BIOLOGICAL OPINION

for

Oil and Gas Activities associated with Lease Sale 258 in Lower Cook Inlet, Alaska

Consultation with

Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement

Southern Alaska Fish and Wildlife Field Office Anchorage Fish and Wildlife conservation Office

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ACRONYMS AND ABBREVIATIONS

μPa	micropascal
2D	two-dimensional
3D	three-dimensional
ACP	Arctic Coastal Plain
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
APDES	Alaska Pollutant Discharge Elimination System
ASAP	Alaska Stand-Alone Natural Gas Pipeline
BA	biological assessment
Bcm	billion cubic meters
bbl	barrels of oil
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
cm	centimeter(s)
CI	confidence interval
CrI	credible interval
CWA	Clean Water Act
dB	decibels
DP	dynamic positioning
DPP	Development and Production Plan
DPS	Distinct Population Segment
E&D	Exploration and Development
EDS	Exploration and Development Scenario
EIS	Environmental Impact Statement
EP	Exploration Plan
ERA	environmental resource area
ESA	Endangered Species Act
EVOS	Exxon Valdez oil spill
EZ	Exclