NMFS revised the listing status of the humpback whale. NMFS divided the globally listed species into 14 DPSs, removing the current species listing and replacing it with four DPS as endangered (Cape Verde Islands/Northwest Africa, Western North Pacific, Central America, and Arabian Sea) and one DPS as threatened (Mexico). The remaining nine DPSs did not warrant listing. Critical habitat for the three DPSs found in U.S. waters (Western North Pacific, Central America, and Mexico) has not been determined (81 FR 62260).

The humpback whale is distributed worldwide in all ocean basins. In winter, most humpback whales occur in the subtropical and tropical waters of the northern and southern hemispheres. Humpback whales in the high latitudes of the North Pacific Ocean are seasonal migrants that feed on euphausiids and small schooling fishes. During the spring, these animals migrate north and spend the summer feeding in the prey-rich sub-polar waters of southern Alaska, British Columbia, and the southern Chukchi Sea. Individuals from the Western North Pacific (endangered), Hawaii (not listed under the ESA), and the Mexico (threatened) DPSs migrate to areas near and potentially in the project area; however, most of the individuals that migrate to the Cook Inlet area are likely from the Hawaii DPS and not the Western North Pacific or Mexico DPSs (NMFS, 2017b).

In the summer, humpback whales are regularly present and feeding in the Cook Inlet region, including Shelikof Strait, Kodiak Island bays, and the Barren Islands, as well as the Gulf of Alaska regions adjacent to the southeast side of Kodiak Island (especially Albatross Banks), the Kenai and Alaska peninsulas, Elizabeth Island, and the Aleutian Islands. Humpbacks also may be present in some of these areas throughout autumn. Humpback whales have been observed during marine mammal surveys conducted in Cook Inlet; however, presence is largely confined to lower Cook Inlet. During SAExploration, Inc.'s (SAE) 2015 seismic program, three humpback whales were observed in Cook Inlet; two near the Forelands and one in Kachemak Bay. During NMFS Cook Inlet beluga whale aerial surveys from 2000 to 2016, there were 88 sightings of 191 estimated individual humpback whales in lower Cook Inlet. They have been regularly seen near Kachemak Bay during the summer months. There are observations of humpback whales as far north as Anchor Point, with recent summer observations extending to Cape Starichkof. Although several humpback whale sightings occurred mid-inlet between Iniskin Peninsula and Kachemak Bay, most sightings occurred outside of the project area near Augustine, Barren, and Elizabeth Islands.

Ferguson et al. (2015) has established Biologically Important Areas (BIAs) as part of the NOAA Cetacean Density and Distribution Mapping Working Group (CetMap) efforts. This information supplements the quantitative information on cetacean density, distribution, and occurrence by: 1) identifying areas where cetacean species or populations are known to concentrate for specific behaviors, or be range-limited, but for which there is not sufficient data for their importance to be reflected in the quantitative mapping effort; and 2) providing additional context within which to examine potential interactions between cetaceans and human activities. A "Feeding Area" BIA for humpback whales in the Gulf of Alaska region encompasses the waters east of Kodiak Island (the Albatross and Portlock Banks), a target for historical commercial whalers based out of Port Hobron, Alaska (Ferguson et al., 2015). This BIA also includes waters along the southeastern side of Shelikof Strait and in the bays along the northwestern shore of Kodiak Island. The highest densities of humpback whales around the Kodiak Island BIA occur from July to August (Ferguson et al., 2015). There are no BIAs for humpback whales within the project area. Humpback whales are found in the Cook Inlet region as shown in Figure 3-3.

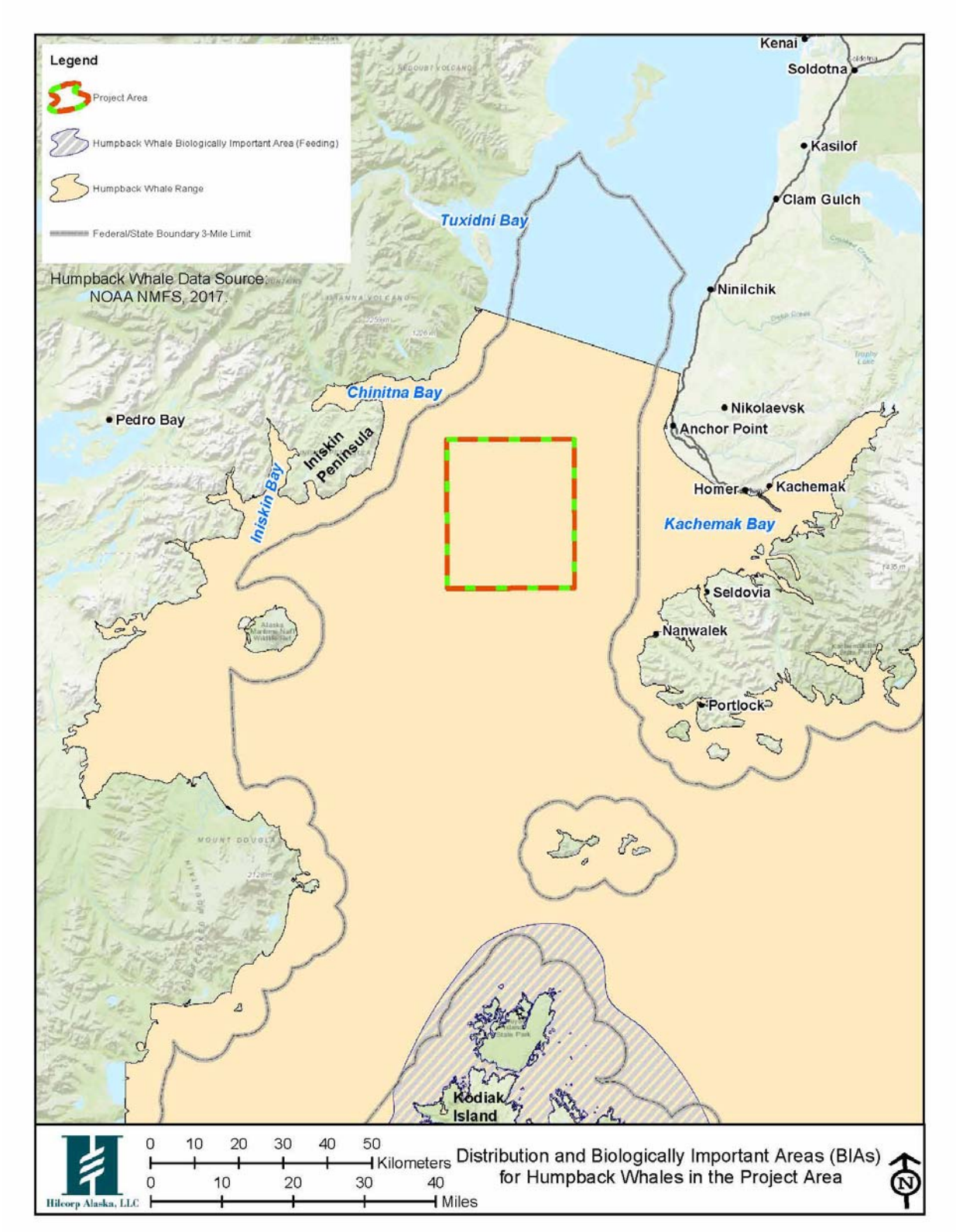


Figure 3-3 Distribution and BIAs for humpback whales in the project area

3.2.3.3 Minke Whale

Minke whales are most abundant in the Gulf of Alaska during summer and occupy localized feeding areas. Concentrations of minke whales have occurred along the north coast of Kodiak Island (and along the south coast of the Alaska Peninsula. The current estimate for minke whales between Kenai Fjords and the Aleutian Islands is 1,233 individuals. 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 (NMML, 2003).

Minke whales are a non-ESA listed cetacean uncommonly 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.

In the North Pacific, minke whales occur from the Bering and Chukchi seas south to near the Equator. In the eastern North Pacific, minke whales are relatively common in the Bering and Chukchi seas and in the inshore waters of the Gulf of Alaska.

Minke whales become scarce in the Gulf of Alaska in fall; most whales are thought to leave the region by October. Minke whales are migratory in Alaska, but recently have been observed off Cape Starichkof and Anchor Point year-round.

During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered three times (1998, 1999, and 2006) off Anchor Point, 16 miles northwest of Homer. A minke whale was also reported off Cape Starichkof in 2011 and 2013, suggesting this location is regularly used by minke whales, including during winter. Several minke whales were recorded off Cape Starichkof in early summer 2013 during exploratory drilling, suggesting this location is regularly used by minke whales year-round. During Apache's 2014 survey, a total of two minke whale groups (three individuals) were observed, one sighting to the southeast of Kalgin Island and another sighting near Homer. SAE noted one minke whale near Tuxedni Bay in 2015. This species is unlikely to be seen in upper Cook Inlet but may be encountered in the mid and lower Inlet (Figure 3-4).

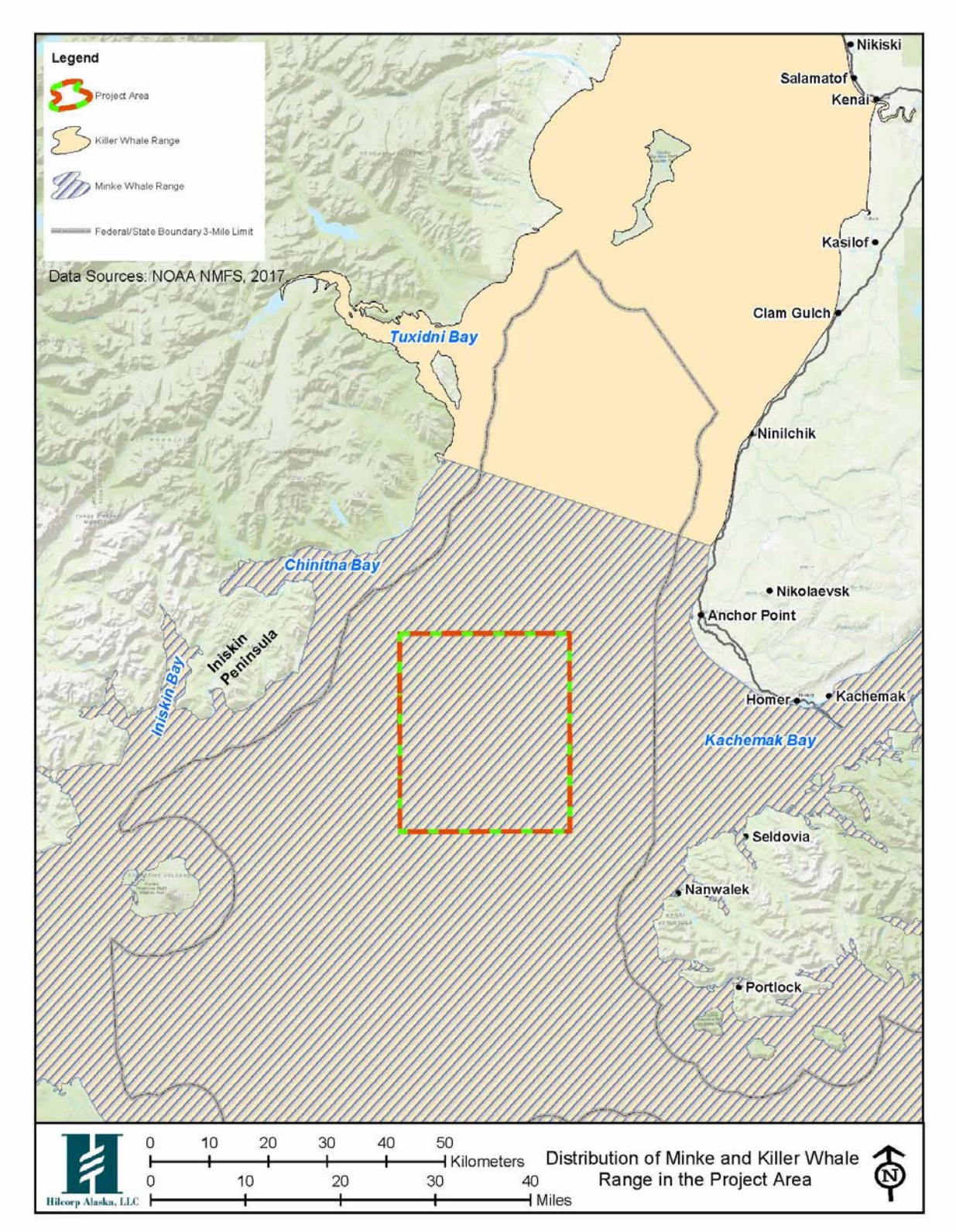


Figure 3-4 Distribution of minke and killer whales in the project area

3.2.3.4 Killer Whale

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S. Exclusive Economic Zone. Two different stocks of killer whales inhabit the Cook Inlet region of Alaska: the Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock.

The population estimate for the Alaska Resident Stock is estimated at 2,347 individuals, with a minimum population estimate of 2,084. Though no official abundance estimate exists for this stock because of incomplete surveys of the range, a minimum population estimate for the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock was estimated to be 587 individuals.

The Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock of killer whales are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA).

Seasonal and year-round occurrence has been noted for killer whales throughout Alaska, where whales have been labeled as 'resident,' 'transient,' and 'offshore' type killer whales. The killer whales using Cook Inlet are thought to be a mix of resident and transient individuals from two different stocks: the Alaska Resident Stock, and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock. Although recent studies have documented movements of Alaska Resident killer whales from the Bering Sea into the Gulf of Alaska as far north as southern Kodiak Island, none of these whales have been photographed further north and east in the Gulf of Alaska where regular photo-identification studies have been conducted since 1984.

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham. The few whales that have been photographically identified in lower Cook Inlet belong to resident groups more commonly found in nearby Kenai Fjords and Prince William Sound. The availability of these prey species largely determines the likeliest times for killer whales to be in the area. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area. However, anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s, possibly in response to declines in sea lion and harbor seal prey elsewhere.

One killer group of two individuals whale was observed during the 2015 SAE seismic program near the North Foreland. During NMFS aerial surveys, killer whales were observed in 1994 (Kamishak Bay), 1997 (Kachemak Bay), 2001 (Port Graham), 2005 (Iniskin Bay), 2010 (Elizabeth and Augustine Islands), and 2012 (Kachemak Bay). 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 Project area (Figure 3-4).

3.2.3.5 Gray Whale

In 1994, the Eastern North Pacific (ENP) Stock of gray whales was removed from the ESA in 1994 (59 FR 31094). The ENP is an estimated size of 20,990 animals, with an estimated minimum of 20,125.

Gray whales have been reported feeding near Kodiak Island, in southeastern Alaska, and south along the Pacific Northwest. Because most gray whales migrating through the Gulf of Alaska region are thought to take a coastal route, BIA boundaries for the migratory corridor in this region were defined by the extent of the continental shelf.

Most gray whales calve and breed from late December to early February in protected waters along the western coast of Baja California, Mexico. In spring, the ENP Stock of gray whales migrates approximately 8,000 km (5,000 miles) to feeding grounds in the Bering and Chukchi seas before returning to their wintering areas in the fall). Northward migration, primarily of individuals without calves, begins in February; some cow/calf pairs delay their departure from the calving area until well into April.

Gray whales approach the proposed Project Area in late March, April, May, and June, and leave again in November and December but migrate past the mouth of Cook Inlet to and from northern feeding grounds. Some gray whales do not migrate completely from Baja to the Chukchi Sea but instead feed in select coastal areas in the Pacific Northwest, including lower Cook Inlet .

Most of the population follows the outer coast of the Kodiak Archipelago from the Kenai Peninsula in spring or the Alaska Peninsula in fall. Though most gray whales migrate past Cook Inlet, small numbers have been noted by fishers near Kachemak Bay, and north of Anchor Point (BOEM 2015). During the NMFS aerial surveys, gray whales were observed in the month of June in 1994, 2000, 2001, 2005 and 2009 on the east side of Cook Inlet near Port Graham and Elizabeth Island but also on the west side near Kamishak Bay. One gray whale was sighted as far north at the Beluga River. Additionally, summering gray whales were seen offshore of Cape Starichkof by marine mammal observers monitoring Buccaneer's Cosmopolitan drilling program in 2013. During Apache's 2012 seismic program, nine gray whales were observed in June and July. During Apache's seismic program in 2014, one gray whale was observed. During SAE's seismic survey in 2015, no gray whales were observed. This species is unlikely to be seen in upper Cook Inlet but may be encountered in mid and lower Cook Inlet (**Error! Reference source not found.**).

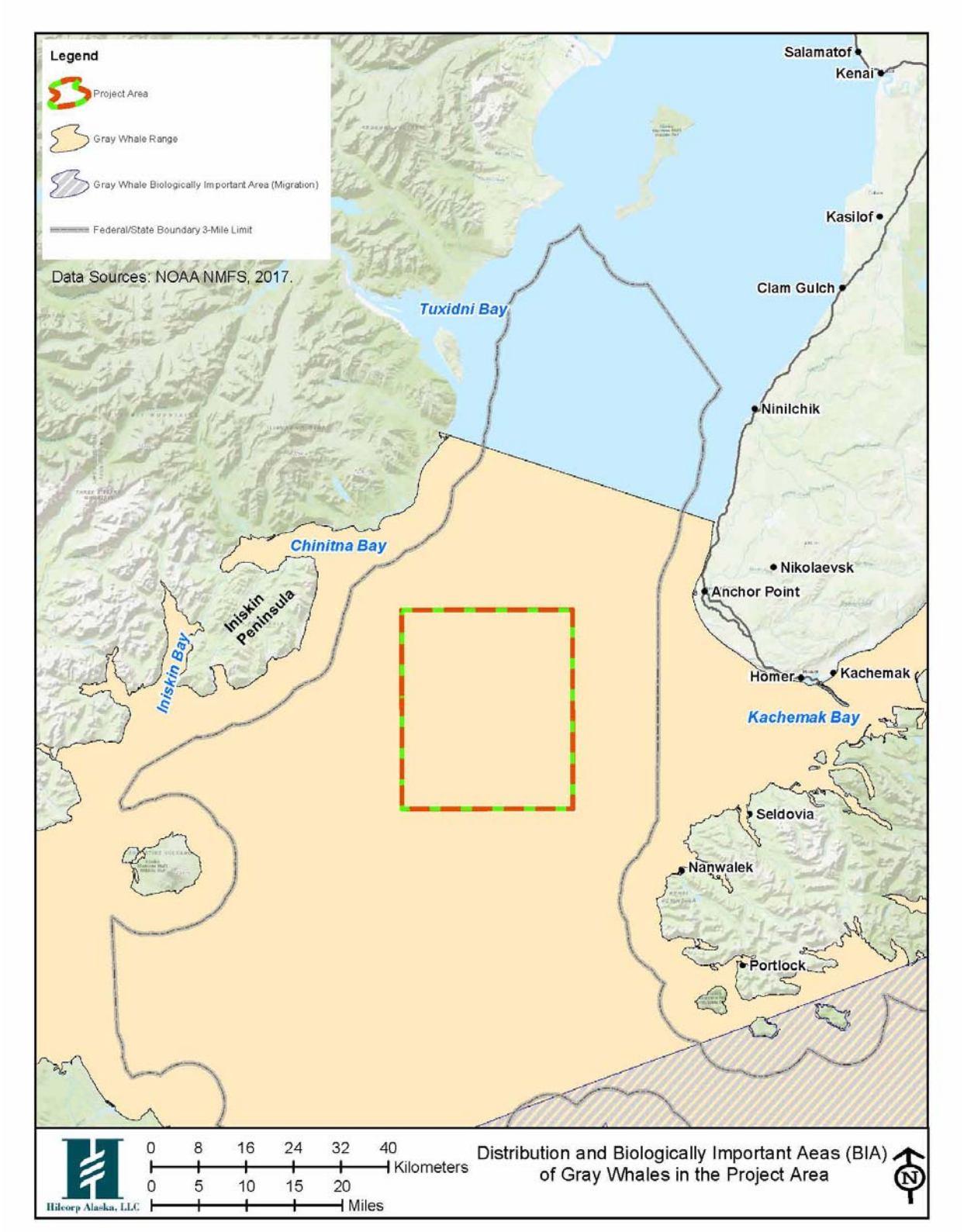


Figure 3-5 Distribution and BIA of gray whales in the project area

3.2.3.6 Cook Inlet Beluga Whale

The Cook Inlet beluga whale DPS is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically distinct from other Alaska populations, suggesting the Peninsula is an effective barrier to genetic exchange.

The Cook Inlet beluga whale population is estimated to have declined from 1,300 in the 1970s to about 340 in 2014. The current population estimate is 328. The precipitous decline documented in the mid-1990s was attributed to unsustainable subsistence practices by Alaska Native hunters (greater than 50 whales harvested per year). In 2006, the subsistence hunting ceased to protect the species.

NMFS listed the population as depleted in 2000 because of the decline and as endangered under the ESA in 2008 when the population failed to recover following a moratorium on subsistence harvest (65 FR 34590). In April 2011, NMFS designated critical habitat for the beluga whale under the ESA (76 FR 20180). NMFS finalized the conservation plan for the Cook Inlet beluga whale in 2008 (NMFS, 2008a). NMFS finalized the recovery plan for Cook Inlet beluga whales in 2016 (NMFS, 2016a).

The Cook Inlet beluga Stock remains within Cook Inlet throughout the year. Two areas, consisting of 7,809 km^2 (3,016 mi^2) of marine and estuarine environments considered essential for the species' survival and recovery were designated critical habitat. However, in recent years, the range of the beluga whale has contracted to the upper reaches of Cook Inlet because of the decline in population. Area 1 of the Cook Inlet beluga whale critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession (61.04°N, 150.37°W) and the mouth of Three Mile Creek (61.08.55°N, 151.04.40°W), including waters of the Susitna, Little Susitna, and Chickaloon rivers below mean higher high water. This area provides important habitat during ice-free months and is used intensively by Cook Inlet beluga whales between April and November (NMFS, 2016a).

Since 1993, NMFS has conducted annual aerial surveys in June, July, or August to document the distribution and abundance of beluga whales in Cook Inlet. The collective 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 had also been recorded farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but 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. Based on these aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be consistent from June to October.

Though Cook Inlet beluga whales can be found throughout the inlet at any time of year, generally, they spend the ice-free months in the upper Cook Inlet, shifting into the middle and lower Cook Inlet in winter. In 1999, one beluga whale was tagged with a satellite transmitter, and its movements were recorded from June through September of that year. Since 1999, 18 beluga whales in upper Cook Inlet have been captured and fitted with satellite tags to provide information on their movements during late summer, fall, winter, and spring. Using location data from satellite-tagged Cook Inlet belugas, one study found most tagged whales were in lower to middle Cook Inlet (70 to 100 percent of tagged whales) during January through March, near the Susitna River delta from April to July (60 to 90 percent of tagged whales), and in Knik Arm and Turnagain Arm from August to December.

During 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. Beluga whales in Cook Inlet are believed to mostly calve between mid-May and mid-July, and concurrently breed between late spring and early summer (NMFS, 2016a), primarily in upper Cook Inlet. Movement was correlated with the peak discharge of seven major rivers emptying into Cook Inlet. Boat-based surveys from 2005 to 2017, and initial results from passive acoustic monitoring across the entire inlet, also support seasonal patterns observed with other methods, and other surveys confirm Cook Inlet beluga whales near the Kenai River during summer months.

During summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay) where they feed on migrating eulachon (*Thaleichthys pacificus*) and salmon (*Onchorhyncus spp.*). Data from tagged whales (14 tags between July and March 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn. Critical Habitat Area 1 reflects this summer distribution (Figure 3-6).

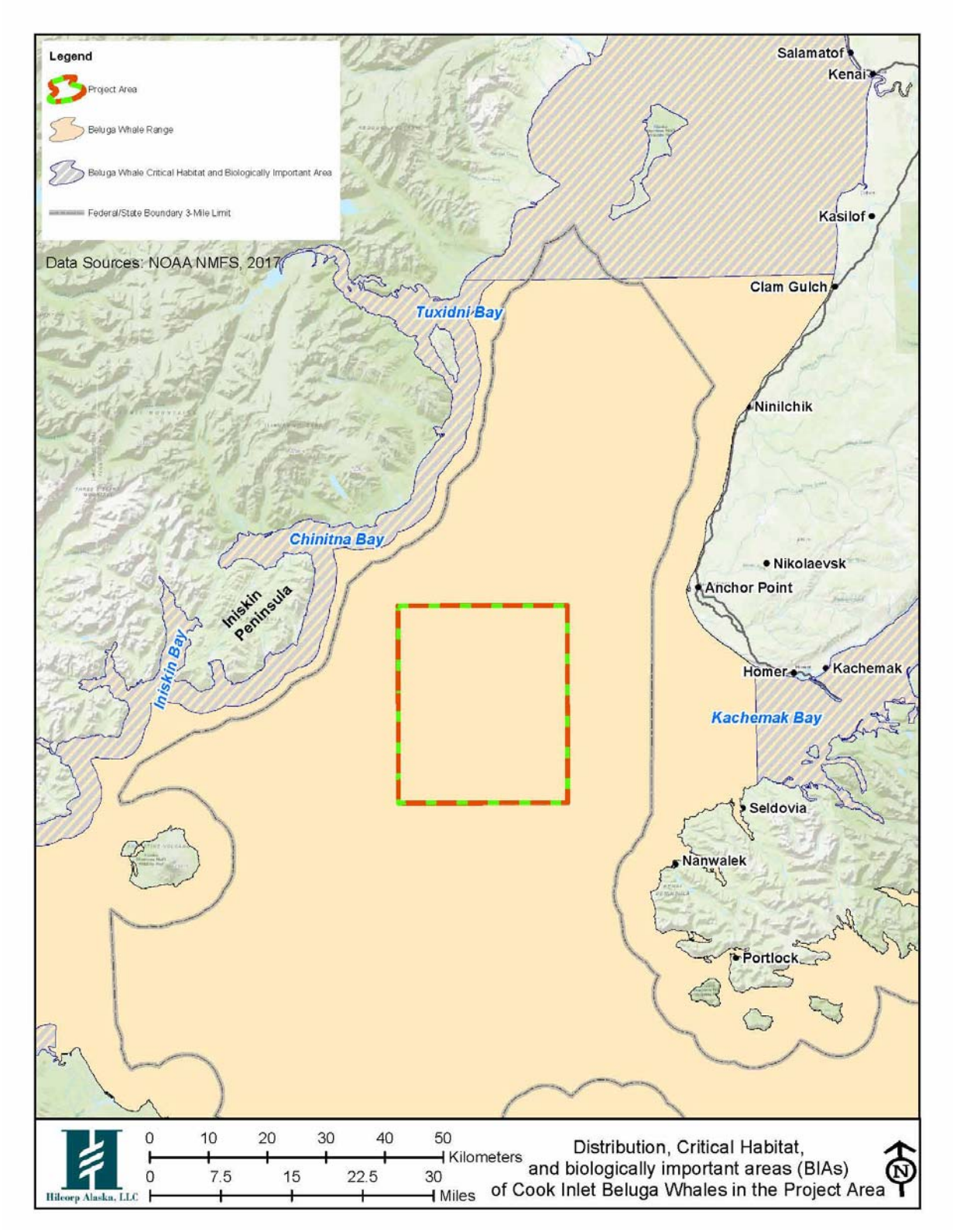


Figure 3-6 Distribution, critical habitat, and BIAs of Cook Inlet beluga whales in the project area

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. Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during winter months (November through April), with animals found between Kalgin Island and Point Possession. In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September. 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 despite ice cover greater than 90 percent.

During Apache's seismic test program in 2011 along the west coast of Redoubt Bay (lower Cook Inlet), a total of 33 beluga whales were sighted during the survey. During Apache's 2012 seismic program in mid-Cook Inlet, a total of 151 sightings of approximately 1,463 estimated individual beluga whales were observed. During SAE's 2015 seismic program, a total of eight sightings of approximately 33 estimated individual beluga whales were visually observed during this time period, and there were two acoustic detections of beluga whales.

There is one delineated "Small" and "Resident" BIA for Cook Inlet beluga whales. Small and Resident BIA's are defined as "areas and time within which small and resident populations occupy a limited geographic extent." The Cook Inlet beluga whale BIA in Figure 3-6 was delineated using the habitat model results of Goetz et al., 2012 and the critical habitat boundaries (76 FR 20180).

3.2.3.7 Harbor Porpoise

In Alaskan waters, three stocks of harbor porpoises are currently recognized for management purposes: Southeast Alaska, Gulf of Alaska, and Bering Sea stocks. Porpoises found in Cook Inlet belong to the Gulf of Alaska Stock, which are distributed from Cape Suckling to Unimak Pass and most recently was estimated to number 31,046 individuals. They are one of the three marine mammals (the other two being beluga whales and harbor seals) regularly seen throughout Cook Inlet, especially during spring eulachon and summer salmon runs.

Harbor porpoises are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA.

Harbor porpoises primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska, typically occurring in waters less than 100 m deep. The range of the Gulf of Alaska Stock includes the entire Cook Inlet, Shelikof Strait, and the Gulf of Alaska (Figure 3-7). Harbor porpoises have been reported in lower Cook Inlet from Cape Douglas to the West Foreland, Kachemak Bay, and offshore. Although they have been frequently observed during aerial surveys in Cook Inlet, most sightings are of single animals and are concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet and in upper Cook Inlet.

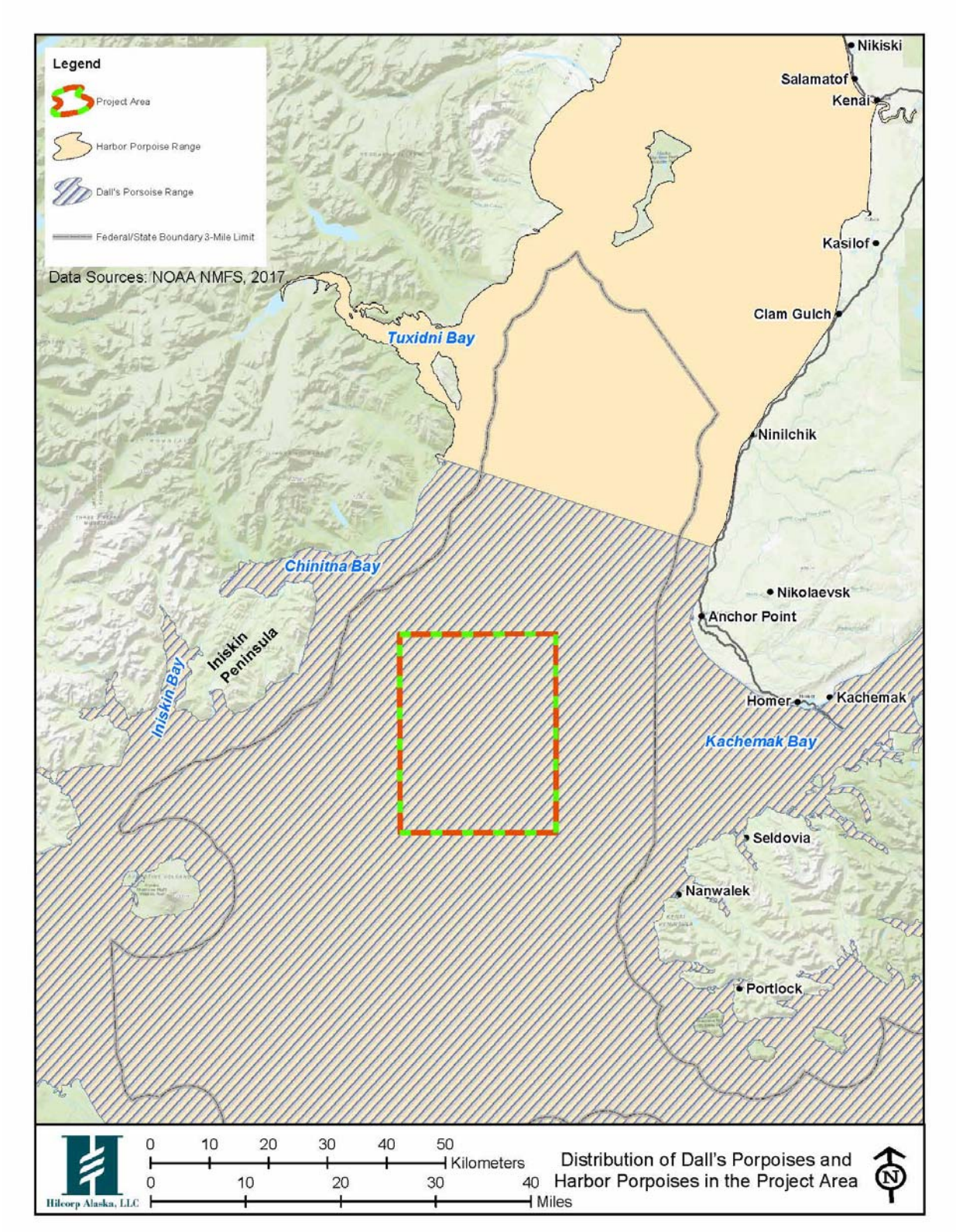


Figure 3-7 Distribution of Dall's porpoises and harbor porpoises in the project area

The occurrence of larger numbers of porpoise in the lower Cook Inlet may be driven by greater availability of preferred prey and possibly less competition with beluga whales, as belugas move into upper inlet waters to forage on Pacific salmon, *Oncorhynchus spp*., during summer months.

Mating probably occurs from June or July to October, with peak calving in May and June. 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 typical. NMFS aerial surveys between 1993 and 2016 have identified many harbor porpoise sightings throughout Cook Inlet. During Apache's 2012 seismic program, 137 sightings (190 individuals) were observed between May and August. During Apache's 2014 seismic survey, there were 77 groups of harbor porpoise, totaling 13 individuals identified from both vessels and aircraft during the month of May. During SAE's 2015 seismic survey, 52 sightings (65 individuals) were observed north of the Forelands.

Recent passive acoustic research in Cook Inlet by ADF&G and NMML have indicated that harbor porpoises occur more frequently than expected, particularly in the West Foreland area in the spring, although overall numbers are still unknown at this time. Because harbor porpoises have been observed throughout Cook Inlet during summer months, including mid-inlet waters, they represent one species that could be encountered during the proposed 3D seismic survey in Cook Inlet.

3.2.3.8 Dall's Porpoise

Dall's porpoises are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA. The abundance estimate for the Alaska Stock of Dall's porpoise is 83,400 animals, making it one of the more abundant cetaceans in Alaskan waters.

Dall's porpoises are widely distributed throughout the North Pacific Ocean including preferring deep offshore and shelf-slopes, and deep oceanic waters. The Dall's porpoise range in Alaska extends into the southern portion of the project area (Figure 3-7). Dall's porpoises are present year-round throughout their entire range in the northeast including the Gulf of Alaska, and occasionally the Cook Inlet area. This porpoise also has been observed in lower Cook Inlet, around Kachemak Bay, and rarely near Anchor Point (BOEM, 2015).

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. Dall's porpoises were observed (two groups, three individuals) during Apache's 2014 seismic survey, which occurred during summer months. Dall's porpoises were observed in June 1997 (Iniskin Bay), 1999 (Barren Island), and 2000 (Elizabeth Island, Kamishak Bay and Barren Island). Dall's porpoises have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point. One Dall's porpoise was observed in August, north of Nikiski in the middle of Cook Inlet, during SAE's 2015 seismic program.

3.2.3.9 Harbor Seal

No harbor seal stocks in Alaska are designated as depleted under the MMPA or listed as threatened or endangered under the ESA. Harbor seals are common in Alaskan waters, with statewide abundance estimates at 152,602. The Cook Inlet/Shelikof Stock, ranging from approximately Anchorage down along the south side of the Alaska Peninsula to Unimak Pass, is estimated at a stable 27,386.

In 2010, NMFS and their co-management partners, the Alaska Native Harbor Seal Commission, defined 12 separate stocks of harbor seals based largely on genetics. The harbor seal stocks present in or near the proposed project area include the Cook Inlet/Shelikof Stock. In 2006, the estimated abundance was 22,900, with a minimum population estimate of 21,896.

Harbor seals occupy a wide variety of habitats in freshwater and saltwater in protected and exposed coastlines and range from Baja California north along the west coasts of Washington, Oregon, and California, British Columbia, and Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands. Harbor seals are found throughout the entire lower Cook Inlet coastline, hauling out on beaches, islands, mudflats, and at the mouths of rivers where they whelp and feed.

The major haulout sites for harbor seals are located in lower Cook Inlet. The presence of harbor seals in upper Cook Inlet is seasonal. In Cook Inlet, seal use of western habitats is greater than use of the eastern coastline. NOAA has documented a strong seasonal pattern of more coastal and restricted spatial use during spring and summer for breeding, pupping, and molting, and more wide-ranging seal movements within and outside of Cook Inlet during winter months. Large-scale patterns indicate a portion of harbor seals captured in Cook Inlet move out of the area in the fall, and into habitats within Shelikof Strait, Northern Kodiak Island, and coastal habitats of the Alaska Peninsula where they are most concentrated in Kachemak Bay, across Cook Inlet toward Iniskin and Iliamna Bays, and south through the Kamishak Bay, Cape Douglas and Shelikof Strait regions.

A portion of the Cook Inlet seals move into the Gulf of Alaska and Shelikof Strait during winter months. Seals move back into Cook Inlet as the breeding season approaches and their spatial use is more concentrated around haulout areas. Some seals expand their use of the northern portion of Cook Inlet; however, in general, seals that were captured and tracked in the southern portion of Cook Inlet remained south of the Forelands. Important harbor seal haulout areas occur within Kamishak Bay and Kachemak Bay and along the coast of the Kodiak Archipelago and the Alaska Peninsula. Chinitna Bay, Clearwater and Chinitna creeks, Tuxedni Bay, Kamishak Bay, Oil Bay, Pomeroy Island, Iniskin Island, and Augustine Island are also important spring-summer breeding and molting areas and known haulout sites (Figure 3-8). Small-scale patterns of movement within Cook Inlet also occur. There are over 200 haulout sites recorded in lower Cook Inlet alone. However, only a few dozens to a couple hundred seals seasonally occur in upper Cook Inlet, mostly at the mouth of the Susitna River where their numbers vary in concert with the spring eulachon and summer salmon runs. The closest preferred harbor seal habitat to the project area is located near Anchor Point.

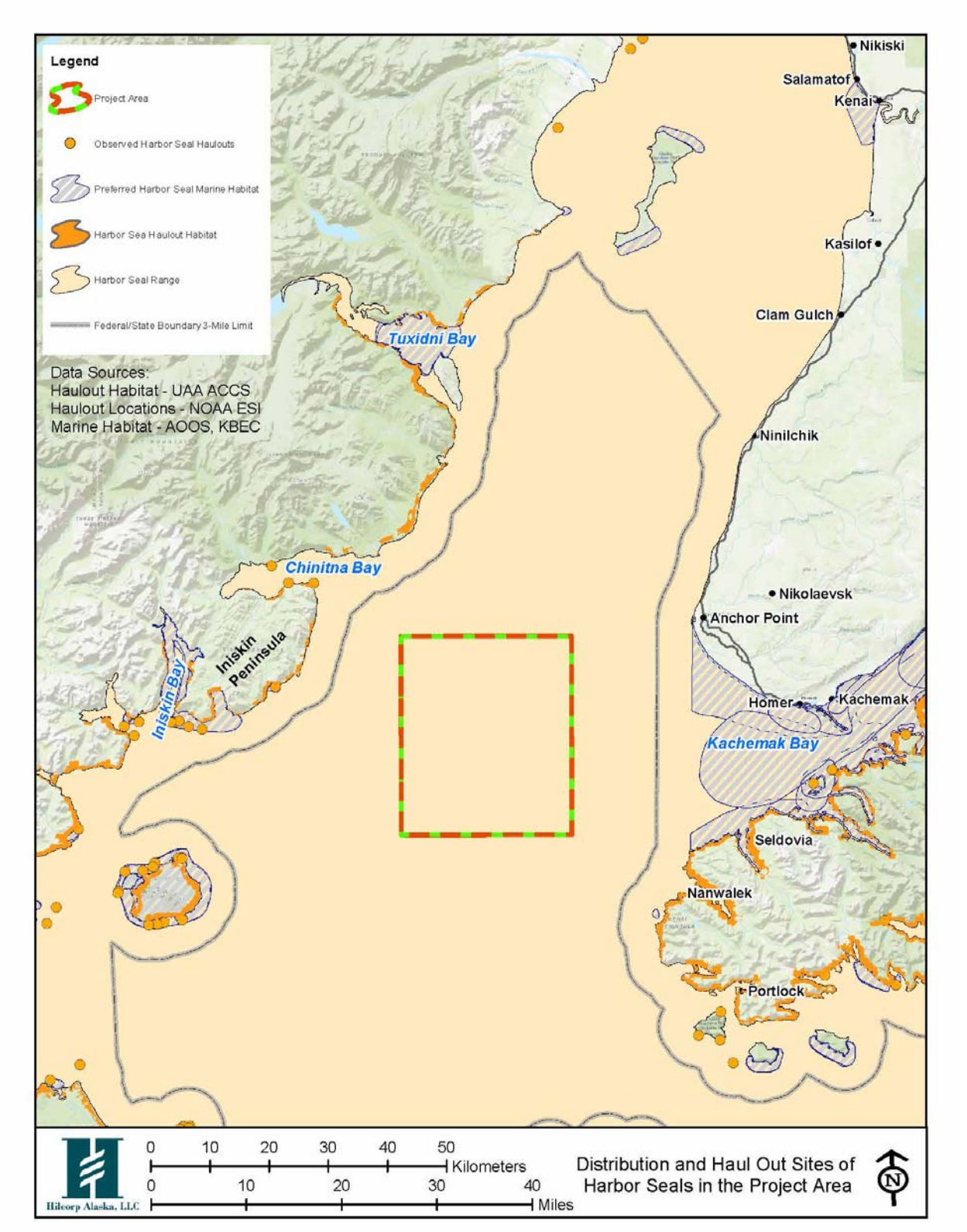


Figure 3-8 Distribution and haulout sites of harbor seals in the project area

The Cook Inlet/Shelikof Stock is distributed from Anchorage into lower Cook Inlet during summer and from lower Cook Inlet through Shelikof Strait to Unimak Pass during winter. Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay, and several haulout sites have been identified on the southern end of Kalgin Island in lower Cook Inlet.

NMFS aerial surveys have identified many harbor seals sightings throughout Cook Inlet: 1993 through 2012, 2014, and 2016. During Apache's 2012 seismic program, harbor seals were observed in the project area from early May until the end of the seismic operations in late September. Also in 2012, up to 100 harbor seals were observed hauled out at the mouths of the Theodore and Lewis rivers during monitoring activity associated with Apache's 2012 Cook Inlet seismic program. During Apache's 2014 seismic program, 492 groups of harbor seals (613 individuals) were observed; the highest sighting rate of any marine mammal observed was during the summer of 2014. During SAE's 2015 seismic survey, 823 sightings (1,680 individuals) were observed north and between the Forelands.

3.2.3.10 Steller Sea Lion

The Western DPS (WDPS) Stock of Steller sea lions most likely occurs in Cook Inlet (78 FR 66139). The center of abundance for the WDPS of Steller sea lions is considered to extend from Kenai to Kiska Island (NMFS, 2008a). The WDPS of the Steller sea lion is defined as all populations west of longitude 144°W to the western end of the Aleutian Islands. The range of the WDPS includes 38 rookeries and hundreds of haulout sites. Only the WDPS Stock is addressed in this EED. The most recent comprehensive aerial photographic and land-based surveys of WDPS Steller sea lions in Alaska were conducted during the 2014 and 2015 breeding seasons. WDPS Steller sea lion pup and non-pup counts in 2015 in Alaska were estimated to be 12,492 and 38,491, respectively, which total 50,983 and is used as the minimum population estimate for the U.S. portion of the WDPS of Steller sea lions.

The WDPS of Steller sea lions is currently listed as endangered under the ESA (55 FR 49204) and designated as depleted under the MMPA. Critical habitat was designated on August 27, 1993 (58 FR 45269), south of the proposed project area in the Cook Inlet region (Figure 3-9). The critical habitat designation for the WDPS of Steller sea lions was determined to include a 37 km (20 nautical miles) buffer around all major haulout sites and rookeries, and associated terrestrial, atmospheric, and aquatic zones, plus three large offshore foraging areas. NMFS also designated no entry zones around rookeries (50 CFR 223.202). Designated critical habitat is located outside Cook Inlet at Gore Point, Elizabeth Island, Perl Island, and Chugach Island (NMFS, 2008b).

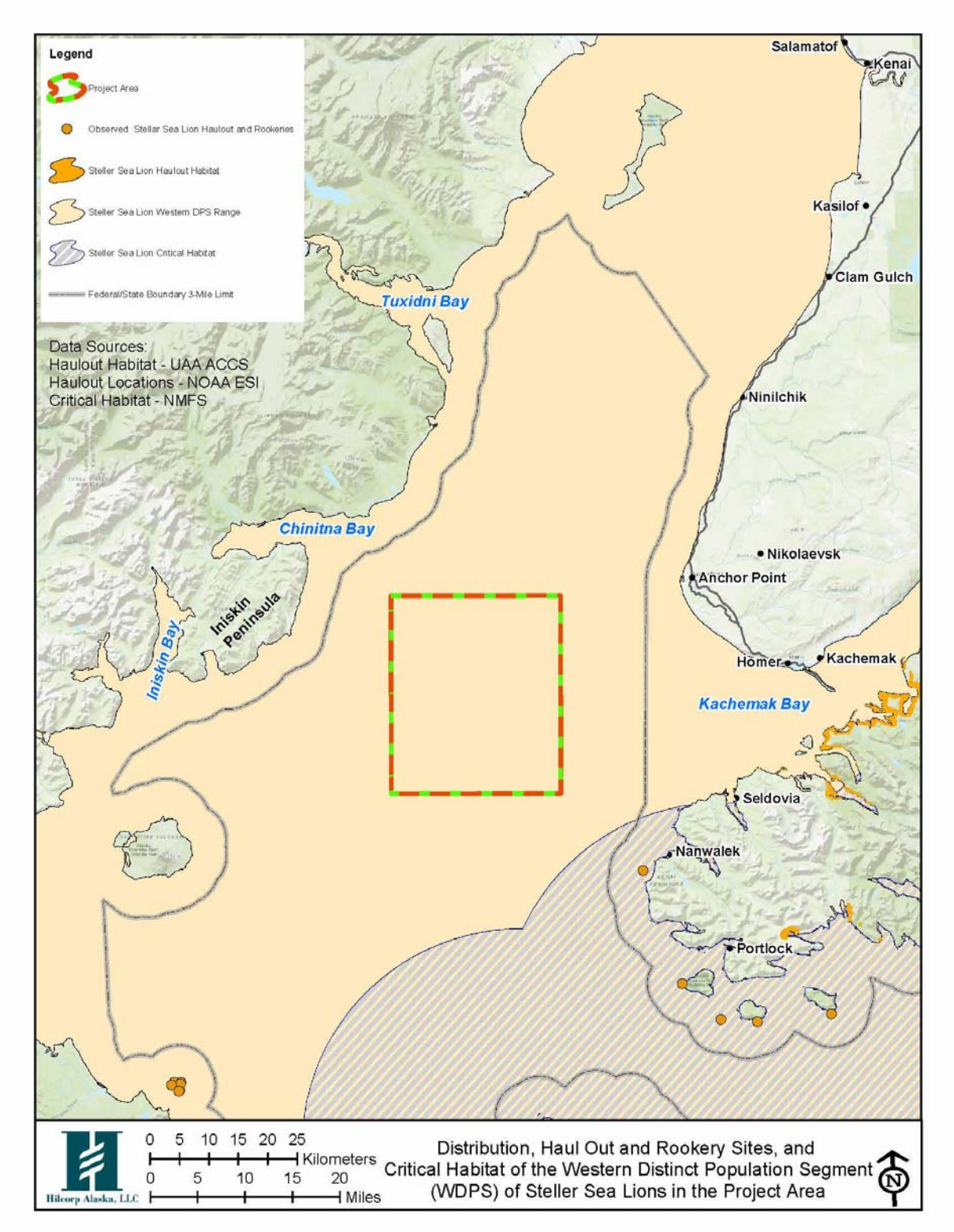


Figure 3-9 **Distribution, haulout and rookery sites, and critical habitat of the WDPS of Steller sea lions in the project area**

The geographic center of Steller sea lion distribution is the Aleutian Islands and the Gulf of Alaska, although as the WDPS has declined, rookeries in the west became progressively smaller (NMFS, 2008b). Steller sea lion habitat includes terrestrial sites for breeding and pupping (rookeries), resting (haulouts), and marine foraging areas. Nearly all rookeries are at sites inaccessible to terrestrial predators on remote rocks, islands, and reefs.

Steller sea lions inhabit lower Cook Inlet, especially near Shaw Island and Elizabeth Island (Nagahut Rocks) haulout sites, but are rarely seen in upper Cook Inlet. 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.). Portions of the southern reaches of the lower inlet are designated as critical habitat, including a 20-nautical-mile buffer around all major haulout sites and rookeries. Rookeries and haulout sites in lower Cook Inlet include those near the mouth of the inlet, which are far south of the project area.

Steller sea lions feed largely on walleye pollock (*Theragra chalcogramma*), salmon (*Onchorhyncus spp*.), and arrowtooth flounder (*Atheresthes stomias*) during summer, and walleye pollock and Pacific cod (*Gadus macrocephalus*) during winter, none of which, except for salmon, are found in abundance in upper Cook Inlet.

Steller sea lions can travel considerable distances. Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late May to early July). Most adult Steller sea lions inhabit rookeries during the breeding season (late May to early July); some juveniles and non-breeding adults occur at or near rookeries during the breeding season, but most are on haulouts. Adult males may disperse widely after the breeding season and during fall and winter; many sea lions increase use of haulouts, especially terrestrial sites, but also on sea ice in the Bering Sea (NMFS, 2008b).

Steller sea lions have been observed during marine mammal surveys conducted in Cook Inlet. In 2012, during Apache's 3D seismic surveys, there were three sightings of approximately four individuals in upper Cook Inlet. Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof observed seven Steller sea lions during the summer of 2013. During SAE's 3D seismic survey program in 2015, four Steller sea lions were observed in Cook Inlet. One sighting occurred between the West and East Forelands, one near Nikiski and one northeast of the North Foreland in the center of Cook Inlet. During NMFS's Cook Inlet beluga whale aerial surveys from 2000 to 2016, there were 39 sightings of 769 estimated individual Steller sea lions in lower Cook Inlet . Sightings of large congregations of Steller sea lions during NMFS aerial surveys occurred outside the project area, on land in the mouth of Cook Inlet (e.g., Elizabeth and Shaw Islands).

3.2.3.11 California Sea Lion

There is limited information on the presence of California sea lions in Alaska. From 1973 to 2003, a total of 52 California sea lions were reported in Alaska, with sightings increasing in the later years. Most sightings occurred in the spring, however, they have been observed during all seasons. California sea lion presence in Alaska was correlated with increasing population numbers within their southern breeding range.

California sea lions in the U.S. are not listed as endangered or threatened under the ESA or as depleted under the MMPA. The total human-caused mortality of this stock is considered to be insignificant and approaching zero mortality and serious injury rate. California sea lions are not considered strategic under the MMPA, and no critical habitat has been designated or proposed for California sea lions.

California sea lions are distributed along the North Pacific waters from central Mexico to southeast Alaska, with breeding areas on islands located in southern California, western Baja California, and the Gulf of California. There

are five genetically distinct geographic populations: Pacific Temperate, Pacific Subtropical, Southern Gulf of California, Central Gulf of California, and Northern Gulf of California. Animals from the pacific temperate population range into Canadian waters and beyond.

There have been relatively few California sea lions observed in Alaska, occurring during the spring and not typically farther north than southeast Alaska. Most are often alone or occasionally in small groups of two or more and associated with Steller sea lions at their haulouts and rookeries. Sightings are very rare in Cook Inlet. and have not been observed during the annual NMFS aerial surveys in Cook Inlet. However, a sighting of two California sea lions was documented during for the Apache 2012 seismic survey. Additionally, NMFS' anecdotal sighting database has four sightings in Seward and Kachemak Bay.

3.2.3.12 Northern Sea Otter

The northern sea otter is the smallest marine mammal species and a member of the weasel family (*Mustelidae*) (USFWS, 2005). They are the only marine mammal that does not rely on blubber for insulation; sea otters' dense waterproof undercoats contain more follicles per square inch than any other mammal, and keep air bubbles trapped close to their bodies for heat retention (ADF&G, 2008). Sea otters forage in nearshore waters at depths around 40 m. They spend approximately 40 percent of their daily activity foraging and primarily feed on benthic invertebrates, including; mussels, crabs, urchins, sea cucumbers, and clams. Red sea cucumbers (*Parastichopus californicus*) and sea urchins (*Strogylocentrotus* spp.), found among shell debris, are also important otter prey.

Northern sea otter populations in Cook Inlet are generally confined to lower Cook Inlet, or south of the Forelands to the inlet mouth between English Bay and Cape Douglas (Hilcorp, 2018b). Northern sea otters are non-migratory and occur year-round throughout lower Cook Inlet in nearshore coastal waters, typically within 40 m deep, to maintain consistent access to benthic foraging habitat. Although individuals can cover long distances (greater than 100 km), movement is generally restricted by geography, energy requirements, and social behavior; and individuals tend to remain within a home range of less than 30 km^2. Sea otter movement is also affected by tidal and wind patterns, and inclement weather. Storm conditions often cause otters to seek shelter in protected bays, inlets, or lees; however, in calmer conditions, otters may be sighted farther from the shore. If transiting through open water, otters may be seen rafting together.

Three sea otter populations are identified in Alaska, including southeast, southcentral, and southwest. Of these, two distinct stocks occur in lower Cook Inlet; the Southwest Alaska Stock and the Southcentral Alaska Stock.

The Southwest Alaska Stock is listed as threatened under the ESA, and ranges along the western shore of lower Cook Inlet and throughout Alaska Peninsula and Bristol Bay coasts, as well as the Aleutian, Barren, Kodiak, and Pribilof islands (USFWS, 2014a). Overall, the current population abundance estimate for the Southwest Alaska Stock is 45,064 otters, and the population seems to be stable (USFWS, 2014b). A 15,164 km^2 critical habitat area was designated for the southwest Alaska distinct population segment (DPS) in 2009 (74 FR 51988), and in 2013 the most recent five-year status review of the Southwest Alaska DPS was published, in which USFWS recommended no change in status of the population (78 FR 24767; USFWS, 2013. The Hilcorp project area does not overlap the Southwest Alaska DPS critical habitat area.

The non-listed Southcentral Alaska Stock extends from Cape Yakataga to the eastern shoreline of lower Cook Inlet, including Prince William Sound, Kachemak Bay, and the Kenai Peninsula coast (USFWS, 2014a) and is mostly localized to Kachemak Bay and south and east of Prince William Sound. (USFWS, 2005). The combined population

estimates from aerial surveys produces the current total estimate of 18,297 sea otters for the Southcentral Alaska Stock (USFWS, 2014a). Overall abundance assessments show a stable or increasing trend (USFWS, 2014a), and the Kachemak Bay population in particular experienced a 26 percent annual increase between 2002 and 2008. Except at Kachemak Bay, this stock typically occurs at low densities throughout its range (USFWS, 2014b).

The habitat range for the Southwest and Southcentral sea otter stocks overlap in the Hilcorp project area (Figure 3-10), therefore both or either stocks of otters may be encountered. The Hilcorp geophysical project area is situated in central lower Cook Inlet and also predominantly within transects categorized as low otter density. The Hilcorp planned project area falls within the Bodkin et al. (2003) "low density" transect area (water 40 to 100 m deep), in which only one otter was sighted during the 70 total hours of survey time. Most of the surveys were conducted between May 22 and June 6, 2002. NMFS has conducted annual beluga whale aerial surveys over Cook Inlet for most years since 1991. The most recent survey was performed in 2016 and recorded 102 sea otter sightings, or 1,835 animals, of which 19 sightings (69 total otters, or 3.7 percent of the total animals counted) were recorded "mid-inlet off Kachemak Bay," which is the area nearest to/intersecting the proposed Hilcorp 3D seismic survey area. USFWS conducted aerial surveys in May 2017 within three density units in lower Cook Inlet (Figure 3-10); Kachemak Bay, Western Cook Inlet (includes upper west Cook Inlet and Kamishak Bay), and Eastern Cook Inlet (includes upper east Cook Inlet and outer Kenai). Of these, the Western and Eastern Cook Inlet survey units have areas that overlap the project area. The Western Cook Inlet survey yielded a total unit abundance estimate of 10,737 sea otters. The unit was divided at Chinitna Point into two density regions; Upper West Cook Inlet to the north, which yielded a density estimate of 0.026 sea otters per km^2, and Kamishak Bay to the south, which yielded a density estimate of 3.53 sea otters per km^2. The Kamishak Bay area does not overlap the proposed project region. The Eastern Cook Inlet unit yielded a density estimate of 1.71 sea otters per km^2. Excluding Kachemak Bay, the total population estimate for lower Cook Inlet from the 2017 surveys was 13,901 animals.

Based on otter habitat preferences, it is unlikely that the proposed work will encounter many otters due to its location outside nearshore ranges.

Sea otter reactions to the planned seismic survey are expected to be localized and confined to relatively small distances and durations, with no long-term effects on individuals or populations. Otters are only exposed to underwater noise while foraging, which comprises about 40 percent of daily activity; thus, the level of exposure is further limited by short dives. The planned seismic survey will not likely affect sea otters because the proposed project is located outside of critical habitat, and mitigation measures described will be implemented to reduce the impacts on sea otters from noise associated with the seismic activity.

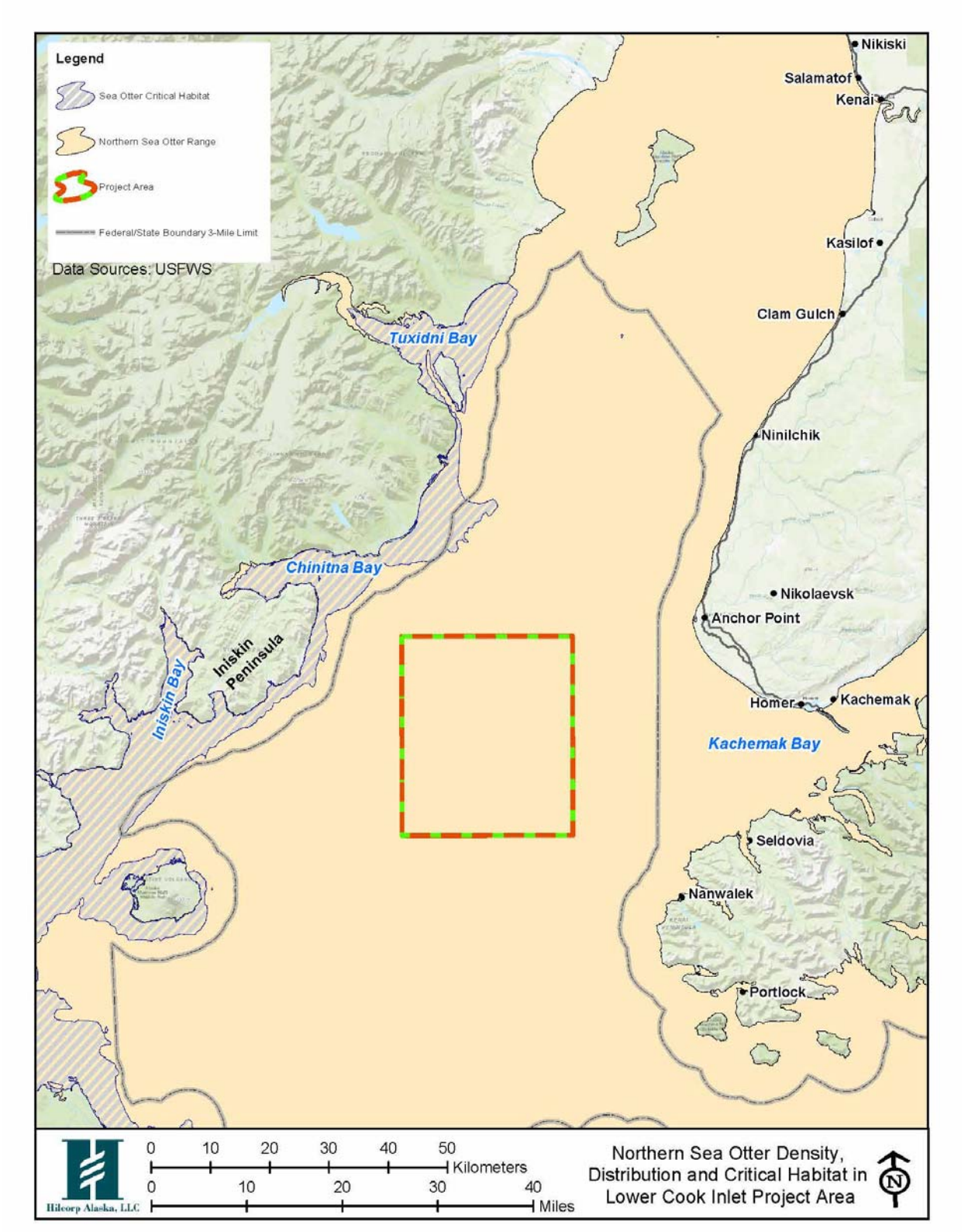


Figure 3-10 Northern sea otter density distribution and critical habitat in lower Cook Inlet project area

3.2.3.13 General Effects of Noise on Marine Mammals

Marine mammals use hearing and sound transmission to perform vital life functions. Introducing sound into their environment could be disruptive to those functions. Sound (hearing and vocalization/echolocation) serves four primary functions for marine mammals, including: 1) providing information about their environment, 2) communication, 3) prey detection, and 4) predator detection. The distance to which noise is audible depends on source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the receptor.

The effects of sounds from anthropogenic sound sources on marine mammals might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and temporary or permanent hearing impairment, or non-auditory physical effects. In assessing potential effects of noise, Richardson et al. (1995) has suggested four criteria for defining zones of influence. These zones are described below from greatest influence to least:

Zone of hearing loss, discomfort, or injury – the area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. This includes temporary loss in hearing or loss in hearing at specific frequencies or deafness. Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage.

Zone of masking – the area within which the noise may interfere with detection of other sounds, including communication calls, prey sounds, or other environmental sounds.

Zone of responsiveness – the area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound is dependent on a number of factors, including: 1) acoustic characteristics the noise source of interest, 2) physical and behavioral state of animals at time of exposure, 3) ambient acoustic and ecological characteristics of the environment, and 4) context of the sound (e.g., whether it sounds similar to a predator). However, temporary behavioral effects are often simply evidence that an animal has heard a sound and may not indicate lasting consequence for exposed individuals.

Zone of audibility – the area within which the marine mammal might hear the noise. Marine mammals as a group have functional hearing ranges of 10 Hertz (Hz) to 180 kiloHertz (kHz), with best thresholds near 40 decibels (dB); northern sea otters have a functional hearing range of 60 Hz to 39 kHz, with highest sensitivity between 2 and 16 kHz (NMFS, 2016b). There are no applicable criteria for the zone of audibility due to difficulties in human ability to determine the audibility of a particular noise for a particular species.

3.2.3.14 Potential Effects of Proposed Survey Sounds on Marine Mammals

The following text describes the potential impacts on marine mammals due to seismic activities. Seismic operations will be active 24 hrs per day for a 60- to 70-day period as described in Section 2.2.

Most of Cook Inlet is a poor acoustic environment because of its shallow depth, soft bottom, and high background noise from currents and glacial silt, which greatly reduces the distance sound travels. Due to the implementation of mitigation and monitoring measures discussed in Section 4, it is unlikely there would be any temporary or especially permanent hearing impairment, or non-auditory physical effects on marine mammals.

There are three primary sound components associated with the proposed survey: the airgun array, the echosounder for bathymetry collection, and acoustic units/lateral birds for streamer positioning. The echosounder will have a frequency above 200 kHz. NMFS does not consider sounds over 200 kHz to be harmful to marine mammals and therefore no impacts are expected as a result of echosounder use. The streamer positioning system emits a very small pulse for positioning the streamers of 0.1 ms in duration at a frequency range of 50 to 100 kHz. The streamer positioning system will only be active during data acquisition activities (when the entire array is operating) and is designed to ping at the same times as the airguns. Because of the size and timing of the streamer positioning system operation, the sound generated is expected to be masked by the airgun array.

Tolerance

Studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers, but they do not necessarily cause behavioral disturbances. Stone and Tasker (2006) suggests that the different species of cetaceans may adopt different strategies for responding to sound exposure from seismic surveys. For example, some small odontocetes typically move out of the immediate area, while slower-moving mysticetes orient away from the vessel and increase their distance from the source but do not vacate the area. Some studies have shown that marine mammals at distances over a few kilometers from operating seismic vessels often show no apparent response. That is often true even when pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to temporarily react behaviorally to airgun pulses under some conditions, at other times they have shown no overt reactions. However, there is some evidence that increased noise increases stress in right whales, which results in unknown long-term effects on marine mammals. In general, pinnipeds and small odontocetes are more tolerant of exposure to airgun pulses than baleen whales.

Masking

Masking occurs when louder sounds interfere with marine mammal vocalizations or ability to hear natural sounds in their environment, which limit their ability to communicate or avoid predation or other natural hazards. Masking of marine mammal calls and other natural sounds are expected to be limited in the presence of seismic noise, although there are very few specific data of relevance. Some whales are known to continue calling in the presence of seismic pulses; their calls can be heard between seismic pulses. Masking effects of seismic pulses are expected to be negligible in the case of the odontocete cetaceans, given the intermittent nature of seismic pulses. Also, the sounds important to small odontocetes are predominantly at much higher frequencies than airgun sounds. Therefore, the potential problem of auditory masking for beluga whales is diminished by the small amount of overlap between frequencies produced by seismic and other industrial noise (less than1 kHz) and frequencies that beluga whales call (0.26 to 20 kHz) and echolocate (40 to 60 kHz and 100 to 120 kHz). Additionally, beluga whales have been known to change their vocalizations in the presence of high background noise, possibly to avoid masking calls.

Disturbance Reactions

Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, environmental conditions, and many other factors. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a short distance, the impacts of the change are unlikely to be significant to the individual, let alone to the stock or to the species as a whole. However, if a sound source

displaces marine mammals from an important feeding or breeding area for a prolonged period, which is not anticipated in the proposed seismic program, impacts on the animals could be significant.

Given the many uncertainties in predicting the quantity and types of impacts of sound on marine mammals, it is common practice to estimate how many mammals were present within a particular distance of industrial activities, or exposed to a particular level of industrial sound to assess behavioral disturbance. The uncertainties in this approach include the differences in how individuals respond to sound, differences in behavioral states and responses therein, or movement of the animal away from the source. However, this procedure likely overestimates the numbers of marine mammals that are affected in some biologically important manner.

The sound criteria used to estimate how many marine mammals might be disturbed to some biologically important but unknown degree by a seismic program are based on behavioral observations during studies of several species. However, information is largely lacking for many species, including those species likely to occur in the project areas. Detailed studies have been done on other species found elsewhere in Alaska waters, including gray whales, bowhead whales, and ringed seals.

The criteria established for these marine mammals, which are applied to others are conservative and have not been demonstrated to significantly affect individuals or populations of marine mammals in Alaska waters. Therefore, the effect of the 3D seismic survey program on the behavior of marine mammals should be no more than negligible for reasons stated earlier.

Baleen Whales. Humpbacks, gray whales, and other large baleen whales, have shown strong overt reactions to impulsive noises, such as seismic operations, at received levels between 160 and 173 decibels relative to 1 microPascal root mean square (dB re 1 µPa rms). However, baleen whales seem to be less tolerant of continuous noise, often detouring around drilling activity when received levels are as low as 119 dB re 1 µPa rms. Based on the previously cited studies, NMFS developed the 120 dB re 1 µPa rms harassment criteria for continuous noise sources.

Ship noise due to propeller cavitation can cause behavioral changes by baleen whales. Humpback whales show a general avoidance behavior to cruise ships and tankers at distance from 2 to 4 km, but no reaction at distances beyond 800 m when the whales were feeding. Also, humpback whales are especially responsive to fast moving vessels, exhibiting aerial behaviors such as breaching or tail/flipper slapping. However, temporarily disturbed whales often remain in the area despite the presence of vessels.

Based on the information regarding baleen whale disturbance reactions and that baleen whales are rarely present in the project area, some baleen whales may exhibit minor, short-term disturbance responses to underwater sounds from seismic activities. Any potential impacts on baleen whale behavior would be localized within the project area and would not result in population-level effects.

Toothed Whales. Little systematic information is available about reactions of beluga whales, killer whales, and harbor porpoises to noise pulses. Beluga whales exhibit changes in behavior when exposed to strong, pulsed sounds similar in duration to those typically used in seismic surveys. However, the animals tolerated high received levels of sound (peak–peak level greater than 200 dB re 1 µPa) before exhibiting aversive behaviors. Some belugas summering in the eastern Beaufort Sea may have avoided the specific area of seismic operations (2 arrays with 24 airguns per array), which used a larger array than the proposed program (2 arrays of 16 airguns per array), by 10 to 20 km, although beluga whales occurred as close as 1,540 m to the line of seismic operations.

Observers stationed on seismic vessels operating off the United Kingdom from 1997 to 2000 have provided data on the occurrence and behavior of various toothed whales exposed to seismic pulses. Killer whales were found to be significantly farther from large airgun arrays during periods of shooting compared to periods of no shooting. The displacement of the median distance from the array was approximately 0.5 km (0.3 miles) or more. Killer whales also appear to be more tolerant of seismic shooting in deeper water.

The proposed 3D seismic survey program may affect beluga whales in the project area; however, the seismic activity is short-term, localized, and will implement mitigation described in Section 4 to reduce impacts from noise associated with the seismic activity on beluga whales. Killer whales are rare to uncommon in Cook Inlet, therefore, the planned 3D seismic survey program should have no more than a negligible impact on killer whales and no effect on the population. Harbor porpoises are rarely sighted, but have been detected acoustically throughout Cook Inlet. However, based on the relatively few animals observed, the planned 3D seismic survey program should have no more than a negligible impact and no effect on the population.

Pinnipeds. While there are no published data on seismic effect on sea lions or harbor seals, anecdotal data and data on arctic seals indicate that sea lions and other pinnipeds generally tolerate strong noise pulses. Monitoring studies in the Alaskan and Canadian Beaufort seas during 1996 to 2002 provided considerable information regarding behavior of arctic seals exposed to seismic pulses. These seismic projects usually involved arrays of 6 to 16, with as many as 24 airguns with total volumes of 560 to 1500 in^3. The combined results suggest that some seals avoid the immediate area around seismic vessels. In most survey years, ringed seal sightings tended to be farther away from the seismic vessel when the airguns were operating than when they were not. However, these avoidance movements were relatively small, on the order of 100 m (328 ft) to (at most) a few hundred meters, and many seals remained within 100 to 200 m (328 to 656 ft) of the trackline as the operating airgun array passed by them.

Seal sighting rates at the water surface were lower during airgun array operations than during no-airgun periods in each survey year except 1997. There have also been reported higher sighting rates during non-seismic than during line seismic operations, but there was no difference for mean sighting distances during the two conditions, nor was there evidence that ringed or bearded seals were displaced from the area by the operations. The operation of the airgun array had minor and variable effects on the behavior of seals visible at the surface within a few hundred meters of the array. The behavioral data from these studies indicated that some seals were more likely to swim away from the source vessel during periods of airgun operations and more likely to swim towards or parallel to the vessel during non-seismic periods. No consistent relationship was observed between exposure to airgun noise and proportions of seals engaged in other recognizable behaviors, e.g., “looked” and “dove.” Such a relationship might have occurred if seals seek to reduce exposure to strong seismic pulses, given the reduced airgun noise levels close to the surface where “looking” occurs.

Consequently, by using the responses of bearded, ringed, and spotted seals to seismic operations as surrogates for harbor seals and sea lions, it is reasonable to conclude that the relatively small numbers relative to the population size of harbor seals and the even smaller numbers of Steller sea lions possibly occurring in the project area during seismic operations are not likely to show a strong avoidance reaction to the proposed airgun sources. Pinnipeds frequently do not avoid the area within a few hundred meters of operating airgun arrays, even for airgun arrays much larger than that planned for the proposed project. Reactions are expected to be localized and confined to relatively small distances and durations, with no long-term effects on individuals or populations.

Strandings and Mortality

There is no evidence in the literature that airgun pulses can cause serious injury, death, or stranding of marine mammals, even in the case of larger airgun arrays than planned for the proposed 3D seismic survey program (76 FR 58473; Hilcorp 2018a). Seismic surveys have been referenced as possible causes of marine mammal strandings, but the evidence is inconclusive (71 FR 43112). While strandings have been associated with military mid-frequency sonar pulses, Hilcorp does not plan to use such sonar systems during the seismic survey. Seismic pulses and military mid-frequency sonar pulses are quite different. Sounds produced by airgun arrays are broadband, with most of the energy below 1 kHz. In addition, strandings associated with sound exposure have not been documented in Cook Inlet (76 FR 58473).

Noise-Induced Threshold Shift

Animals exposed to intense sound may experience reduced hearing sensitivity for some period of time following exposure. This increased hearing threshold is known as noise-induced threshold shift (TS). The amount of TS incurred in the animal is influenced by a number of noise exposure characteristics, such as amplitude, duration, frequency content, temporal pattern, and energy distribution. It is also influenced by characteristics of the animal, such as behavior, age, history of noise exposure, and health. The magnitude of TS generally decreases over time after noise exposure, and if it eventually returns to zero, it is known as temporary threshold shifts (TTS). If TS does not return to zero after some time (generally on the order of weeks), it is known as permanent threshold shift (PTS). TTS is not considered to be auditory injury and does not constitute "Level A Harassment," as defined by the MMPA. Sound levels associated with TTS onset are generally considered to be below the levels that will cause PTS, which is considered to be auditory injury.

TTS has been studied in captive odontocetes and pinnipeds. Data are available for three cetacean species (bottlenose dolphin [*Tursiops truncatus*], beluga whale, and harbor porpoise) and three pinniped species (harbor seal, California sea lion [*Zalophus californianus*], and Northern elephant seal [*Mirounga angustirostris*]). However, these data have been collected from captive animals and no documentation exists for TTS or PTS in free ranging marine mammals exposed to airgun pulses. Inner ears of beluga and bowhead whales examined shortly after being taken in subsistence hunts show little to no evidence of auditory trauma sustained pre-mortem. Beluga whales show some acoustic trauma, though not substantial enough to have caused deafness and not attributed to a specific sound source.

Many marine mammal species avoid ships and/or seismic operations. This behavior in and of itself should be sufficient to avoid TTS onset. In addition, monitoring and mitigation measures often implemented during seismic surveys are designed to detect marine mammals near the airgun array and avoid exposing them to sound pulses that may cause hearing impairment. For example, it is standard protocol for many seismic operators to ramp up airgun arrays, which should allow animals near the airguns at startup time to move away from the source and thus avoid TTS. If animals do incur TTS, it is a temporary and reversible phenomenon unless exposure exceeds the TTS-onset threshold by an amount sufficient to cause PTS.

It is also unlikely that a marine mammal would remain close enough to a large airgun array long enough to incur PTS. Some concern arises for bowriding dolphins; however, the auditory effects of seismic pulses are reduced by Llyod's mirror and surface release effects. In addition, the presence of the ship between the bowriding animals and the airgun array may also reduce received levels. As discussed in the ITR Petition, the levels of successive pulses received by a marine mammal will increase and then decrease gradually as the seismic vessel approaches, passes,

and moves away, with periodic decreases also caused when the animal goes to the surface to breathe, reducing the probability of the animal's exposure to sound levels large enough to elicit PTS.

3.2.4 Birds

Over 450 species of birds are found in Alaska, most of which can be found in the Cook Inlet area, either as residents or migrating through. These include passerines, raptors, seabirds, waterfowl, and shorebirds (ADNR, 2009). Cook Inlet provides an important resting and staging area for migrating birds, as well as breeding and nesting habitat for over 100 species of marine and coastal birds (waterfowl, shorebirds, and seabirds).

Birds migrating to and from breeding areas along the Pacific Flyway may be present in the Cook Inlet area. Large numbers of waterfowl and shorebirds use Cook Inlet coastal areas as stop-over areas. During migrations, large numbers of birds arrive typically in early May and depart in mid-to-late May. Bird density is lower in summer because most shorebirds and waterfowl continue to summer nesting grounds. Bird densities increase during the fall migration; however, they are approximately half those during the spring migration (BOEM, 2016).

The lower Cook Inlet is important for seabirds due to the shallow coastal areas that support high densities of forage fish. Seabirds tend to nest in colonies on islands and bluffs. Important nesting sites in the Cook Inlet area include Chisik Island and Duck Island, located near Tuxedni Channel; Gull Island, located in Kachemak Bay outside the project area; the Barren Islands; and Shuyak Island. About 5,000 seabirds use Duck Island, including about 3,000 horned puffins, and more than 16,000 seabirds use Gull Island (ADNR, 2009). Kachemak Bay is also lower Cook Inlet's primary bird wintering habitat because it remains relatively ice-free and supports large seabird colonies (BOEM, 2016).

Important Bird Areas (IBAs) in the project area are shown on Figure 3-11. IBAs are sites that provide essential habitat for one or more species of bird, and include sites for breeding, wintering, and/or migrating birds. IBAs have no regulatory consequences but do provide information on avian habitats of Cook Inlet. There are two IBAs within the project area.

Common seabird species found in marine waters of lower Cook Inlet that may be encountered in the project area, include common murre (*Uria aalge*), black-legged kittiwake (*Rissa tridactyla*), pelagic cormorant (*Phalacrocorax pelagicus*), and fork-tailed storm-petrel (*Oceanodroma furcata*). Glaucous-winged gull (*Larus glaucescens*), tufted puffin (*Fratercula cirrhata*), and black-legged kittiwake have some of the most abundant colonies in the vicinity. Marbled murrelet (*Brachyramphus marmoratus*) and Kittlitz's murrelet (*B. brevirostris*) also regularly use pelagic and nearshore waters of Cook Inlet (BOEM, 2016).

Table 7 provides a description of birds that occur near the project area in lower Cook Inlet. More detailed information may be found in the *Cook Inlet Planning Area Oil and Gas Lease Sale 244 Final EIS* (BOEM, 2016). This table includes birds that are not expected to occur in the project area, such as landbirds, raptors, and owls, because these birds may be, but are not likely to be, encountered during nearshore vessel turnaround activities. The majority of bird species will be likely transient during the survey timeframe, passing through the area on their way to summer/wintering grounds and are not likely to be present during the survey.

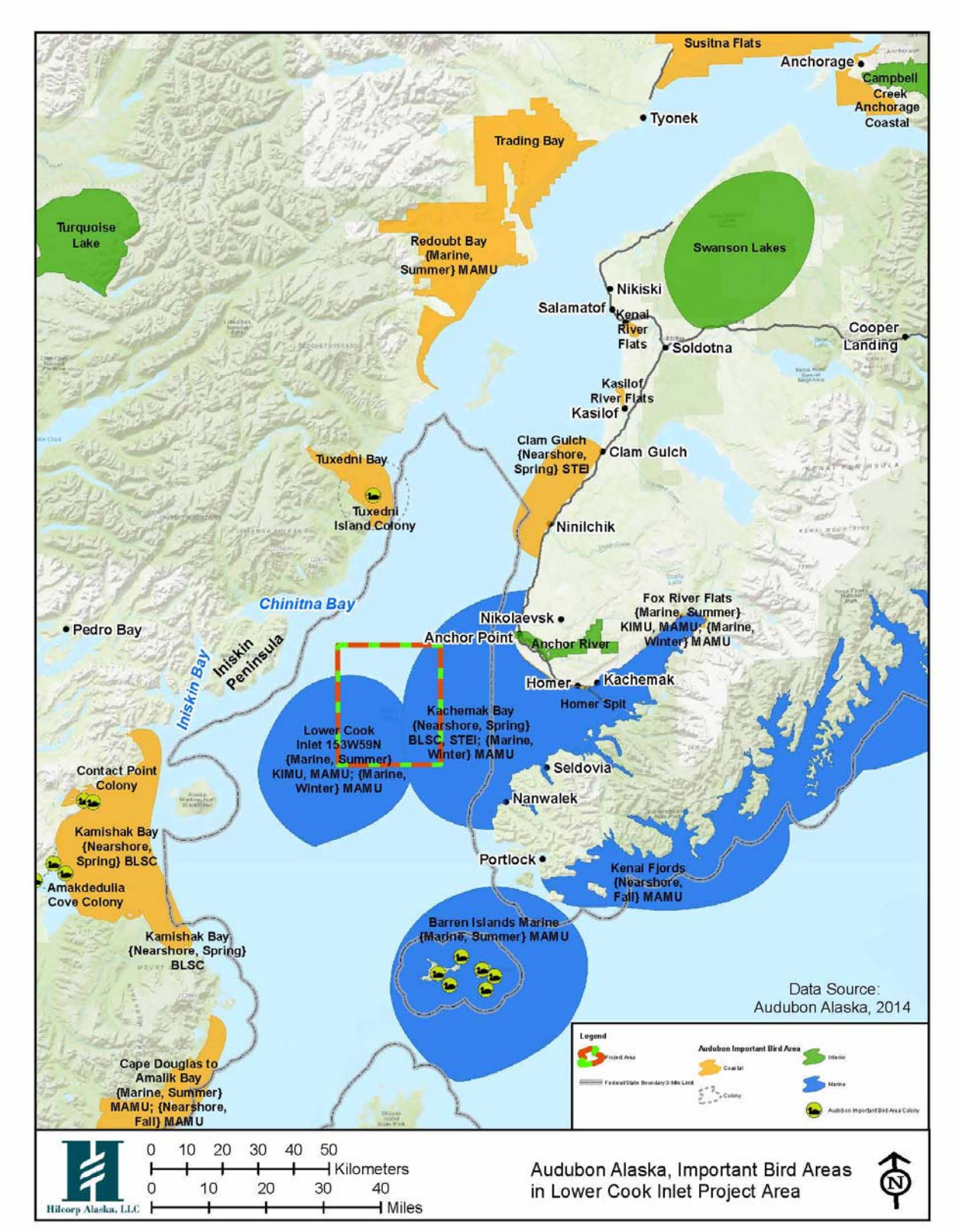


Figure 3-11 Important Bird Areas in lower Cook Inlet project area

Table 7 Birds Occurring in and Adjacent to the Cook Inlet Lease Sale 244

Ecological Group	Common Names	Description
Landbirds	Perching Birds (e.g., warblers, sparrows, flycatchers, swallows, chickadees)	Passeriformes include several distinctly different life history strategies in the Cook Inlet area: large flocks of nocturnally-migrating songbirds pass through the area during migration (many staying locally to breed); many small songbirds (e.g., chickadee sp., redpoll) are common year-round residents; and larger corvids (northwestern crow and common raven) are important year-round scavengers and predators. Apodiformes are hummingbirds, with one species commonly breeding in the Cook Inlet area.
Landbirds	Belted kingfisher	Relatively small birds that plunge-dive for fish in sheltered waters, including coastal bays and marshes. Non-colonial birds that nest in burrows along earthen banks in Cook Inlet area, and are found there year-round.
Raptor and Owl	Falcons	Feed primarily on other birds captured in flight, including ducks. Some species are found year-round in the Cook Inlet. Territorial birds that nests along river bluffs and cliffs. Four species of falcons breed in Alaska, including gyrfalcon, peregrine falcon, American kestrel, and merlin. Merlin, a small falcon, is particularly common in Cook Inlet and found in the area year round.
Raptor and Owl	Hawks and Eagles (e.g., bald eagle, northern goshawk, osprey)	Bald eagle found in Cook Inlet year-round; preys on fish, ducks, small mammals, and carrion; territorial nester in trees close to the water; common bird in Cook Inlet year-round, with the highest nest densities occurring in and along the southern shore of Kachemak Bay.
Raptor and Owl	Owls (e.g., great horned owl, great grey owl, northern hawk-owl, short-eared owl, and snowy owl)	Found in Cook Inlet year-round (except for short-eared owl); prey on small mammals, birds, and even fish; nest in forested areas (great horned owl, great grey owl, and northern hawk- owl), on open tundra (snowy owl), and in open country including marshes, muskegs, tundra, and prairies (short-eared owl).
Seabird	Jaegers	Three species of pelagic, gull-like birds, coming to land only to nest. Regularly occur in project area during summer and during migration, and can be found over pelagic and coastal waters in winter. Feed by stealing from, scavenging, or directly preying on other birds and eggs.
Seabird	Gulls and Terns	Gregarious. Nest colonially on islands and rocky coasts in Cook Inlet; found in area year-round. Gulls omnivorous and opportunistic; terns plunge-dive small prey from water surface.
Seabird	Murres, Murrelets, Guillemots, Auklets, and Puffins	Pelagic, coming to land only to nest colonially. Dive for fish and crustaceans; ungainly on land. Nest colonially on islands and coastal slopes near project area; some species remain through the winter.
Seabird	Grebes	Waterbirds that breed on freshwater lakes and ponds during the summer and spend the rest of the year on coastal marine waters. Dives from surface for fish and aquatic invertebrates. Nest as isolated pair or in small colonies.
Seabird	Fulmars, Petrels, and Shearwaters	Highly pelagic and aerial species, coming to land only to nest. Found year-round in project area. Feeds from water surface or using shallow dives.
Seabird	Storm-petrels	Small pelagic birds primarily found well offshore but come to land for nesting in cliffside burrows from April to June (Drummond and Leonard, 2009). Plucks food or skims oily fat from water surface. Colonial nesters. Found in project area year-round.

Ecological Group	Common Names	Description
Seabird	Cormorants	Waterbirds that sit and swim on the water and dive for fish. Nest colonially in Cook Inlet; found there year-round.
Waterfowl	Sea ducks, Ducks, Mergansers, Geese, and Swans	A large and diverse family using a variety of habitats including coastal ponds, bays, saltmarshes, rivers, and open ocean. Species feed by dabbling or diving; some have specialized diets. Found in project area year-round.
Waterfowl	Loons	Somewhat large, territorially-breeding waterbirds that dive for fish. Leave water only to nest by late May. Present near project area year-round. During fall migration, some loons congregate on large inland lakes before flying to coastal wintering areas. Loons, such as the common loon, are found on lakes throughout the Cook Inlet area during the summer, and they winter offshore and along the coast from the Aleutians to Baja, California.
Waterfowl	Sandhill crane	Large, long-legged birds; breeds in salt marshes and feeds in agricultural fields in Cook Inlet. Occurs in small groups to groups of several hundred or more during migration. Feeds primarily on vegetation.
Shorebird	Plovers	Small shorebirds that nest in pairs on beaches and dunes in Cook Inlet. Pick small prey from intertidal zone. Found near project area in summer and during migration.
Shorebird	Oystercatchers	Medium-sized shorebirds specialized for consuming mussels and other mollusks. Nest in pairs on islands. Nests in Cook Inlet and found there year-round.
Shorebird	Sandpipers, Turnstones, Godwits, Curlews, and Phalaropes	A diverse family of birds using a variety of habitats including beaches, dunes, mudflats, salt marshes, rocky coasts, and, most unusually, in the case of phalaropes, open water. Short-billed species pick prey from ground or water, while larger-billed species probe into mud or sand. Many species pass through during migration and a few breed in the Cook Inlet. Rock sandpiper remains in coastal areas through the winter, and red and red-necked phalaropes may be found in open water year-round.

Source: BOEM, 2016

3.2.4.1 Birds Listed Under the Endangered Species Act

Two species of birds that are listed under the ESA may be present in the lower Cook Inlet region: the short-tailed albatross (*Pheobastria albatrus*), which is endangered and the Alaska breeding population of the Steller's eider (*Polysticta stelleri*) and listed as threatened (BOEM, 2016).

The short-tailed albatross is a long-winged pelagic seabird that spends most of its life at sea. It breeds on a limited number of islands in the North Pacific, with the largest breeding colony (greater than 70 percent of the breeding population) on Torishima Island, Japan. Non-breeding individuals, especially juveniles, are relatively frequent visitors to U.S. waters, however, these birds are not expected to occur in the lower Cook Inlet project area. (BOEM, 2016)

The Steller's eider is a sea duck that spends most of the year in coastal marine waters and feeds by dabbling and diving. Steller's eiders nest in Arctic and subarctic tundra. In Alaska, Steller's eiders move to primarily nearshore marine waters in the vicinity of the Alaska Peninsula to molt beginning in late July and then winter over from late August to April. The birds are found wintering in flocks in shallow, nearshore marine waters along both sides of the Alaska Peninsula, with the largest numbers concentrated along the north side of the Alaska Peninsula and in smaller numbers along the eastern Aleutian Islands, the Kodiak Archipelago, and lower Cook Inlet (USFWS, 2002). Steller's eiders are present in Cook Inlet between late July to late April, with numbers reportedly peaking in January through February (BOEM, 2016). Wintering Steller's eiders are usually found within 400 m (400 yards) of shore in water less than 10 m deep; however, recent analysis of data from 2000 to 2002 concluded that Steller's eiders will occupy water up to 30 m deep during nighttime hours from December through April (BOEM, 2016; Martin et al., 2015). Critical habitat was designated in southwest Alaska; however, no critical habitat has been designated near the lower Cook Inlet. (BOEM 2016).

3.2.4.2 Potential Effects on Birds

There is a potential to impact some birds for brief periods as a result of the survey program during the spring migration (i.e., early May); however, impacts are expected to be temporary and limited and therefore negligible.

The seismic survey is planned primarily in waters over 30 m deep, reducing the likelihood of Steller's eiders being in the project area. The birds that are likely to be present in the project area during seismic activities are the black-legged kittiwake, pelagic cormorant, and Glaucous-winged gull. Near the outer-boundaries of the project area closest to shore, common murre, fork-tailed storm-petrel, tufted puffin, Marbled murrelet, and Kittlitz's murrelet may also be encountered.

Birds could potentially be affected by sounds propagating horizontally away from the airgun array, and diving birds could potentially be affected by underwater noise. However, diving birds are likely to move away from the area in advance of the slow-moving survey vessel and associated airgun noise. The ramp-up procedure of gradually increasing the airgun volume at a specified rate will also mitigate potential impacts to birds by allowing the birds to hear the start of the seismic activities and disperse before any direct impacts can occur. The planned seismic program also avoids the June through August molting period when waterfowl are considered particularly vulnerable. Potential displacement of prey abundance or distribution may occur due to active acoustic sound sources; however, any effects on birds would be limited spatially and temporarily.

Overall, impacts to birds are expected to be limited due to the short duration of the seismic activities, low chance of encounter, the tendency and opportunity of birds to move away from the survey vessels, and the minor impacts to prey species.

3.3 SOCIOCULTURAL ENVIRONMENT

3.3.1 Communities

The nearest governmental jurisdiction to the project area is the Kenai Peninsula Borough (KPB), and there are several Alaska Native villages and other administrative jurisdictions in the region. The waters of the Gulf of Alaska and Prince William Sound border the KPB on the south and east, with the Chigmit Mountains of the Alaska Range rimming the borough to the west. Cook Inlet divides the borough into two land masses. KPB's boundaries encompass 25,600 mi^2, of which 15,700 mi^2 are land, equaling the combined areas of Massachusetts and New Jersey. However, KPB's total population is less than $1/400^{th}$ of those states. Over 87 percent of lands within KPB are owned by the federal (65 percent), state (21 percent) or local governments (1 percent), including the six incorporated cities. The remainder of lands within the borough are owned by Native corporations (9 percent) or private owners (3 percent). Most of these public lands have protected status and are managed as parks, refuges, wildlife habitat, and other designations. (KPB, 2017)

There are six incorporated cities within the KPB (Homer, Kachemak City, Kenai, Seldovia, Seward, and Soldotna), and approximately 35 percent of the borough's population live within the boundaries of an incorporated city (KPB, 2017). The Kenai Peninsula to the east of the project area encompasses 99 percent of the borough's population and most of the development, with the largest concentration of the area's population residing in Kenai-Soldotna area northeast of the project area. Homer, located to the east of the project area, is more sparsely populated than the Kenai-Soldotna area, and is focused economically on commercial fishing and tourism (BOEM, 2016). Almost two thirds (65 percent) of Kenai Peninsula residents do not live within the boundaries of the six incorporated cities, but there are many established communities in the region (KPB, 2017). The closest established community to the project area is Anchor Point to the east.

The west side of Cook Inlet is sparsely inhabited and includes the small communities of Beluga and Tyonek, two national parks, and other protected state-owned lands. The village of Tyonek to the northwest of the project area is the largest populated settlement on the west side. The population of KPB is 84 percent white, 8 percent Alaska Native, and 8 percent all other races, including people who identify as two or more races. (KPB, 2017)

The Cook Inlet region was first populated by the Dena'ina and Aleut peoples, and some communities in the borough are Alaska Native villages, while Alaska Native peoples live throughout the borough. There are also several federally recognized Alaska Native tribes located in the borough: Kenaitze Indian Tribe, Ninilchik Village Traditional Council, Qutekcak Native Tribe (based in Seward), Seldovia Village Tribe, Village of Nanwalek, Village of Port Graham, Village of Salmantof, and Village of Tyonek. (KPB, 2017)

Some communities near the proposed survey area meet the definition of minority populations. In general, these communities have a higher population of Alaska Natives than in KPB as a whole. Tyonek is a Dena'ina Athabascan village with 89 percent Native population (DCCED, 2018). Additional communities that meet the definition of minority populations closest to the project area and within lower Cook Inlet, include Seldovia, Port Graham, Nanwalek, and Ninilchik. Due to the percentage of minority populations in these communities, they qualify as environmental justice communities based on their racial/ethnic minority composition. (BOEM, 2016)

KPB has a more diverse economy than most Alaska communities, with five industries having at least 10 percent of the workforce (BOEM, 2016). The borough has a somewhat seasonal economy, with total employment increasing during summer months, reflecting increased activities in tourism and hospitality, commercial fishing, construction, and other industries that operate seasonally. The top industries for total employment are health care and social services, local government, retail, accommodations and food service, and commercial fishing. The top industries for employee wages are utilities, oil gas and mining, securities and investments, heavy construction, and federal government. Approximately 10 percent of borough residents have incomes below the poverty level, including 6.4 percent of families, and many more are above this threshold but struggle to make ends meet. (KPB, 2017)

3.3.2 Marine Traffic

Marine traffic in lower Cook Inlet is a combination of industries, including fishing, cargo, oil production/transportation, ferries and cruise ships. In 2010, an extensive survey was conducted of vessels greater than 300 gross tons and all smaller vessels having a fuel capacity of at least 10,000 gallons using an automated information system to track vessel movement. Figure 3-12 illustrates the relative vessel activity on lower Cook Inlet and Figure 3-13 summarizes the vessel traffic in Cook Inlet. The busiest times of year were the third quarter (July through September) followed by the second quarter (April through June).

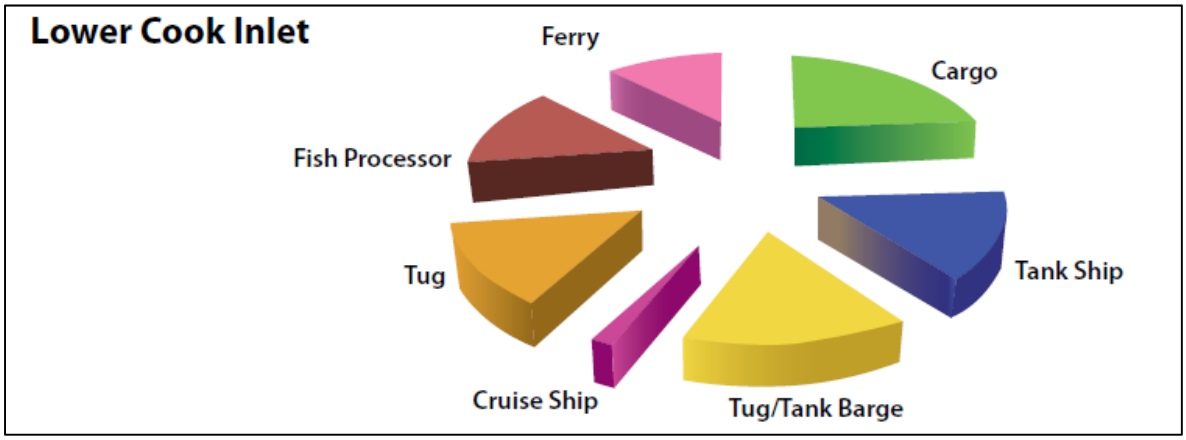


Figure 3-12 Lower Cook Inlet Relative Vessel Activity by Vessel Type (2010) (Cape International, Inc., 2012)

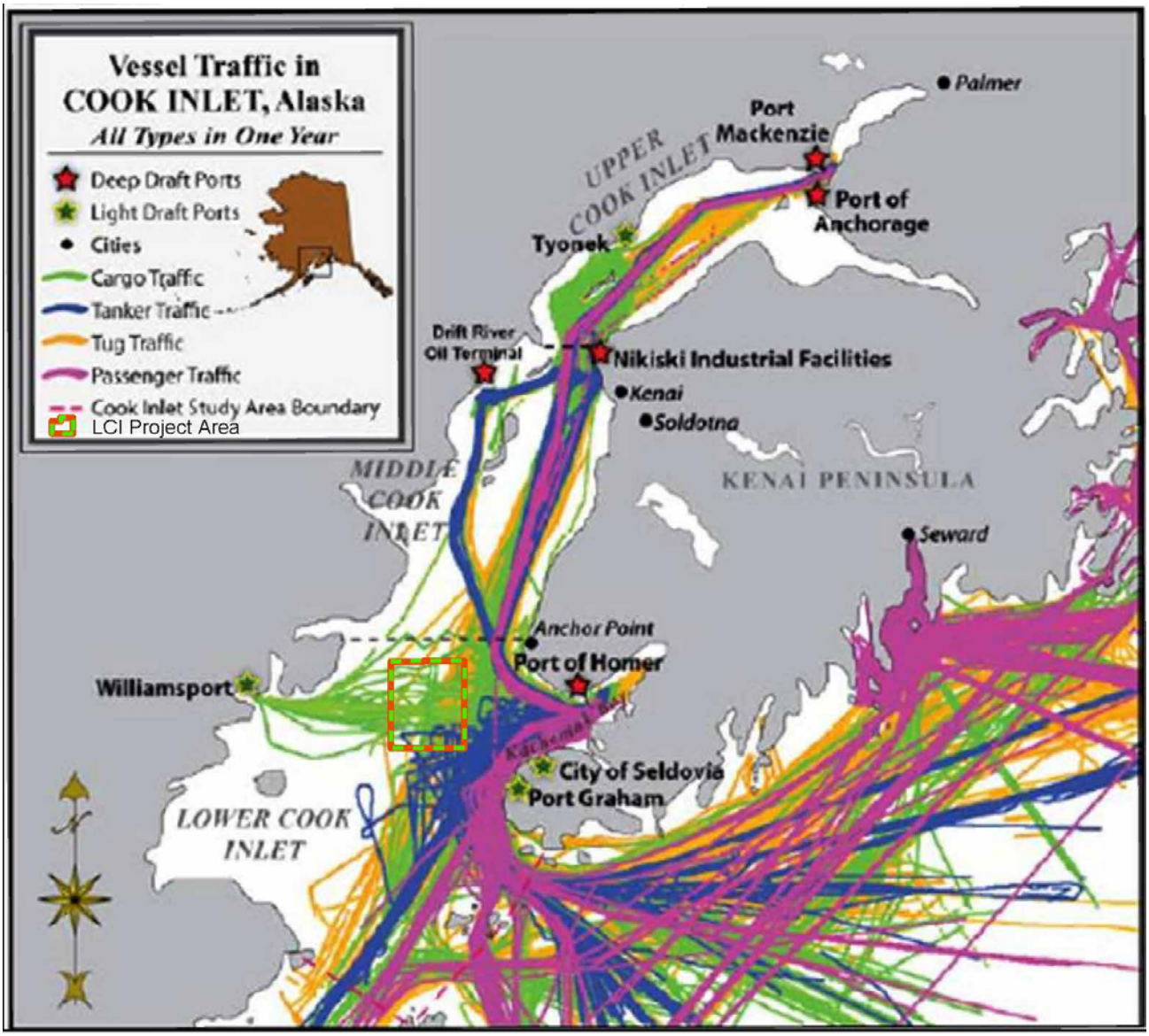


Figure 3-13 **Summary of Cook Inlet Vessel Traffic (2010): Composite of Automated Information System Track Lines by Vessel Type (Cape International, Inc., 2012)**

According to the Cook Inlet Vessel Traffic Study done in 2012 by Cape International, Inc., which analyzed the 2010 data and as presented in BOEM 2016, the following vessel transit patterns were found for Cook Inlet:

- Deep draft vessels generally travelled on the eastern side of Cook Inlet.
- East-west Vessel traffic across lower Cook Inlet in the vicinity of the project area is predominately to Williamsport on the west shore of Iliamna Bay and primarily occurs between June and October when the Pile Bay Road is open, although the large landing craft Polar Bear60 makes approximately eight trips per month (only during periods of +15-ft tides) from April to October between Homer and Williamsport to provide fuel, supplies, and equipment for villages and communities along Iliamna Lake.

- Eighty percent of large ship operations were made by only 15 vessels that regularly called at Homer, Nikiski, or Anchorage.
- 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 to await U.S. Coast Guard (USCG) inspection.
- Kachemak Bay was a frequent and preferred port of refuge for ships and tugs while waiting out bad weather.

3.3.3 Fishing

Fishing is a major industry in Alaska, and there are robust personal use, sport fishing, and subsistence fisheries in lower Cook Inlet.

3.3.3.1 Commercial Fishing

All five species of Pacific salmon, Pacific herring, and smelt are commercially harvested in the Cook Inlet area. Numerous groundfish species are also commercially harvested, including Pacific halibut, Pacific cod, sablefish, lingcod, and pelagic shelf rockfish (primarily black rockfish) (BOEM, 2016; ADF&G, 2018a). Other groundfish species commercially harvested as bycatch to other directed groundfish and halibut fisheries, include walleye pollock, skate, and a variety of rockfish species. Shellfish species commercially harvested in the Cook Inlet area are octopus, which may be retained as bycatch to other directed fisheries, and razor clams. Historically, the area supported crab, littleneck clam, and shrimp fisheries, but these fisheries are currently closed while stocks rebuild (ADF&G 2018a).

Cook Inlet hosts several commercial fisheries; all of which require permits. The commercial fisheries in Cook Inlet are divided into two distinct management areas: the Upper Cook Inlet Management Area and the Lower Cook Inlet Management Area (ADF&G, 2018b, 2018c). The Upper Cook Inlet Management Area is outside the 3D seismic survey program area.

The Lower Cook Inlet Management Area, located within the proposed 3D seismic survey area, is comprised of all waters west of the longitude of Cape Fairfield, north of the latitude of Cape Douglas, and south of the latitude of Anchor Point. All five species of pacific salmon are present in lower Cook Inlet; however, chum and sockeye are the most economically valuable. Over the past three decades, fishery enhancement has played a major role in salmon production in lower Cook Inlet, potentially providing upward of 90 percent of the harvest. (ADF&G, 2018c)

The estimated commercial salmon harvest for 2016 was 434,311 salmon (based on fish ticket data), including 919 Chinook; 260,465 sockeye; 1,632 coho; 97,144 pink; and 74,151 chum (ADF&G, 2016). The harvest was comprised of 234,363 (53.9 percent) commercial common property fishery fish and 199,948 (46.1 percent) hatchery cost recovery fish (ADF&G, 2016). In the lower Cook Inlet, commercial salmon fishing generally opens on or after June 1 and is closed as late as mid-September [5 AAC 21.310(b)].

In addition to a salmon commercial fishery and the shellfish species harvested, lower Cook Inlet provides opportunity for groundfish and scallop harvest. The estimated state-managed groundfish harvest (round weight in pounds) in Cook Inlet for 2017 is described in Table 8.

Table 8 2017 State-managed Commercial Harvest Estimates of Groundfish in the Cook Inlet

Species	Harvest (Round Weight In Pounds)
Lingcod	46,023
Pacific cod (Parallel Season)	1,700,151
Pacific cod (State waters season)	1,636,864
Rockfish	111,963
Sable fish	37,068
Total	3,532,069

Source: ADF&G, 2018c

The Pacific Halibut Stock is managed under the Pacific Halibut treaty between Canada and the United States. Within the U.S., the North Pacific Fishery Management Council (NPFMC) is responsible for allocating the halibut resource among users and user groups fishing off Alaska. The State of Alaska participates in management through the ADF&G Commissioner's seat on the NPFMC (ADF&G, 2018d). The lower Cook Inlet is within Pacific Halibut Regulatory Area 3A, which includes the ports of Homer, Kodiak, and Seward (IPHC, 2018).

Alaska's directed Pacific halibut fishery operates under an individual fishing quota system, where each permit holder is allocated a percentage of the specific regulatory area's catch limit to harvest at any time over an extended fishing season (historically, March to November). In 2018, the season opened March 24, with a scheduled close date of November 7. In 2016, Regulatory Area 3A had the highest catch limit and landed catch level in 2016, with 40 percent of the Alaskan commercial catch landed in the ports of Homer, Kodiak, and Seward. Kodiak received the largest portion of the Alaskan commercial catch, with 2,666,000 pounds (15 percent). Homer received 2,572,000 pounds (14 percent) of catch, and 1,915,000 pounds (11 percent) were landed in Seward. (IPHC, 2018)

There are three commercial fishing associations with oversight on activities in Cook Inlet. The Kenai Peninsula Fishermen's Association and the United Cook Inlet Drift Association are focused on activities in Cook Inlet. The United Fishermen of Alaska is a state-wide organization that typically does not get involved in local issues (e.g., Cook Inlet) unless the local organization has requested it and takes a position on the project/issue.

3.3.3.2 Personal Use Fisheries

In Alaska, "Personal use" is a regulatory category of fishery defined as "the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter." Personal use fishing is open to Alaskan residents only, and participants must have a valid resident sport fishing license. Personal Use fisheries in the Cook Inlet include those provided in Table 9.

Table 9 Personal Use Fisheries in Cook Inlet

Name	Description	Location and Timing
Kenai River Salmon Fisheries	Personal use dipnet fishery focused on sockeye salmon. Since 2003, Alaskans harvest between 130,000 and 540,000 sockeye salmon annually in this fishery.	Late June through July in the marine waters of Cook Inlet just off the mouth of the Kenai River.
Kasilof River Salmon Fishery	Personal use fisheries are allowed only at the mouth of the Kasilof, which is approximately 180 highway miles south of Anchorage. There are both dipnet and gillnet personal use salmon fisheries allowed on the Kasilof River.	Kasilof River personal use salmon dipnetting is open June 25 through August 7 at the mouth of the Kasilof River.
Fish Creek Salmon Fishery	Fish Creek drains Big Lake, which is located approximately 60 highway miles north of Anchorage, and empties into Knik Arm. Fish Creek crosses Knik Goose Bay Road at mile 16. The Fish Creek personal use salmon fishery may be opened for personal use dipnet fishery by Emergency Order only, and only if the Department projects that the escapement of sockeye salmon into Fish Creek will be above 35,000 fish.	Personal use dipnet fishery may open July 15 through July 31 at Fish Creek.
Cook Inlet Clam Fishery	The most popular fishery for clams in Cook Inlet is the fishery for Razor Clams on the beaches between Homer and Kenai. Clammers take almost a million clams a year from this popular fishery. The table quality" of the clam is generally considered best in early summer, just prior to the July-August spawning. On the northern beaches, razor clam beds are exposed on any minus tide. However, tides of -2.0 feet or lower are suggested.	Clamming is open year round in the salt waters of Cook Inlet. However, most digging occurs from April through September. The most popular clamming locations are the beaches between Homer and Kenai.
China Poot Bay Salmon Fishery	China Poot is enhanced with sockeye salmon by the Cook Inlet Aquaculture Association, paid for by commercial fishers. Those that escape the commercial nets are available to harvest by personal use dipnetters.	China Poot Bay is located approximately 4 miles southeast of the Homer Spit, across Kachemak Bay. There is no road access to China Poot Bay. Sockeye salmon generally return to China Poot Creek by July 1, and the typical peak is between July 18 and July 31.
Kachemak Bay Salmon Gillnet Fishery	This fishery traditionally targeted wild stocks of Kachemak Bay coho salmon. In the early 1980s, however, increasing numbers of hatchery-produced coho contributed to catches in the fishery. The "Personal Use Coho Salmon Fishery Management Plan," directs the Department to close the fishery when an estimated 1,000 to 2,000 coho salmon are harvested. Prior year fisheries have been short. In 2002, the fishery closed after 72 hours of fishing time, with only 122 permits issued. In 2001, the fishery lasted 96 hours with 154 permits issued. Because of recent efforts by the ADF&G, Division of Sport Fish to begin stocking early-run coho into the Homer Spit Fishing Hole.	This fishery takes place on the beaches of Kachemak Bay near the community of Homer, about 235 highway miles south of Anchorage. Under 5 AAC 77.549 "Personal Use Coho Salmon Fishery Management Plan," ADF&G is directed to open this fishery from August 16 through September 15, from 6:00 a.m. Monday until 6:00 a.m. Wednesday and from 6:00 a.m. Thursday until 6:00 a.m. Saturday. The short duration of the fishery means that most coho are caught on the first and second openings.

Name	Description	Location and Timing
Cook Inlet Herring and Hooligan Fisheries	Hooligan may be taken by dipnet or by drift gillnet. Dipnets may be used in any waters, fresh or salt. Hooligan runs are highly erratic in terms of when they begin to return. Typically, hooligan are in the Southcentral Alaska rivers by the second week of May. Herring may be taken with dipnets or gillnets, except that gillnets may not be used in Turnagain Arm east of a line from Point Possession to point Campbell. Herring are highly erratic in terms of when they begin to return. Typically, herring are in nearshore Southcentral Alaska salt waters by the second week of May. There are no bag or possession limits for herring or hooligan.	Hooligan may be taken in salt waters from April 1 through May 31 and in fresh waters from April 1 through June 15. Herring may be taken in Cook Inlet north of Anchor Point from April 1 through May 31 and in Cook Inlet south of Anchor Point, including Resurrection Bay, and in the North Gulf Coast, year-round.

Note: There are a number of additional personal use fisheries allowed in different areas of southcentral and southwestern Alaska for salmon, Dolly Varden, shellfish, herring, suckers and whitefish.

Source: ADF&G, 2018e - http://www.adfg.alaska.gov/index.cfm?adfg=PersonalUseByAreaSouthcentral.main

3.3.3.3 Sport Fisheries

Sport fisheries in the lower Cook Inlet are managed by the ADF&G as the Lower Cook Inlet Management Area. There are a number of salt and freshwater sport fishing opportunities in the management area as outlined in Table 10. These include:

- Halibut fishing in Kachemak Bay, Cook Inlet and the North Gulf Coast.
- Trolling for Chinook salmon occurs year-round in these waters too.
- Fishing for Chinook, pink, and coho salmon, Dolly Varden and steelhead trout in streams, many of which are road accessible streams.
- Chinook and coho salmon are also stocked in a few terminal locations in Kachemak Bay, including the famous Nick Dudiak Fishing Lagoon on the Homer Spit.
- Harvesting razor clams from beaches in Cook Inlet.
- Harvesting hardshell clams on the south side of Kachemak Bay.
- Remote fishing opportunities for all five species of salmon from Homer to streams in Kachemak Bay, the North Gulf Coast, and West Cook Inlet.

The sport fisheries in the Lower Cook Inlet Management Area are primarily accessed along the Sterling Highway. Homer is the largest community in the area, but other small communities such as Ninilchik and Anchor Point are located along the Sterling Highway. These communities have many services to support sport fisheries including: motels, bed and breakfasts, restaurants, private and public camping, boat launches, and parking areas. Daily air charter services are available from Anchorage to Homer. Access to remote fisheries is possible via boat, water taxi, and small plane charters.

Table 10 Sport Fisheries in Lower Cook Inlet

Name	Description
SALTWATER SALMON FISHERIES	
Saltwater King (Chinook) Salmon Fisheries	In the Lower Cook Inlet Management area, saltwater Chinook salmon fishing occurs year-round the nearshore waters of Kachemak Bay and east Cook Inlet. The sport fishery targets a mixture of Chinook salmon stocks. Mature (spawning) Chinook salmon are caught April through August in the summer fishery while "feeder" (immature) Chinook salmon are caught year-round.
Feeder King (Chinook) Salmon	This small troll fishery is primarily accessed by boat from the Homer or Seldovia harbors. Although feeder Chinook salmon are present year-round, spring and fall are typically when anglers are most successful. Feeder Chinook salmon are caught along the south shore of Kachemak Bay from Point Pogibshi east to Chugachik Island and the shoreline from Homer north to Anchor Point.
Spawner King (Chinook) Salmon	From April through August, when spawner Chinook salmon are returning to Cook Inlet streams, anglers often target them in the Cook Inlet waters from Bluff Point north to Deep Creek. Access to the area occurs from private tractor launches at Deep Creek and Anchor Point, the Homer harbor, and some anglers launch small skiffs from the beach at Whiskey Gulch. Anglers find their best success fishing close to shore in waters less than 40 feet deep. Additional spawner Chinook salmon are available at one of the three Chinook salmon enhancement fisheries in Kachemak Bay.
ENHANCED (I.E., STOCKED) FISHERIES	
Enhanced Fisheries	Chinook and coho salmon are stocked at terminal locations in Kachemak Bay to provide additional angling opportunities. These include the Nick Dudiak Fishing Lagoon on the Homer Spit, Seldovia Lagoon, and Halibut Cove Lagoon. Fishing for Chinook salmon starts in mid-May, peaks in mid-June and ends by July. Coho salmon fishing occurs from about mid-July through mid-August.
GROUNDFISH FISHERIES	
Pacific Halibut	While sport fishing for Pacific halibut may occur February 1 through December 31 annually, most sport harvest occurs between May and early September when weather conditions are fairer. This marine fishery can be accessed out of the Homer Harbor, or the Anchor Point or Deep Creek tractor launch facilities.
Lingcod and Rockfish	The lingcod fishery occurs primarily along the outer coast around the Chugach Islands and around the Barren Islands, accessible through the Homer Harbor, or the Anchor Point or Deep Creek tractor launch facilities via charter or personal fishing vessels. Lingcod spawn December through March and males of the species fiercely guard the nests through June to prevent other fish and shellfish from eating the eggs, making them more vulnerable to harvest during this time. Therefore, lingcod are available for sport harvest from July 1 through December 31. Rockfish are often caught along the outer coast while lingcod fishing, jigging for halibut, or even while trolling for Chinook salmon in Cook Inlet around kelp beds west of Seldovia or near Bluff Point. Rockfish may be kept year-round.

Name	Description
SHELLFISH FISHERIES	
Razor Clams	Pacific razor clams are found in exposed fine to medium grain sandy beaches along Cook Inlet beaches. Cook Inlet supports popular sport and personal use razor clam fisheries. The remote beaches on the west side of Cook Inlet are accessible by boat or plane and the east side beaches are accessed from the road system. In 2015 the fishery closed from the Kenai River south to the tip of the Homer Spit and remains closed at this time due to low populations of clams.
Hardshell Clams	Hardshell clams are found along the southern shore of Kachemak Bay from Bear Cove to Jakolof Bay. Access is by boat or water taxi. The most commonly harvested types of hardshell clams are Pacific littleneck (steamer) and butter clams. Blue mussels and cockles are also available. The islands in China Poot are popular with clammers looking for butter clams. Littleneck clams are found in most sub bays such as Jakolof and Tutka Bays, Sadie and Bear Coves.
Tanner Crab	Tanner crab live on the seafloor down to about 1,500 feet and anglers use pots to capture them. Most anglers lower a heavily baited crab pot down into 300-500 feet of water. Harvest of Tanner crab is restricted to males whose carapace width is 4.5” or longer from side to side. In order to grow, a Tanner crab must molt.
FRESHWATER FISHERIES	
Roadside Freshwater Fisheries	In the Lower Cook Inlet Management Area, opportunities to fish for salmon and trout are found in four road accessible streams (Ninilchik and Anchor Rivers, Deep and Stariski Creeks). These streams are small coastal streams the feed into Cook Inlet. Sport fishing for Chinook and coho salmon, steelhead trout and Dolly Varden are the most popular. The Ninilchik River and Deep Creek are located in the town of Ninilchik; Stariski Creek and the Anchor River are approximately located near Anchor Point. The Sterling Highway provides access to all four streams. Salmon fishing is only allowed in these streams from the mouth upstream approximately two miles and Stariski Creek is closed to Chinook salmon fishing. Fishing for Steelhead trout and Dolly Varden upstream of the two mile marker is allowed from August 1 through October 31. These streams are closed from November 1 through June 30 except for a few weekends in late May and June.

Source: ADF&G 2018f

3.3.3.4 Potential Effects on Fisheries

Some of the activities related to the planned survey program may adversely affect fish and shellfish due to sound propagation in surface waters, the water column, and seafloor habitats (BOEM, 2016). Fish may be temporarily displaced from the area where airguns are in use, potentially reducing fish harvests in the area closest to the seismic activities. However, any fishes proximately displaced are likely to backfill the survey area shortly after the seismic vessels have transitioned through the area. The majority of the 3D seismic survey program is scheduled to be completed prior to the opening of the drift gillnet fishing season, mitigating impacts to the commercial salmon fishery. Pacific halibut and rockfish fisheries may be impacted by exclusion from the area of active seismic operations. However, the impacts of the 3D seismic survey on commercial, sport, and individual fisheries would be geographically limited and short-term. It is likely that commercial fisheries, charters, and individual sport fishers would be able to use alternative fishing grounds. Overall, impacts to fish harvests are expected to be minor, and limited to the immediate area of the surveys and to the hours of survey operations (BOEM, 2016).

3.3.4 Subsistence Activities

The Alaska National Interest Lands Conservation Act defines subsistence use as:

> "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." (16 U.S.C. 3113)

3.3.4.1 Subsistence Use of Marine Mammals

Many of the communities in the Cook Inlet area participate in subsistence activities. The subsistence way of life is a continuation of centuries-old traditional patterns. Subsistence resources provide special foods for religious and social occasions. The sharing, trading, and bartering of subsistence foods structures relationships among communities, while the giving of such foods helps maintain ties with family members elsewhere in Alaska. (BOEM, 2016)

Federal marine mammal regulations allow Alaska Natives to hunt marine mammals including harbor seals and sea otter. There was a subsistence hunt of Cook Inlet beluga whales until 2005, but there has been no subsistence harvest allowed since 2006 due to the decline in the Cook Inlet beluga population (BOEM, 2016). Hilcorp's proposed activity area is near the subsistence areas used by residents of Port Graham, Seldovia, and Nanwalek (BOEM, 2016). Sea otters, Stellar sea lions, and harbor seals are the most commonly harvested marine mammal subsistence species for these communities (ADF&G, 2018g).

The subsistence harvest of sea otters can occur at any time of year (USFWS, 2007). USFWS data records show that between 1989 and 2009, Port Graham, Seldovia, and Nanwalek harvested a respective average of 11, 6, and 2 otters per year. Between 2010 and 2013, Seldovia residents harvested a total of 6 otters, Port Graham residents harvested 1 otter, and there was no otter subsistence activity for Nanwalek (USFWS, 2014c). Overall, sea otter subsistence activity is currently low, and generally occurs less than two to three miles offshore, and Hilcorp's proposed project area is over five miles away from the nearest point on the Kachemak Bay shore.

In Nanwalek, 22 harbor seals were harvested in 2014 between March and October, the majority of which occurred in April. Nanwalek residents typically hunt harbor seals and Steller sea lions at Bear Cove, China Poot Bay, Tutka Bay, Seldovia Bay, Koyuktolik Bay, Port Chatam, in waters south of Yukon Island, and along the shorelines close to Nanwalek, all south of the project area. In Seldovia, the harvest of harbor seals (5 total) occurred exclusively in December. In Port Graham, harbor seals were the most frequently used marine mammal; Tribal members harvested 16 in the survey year of 2014. Harbor seals were harvested in January, February, July, August, September, November, and December. Steller sea lions were used noticeably less (1 animal harvested) and harvested in November and December. (Jones and Kostock, 2016)

Provisions were included in the MMPA for the development of cooperative agreements between the federal government and Alaska Native organizations to conserve marine mammals and provide for the co-management of subsistence use by Alaska Natives. Under Section 119 of the MMPA, NMFS and USFWS can enter into government-to-government agreements with tribally authorized Alaska Native organizations. These cooperative agreements address the co-management of subsistence use of marine mammals in Alaska.

Co-management agreements entered into by NMFS and USFWS address beluga whales, bowhead whales, Steller sea lions, northern fur seals, harbor seals, bearded seals, ringed seals, spotted seals, ribbon seals, sea otters, polar bears, and Pacific walrus. Co-management groups for species found in Cook Inlet are provided in Table 11.

Table 11 Marine Mammal Co-Management Groups

Name	Interest
Alaska Native Harbor Seal Commission	The Alaska Native Harbor Seal Commission is a nonprofit tribal consortium comprised of Alaska Native communities within the harbor seal habitat range. The overall goal of the commission is to strengthen and increase the role of Alaska Natives in resource management and decisions affecting the harbor seals and their uses. The Commission helps foster this through our co-management agreement for data analysis, population monitoring and harvest assessment. Interests include harbor seal populations and subsistence hunt. NOAA's National Marine Fisheries Service and the Alaska Native Harbor Seal Commission have agreed to share management of harbor seals in Alaska through an accord that ensures the seal populations are conserved and subsistence harvest needs are met. Note: Facebook site was active as of August 2016, but the site does not currently appear to be active.
Alaska Sea Otter and Steller Sea Lion Commission	The mission of The Alaska Sea Otter and Steller Sea Lion Commission is to: develop and protect Alaska Natives' rights in Sea Otter and Steller Sea Lion customary and traditional uses through co-management, conservation, research, education and artistic development. Interests include Sea otter and Steller sea lion populations and subsistence hunt. NOAA's National Marine Fisheries Service website (http://www.nmfs.noaa.gov/stories/2012/10/10_23_12alaska_co_management.html) states that there is an existing co-management agreement for Steller sea lions and they currently are working with the Alaska Sea Otter and Steller Sea Lion Commission.

Note: The Cook Inlet Marine Mammal Council, co-management group for Cook Inlet beluga whales, was disbanded in 2012. The Alaska Beluga Whale Commission is the co-management group for the Western Alaska beluga whale population.

3.3.4.2 Subsistence Fisheries

All Alaska residents are eligible to participate in state subsistence fisheries; rural residents are eligible to participate in federal subsistence fisheries. Subsistence fishing generally takes place in spring and summer. While personal use fishing requires a valid Resident Sport Fishing License, subsistence fishing does not (ADF&G, 2018a). There are several subsistence salmon fisheries in Cook Inlet. The closest fisheries to Cook Inlet's major population centers include the Tyonek Fishery on the west side of Cook Inlet and the Seldovia fishery in Kachemak Bay. Halibut may also be caught by residents of rural communities through the federal subsistence halibut program. Other subsistence fisheries include herring, bottomfish, and shellfish. Additional fisheries that occur outside the non-subsistence use areas include whitefish in the Tyone River, as well as several locations for Dolly Varden and smelt. A list of subsistence fisheries in Cook Inlet are provided in Table 12.

Table 12 Subsistence Fisheries in Cook Inlet

Name	Type of Fishery	Interest
Salmon	State of Alaska	The fisheries for the Port Chatham, Windy Bay, Port Graham and Nanwalek subdistricts are all under one permit and are issued by Division of Commercial Fisheries. The fishery for Seldovia is also issued by Commercial Fisheries. The Division of Sport Fish in Palmer issues permits for the Yentna fish wheel fishery. Permits for Tyonek subsistence salmon fisheries may be obtained from the Division of Subsistence or a local vendor.
Salmon	Federal	For residents of Hope, Cooper Landing, and Ninilchik a federal subsistence fishery is also available. See https://www.doi.gov/subsistence for more details.
Herring	State of Alaska	Herring are found in Cook Inlet and may be harvested using gillnets outside the non-subsistence use area. Gillnets used to take herring may not exceed 50 ft in length and two in in mesh size.
Halibut	Federal	The National Marine Fisheries Service administers the subsistence halibut program under Federal regulations for residents of rural Alaska communities. Before fishing under the subsistence halibut regulations, fishermen must obtain a Subsistence Halibut Registration Certificate (SHARC). Special permits for community harvest, ceremonial, and educational purposes are also available to qualified Alaska communities and Alaska Native Tribes. To obtain a Subsistence Halibut Registration Certificate see the contact information at https://alaskafisheries.noaa.gov/fisheries/subsistence-halibut
Bottomfish	State of Alaska	Subsistence fishing for bottomfish (e.g., ling cod and rockfish) in Cook Inlet, especially in lower Cook Inlet is authorized as long as the harvest takes place outside the non-subsistence use area, which in Cook Inlet includes State of Alaska waters. Both lingcod and rockfish may be harvested in Cook Inlet using a single hand troll, single hand-held line, or single longline, none of which may have more than five hooks attached to it. Both lingcod and rockfish may also be kept if they are harvested incidentally in another subsistence finfish fishery such as salmon.
Shellfish	State of Alaska	Clams may be taken year-round in Cook Inlet and include up to 1,000 littleneck clams and 700 butter clams. The other shellfish subsistence fishery is Tanner crab which may be taken with pots, ring nets, dip nets, diving gear, hand lines, or by hand.

Source: ADF&G, 2018h; NMFS, 2016c

3.3.4.3 Potential Effects on Subsistence Activities

The proposed survey will be performed for a limited timeframe. There is the potential to impact local marine mammals for brief periods during operations; however, disruptions are expected to be limited. Fish and shellfish may be temporarily displaced or deflected; however, subsistence species are likely to backfill the surveyed area in a matter of minutes to hours (BOEM, 2016). Overall, impacts to subsistence harvest patterns are expected to be limited.

3.3.5 Recreation and Tourism

Recreation and tourism are important areas of economic activity in Cook Inlet and the two are closely linked. Recreational based tourism is also important to Alaska's economy. Popular offshore recreational activities include fishing, bird watching, wildlife viewing, ocean kayaking, and power boating (BOEM, 2016). Many visitors to Alaska travel by cruise ship or take day cruises.

Impacts to recreation and tourism experiences and visual and scenic resources occur when the public enjoyment of a particular resource or viewshed is adversely affected by an activity or action that conflicts with individuals' desired or expected conditions. There is a potential that tourists or recreational users could be affected by noise from the seismic survey; however, a stand-off safety exclusion zone will be announced to the public and marine users through issuance of a Local Notice to Mariners. Due to the limited timeframe of the proposed activities, the timing early in the cruise season (CLAA, 2018), and the safety exclusion zone, impacts to recreation and tourism is expected to be negligible.

3.3.6 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (59 FR 7629), requires each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Communities within the lower Cook Inlet are discussed in Section 3.3.1. Some of the communities near the proposed survey area meet the definition of minority populations. In general these communities have a higher population of Alaska Natives than in KPB as a whole. Due to the percentage of minority populations in the communities of Tyonek (DCCED, 2018), Seldovia, Port Graham, Nanwalek, and Ninilchik (BOEM, 2016), these communities qualify as environmental justice communities based on their racial/ethnic minority composition.

Due to the type and location of activities, the environmental justice impacts are likely to be those effects on subsistence resources and the opportunity to access them, as addressed in Section 3.3.4.

3.4 ANALYSIS OF ACCIDENTAL OIL OR HAZARDOUS MATERIAL SPILLS

The vessels conducting the 3D seismic survey will have spill prevention and response plans consistent with international, national, and state standards. The regulations require vessels to report incidents of pollution to state and federal authorities, carry onboard spill response equipment, conduct periodic training exercises for dealing with oil pollution, and demonstrate financial responsibility should an incident occur.

Although the project vessels will comply with these regulations, a spill may still occur. The most likely release would be fuel directly to the waters of Cook Inlet. Generally, the project vessels proposed for use, and those of similar size, use diesel. In the event of a release of diesel, immediate notification and response actions would occur.

Diesel is much lighter than seawater. Once released, it will evaporate and disperse along the water surface. If winds reach 5 to 7 knots, or there are breaking waves, released diesel may be readily dispersed into the water column. Dispersed diesel may form droplets that are small enough to remain in suspension and move with the currents. Oil dispersed in the water column can adhere to fine-grained suspended sediments (adsorption), which then settle out and get deposited on the floor. This is more likely to occur near river mouths where fine-grained sediments are carried in by rivers (such as near both ferry terminals). It is less likely to occur in open settings. This process is not likely to result in measurable sediment contamination for small spills (NOAA, 2018b).

If diesel were to strand on the shoreline, it tends to penetrate porous sediments but it also tends to be washed off quickly by waves and tidal flushing (NOAA, 2018b). Shoreline cleanup is not usually needed for diesel releases. Diesel is toxic to marine wildlife; however, most spills do not result in direct contact with wildlife due to rapid evaporation and dispersion. Nearly all the diesel spilled will evaporate or naturally disperse in a matter of hours or days, even in cold water.

4. MITIGATION MEASURES

The following mitigation measures were developed to avoid, minimize, or reduce potential negative effects of the proposed 3D seismic survey. Hilcorp has drafted a robust monitoring and mitigation program for marine mammals, which is summarized below.

4.1 MITIGATION MEASURES TO REDUCE CONFLICT WITH LOCAL USERS

In order to reduce potential conflict with other user groups in the lower Cook Inlet area, Hilcorp intends to develop and implement a Stakeholder Engagement Program. The purpose of the program is to notify interested parties about the proposed project, to gather feedback about the potential impacts and how they can be mitigated, and to work with stakeholders to mitigate impacts of the project. In addition to agencies from which Hilcorp will be requesting authorizations, stakeholders will include local Alaskan communities, industry and special interest groups, and interested individuals.

In addition to the notifications as part of the Stakeholder Engagement Program, Hilcorp intends to work with the USCG to publish a Notice to Mariners of pending seismic activity to ensure no conflicts with local vessels while seismic activity takes place. In addition, the support vessels will monitor for any local traffic on water and will use radio communications to ensure no conflicts with recreational boaters and sport fishing charters.

4.2 MITIGATION MEASURES DESCRIBED IN LEASE STIPULATIONS

Hilcorp has requested a variance to Lease Stipulations Nos. 6 and 7 as described in Section 1.4. Hilcorp will adhere to the mitigation measures described in Section 4.3 and as required by the authorization under the MMPA from NMFS.

4.3 MARINE MAMMAL MONITORING AND MITIGATION PLAN

In support of Hilcorp's request to USFWS and NMFS for ITRs pursuant to the Marine Mammal Protection Act to allow non-lethal takes of cetaceans and pinnipeds, including sea otters, incidental to the survey program, Hilcorp has submitted a Marine Mammal and Monitoring and Mitigation Plan (4MP) that details its proposed marine mammal monitoring and mitigation measures. These measures are summarized here; however, some details of the mitigation and monitoring may change upon further agency consultation and receipt of the individual authorizations issued by NMFS and USFWS.

4.3.1 Protected Species Observers

Vessel-based monitoring for marine mammals will be conducted by trained protected species observers (PSOs) on vessels throughout the survey program. For the 3D seismic survey, PSOs will be stationed on the source vessel and one chase vessel. PSOs will not be placed on the support vessel, as it may not be in the seismic area all the time. The viewing area may be augmented by placing PSOs on a vessel specifically for mitigation purposes or using an unmanned or manned aerial system.

The main purposes of PSOs aboard the vessels are: to conduct visual watches for marine mammals; to serve as the basis for implementation of mitigation measures; to document numbers of marine mammals present; to record any reactions of marine mammals to seismic survey activities; and to identify any possible effect on accessibility of

marine mammals to subsistence hunters in Cook Inlet. These observations will provide the real-time data needed to implement some of the key measures.

The specific objectives of the vessel-based monitoring and mitigation program provide:

- the basis for real-time mitigation, as required by the various permits;
- the information needed to estimate the number of "takes" of marine mammals by harassment, which must be reported to NMFS and USFWS;
- data on the occurrence, distribution, and activities of marine mammals in the areas where the survey program was conducted; and
- information to compare the distances, distributions, behaviors, and movements of marine mammals relative to the seismic activities.

Specific information on the use of PSOs and qualifications and training will be included in the 4MP.

4.3.2 Description of Exclusion and Safety Zones

The EZ is defined as the area in which all seismic operations are shut down in the event a marine mammal enters or is about to enter this zone. For this project, there are different EZs depending on the species. The EZ for sea otters is based on USFWS requirements for Level A. The EZ for beluga whales is based on the NMFS Level B zone instead of the Level A zone; because of Cook Inlet beluga whales critically endangered status, a low number of allowable Level B "takes" by harassment are expected to be authorized.

Hilcorp will conduct a sound source verification (SSV) survey at the beginning of the seismic program to establish the distances for the specific project environmental parameters for the airgun array and mitigation gun. The SSV will characterize the sound levels, propagation, and verify the monitoring zones (EZ and SZ) for the 3D seismic survey program. Table 13 lists the proposed EZ radii for the seismic program, prior to the SSV.

Table 13 Radii of exclusion zone (EZ) and safety zone (SZ) for Hilcorp seismic program

Exclusion Zone (m)					SZ Radius
Source	Sea Otters	Beluga Whales	Harbor and Dall's Porpoises	All Other Marine Mammals	All Marine Mammals (Other Than Beluga Whales)
40 in^3 airgun	50 m	500 m	50 m	50 m	500 m
2,010 in^3 airgun[1]	180 m	7.33 km	1 km	500 m	7.33 km

Notes:
[1] The proposed EZ and SZ in the ITR petitions are based on a 2,010 in^3 airgun array and 40 in^3 mitigation airgun. The 3D seismic survey array has since been refined to be a 1,945 in^3 array and 40 in^3 mitigation airgun.

4.3.3 Clearing the Exclusion Zone

Prior to the start of daily seismic activities or when activities have been stopped for longer than a 30-minute period, the PSOs will clear the EZ for a period of 30 minutes prior to initiating ramp up or power up procedures. Clearing the EZ means no marine mammals have been observed within the EZ for that 30-minute period. If any

marine mammals have been observed within the EZ, ramp up cannot start until the marine mammal has left the EZ or has not been observed for a 30-minute period.

4.3.4 Powerdown Procedure

A powerdown procedure involves reducing the number of airguns in use, which reduces the EZ or SZ radius. In contrast, a shutdown procedure occurs when all airgun activity is suspended immediately. During a powerdown, a mitigation airgun (in this case a 40 in^3 single airgun) is operated. Operation of the mitigation gun allows the size of the EZ to decrease to the size of the SZ for marine mammals. If a marine mammal is detected outside the safety radius (either SZ or EZ), but is likely to enter that zone, the airguns may be powered down before the animal is within the safety radius, as an alternative to a complete shutdown. Likewise, if a marine mammal is already within the SZ when first detected, the airguns will be powered down if this is a reasonable alternative to an immediate shutdown. If a marine mammal is already within the EZ when first detected, the airguns will be shut down immediately.

Following a powerdown procedure, airgun activity will not resume until the marine mammal has cleared the SZ. The animal will be considered to have cleared the SZ if it:

- is visually observed to have left the SZ; or
- has not been seen within the SZ for 15 minutes in the case of pinnipeds, sea otters, and harbor porpoise; or
- has not been seen within the SZ for 30 minutes in the case of cetaceans.

4.3.5 Shutdown Procedure

A shutdown occurs when all airgun activity is suspended. The operating airguns or profiler will be shut down completely if a marine mammal approaches the EZ. The shutdown procedure will be accomplished within several seconds (of a “one shot” period) of the determination that a marine mammal is either in or about to enter the EZ.

Following a shutdown, airgun activity will not resume until the marine mammal has cleared the EZ. The animal will be considered to have cleared the EZ if it:

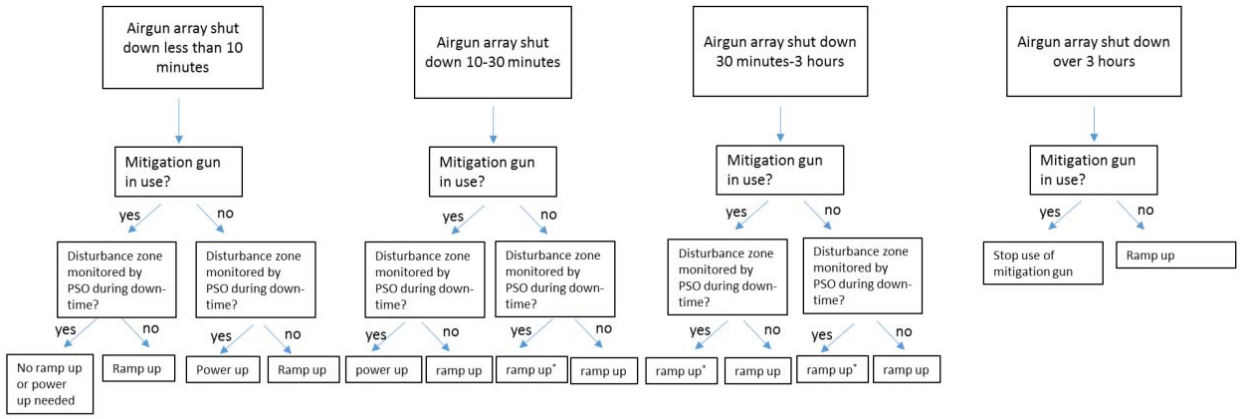
- is visually observed to have left the EZ; or
- has not been seen within the EZ for 15 minutes in the case of pinnipeds, sea otters, and harbor porpoise; or
- has not been seen within the EZ for 30 minutes in the case of cetaceans.

4.3.6 Rampup and Powerup Procedures

A “rampup” procedure gradually increases airgun volume at a specified rate. Ramp up is used at the start of airgun operations, including after a powerdown, shutdown, and after any period greater than 10 minutes in duration without airgun operations. USFWS normally requires that the rate of rampup be no more than 6 dB per five-minute period. Ramp up will begin with the smallest gun in the array that is being used for all airgun array configurations. During the rampup, the EZ for the full airgun array will be maintained.

If the complete EZ has not been visible for at least 30 minutes prior to the start of operations, ramp up will not commence unless the mitigation gun has been operating during the interruption of seismic survey operations. This means that it will not be permissible to ramp up the 24-gun source from a complete shut down in thick fog or at other times when the outer part of the EZ is not visible. Rampup of the airguns will not be initiated if a marine mammal is sighted within or near the EZ at any time.

The following information has been included from NMFS' Biological Opinion to Lease Sale 244. Figure 4-1 shows a flow diagram indicating some seismic exploration mitigation measures under various scenarios described in mitigation measures 2c through 2j in the NMFS Biological Opinion to Lease Sale 244.



* Under these conditions, the PSO's required 30-minute pre-airgun-use observation period would have already been met.

Figure 4-1 Flow diagram of suggested mitigation gun procedures in the NMFS Biological Opinion to Lease Sale 244

4.3.7 Speed or Course Alteration

If a marine mammal is detected outside the EZ and, based on its position and relative motion, is likely to enter the EZ, the vessel's speed and/or direct course may, when practical and safe, be changed. This technique also minimizes the effect on the seismic program. This technique can be used in coordination with a powerdown procedure. The marine mammal activities and movements relative to the seismic and support vessels will be closely monitored to ensure that the marine mammal does not approach within the EZ. If the mammal appears likely to enter the EZ, further mitigative actions will be taken, i.e., either further course alterations, powerdown, or shutdown of the airguns.

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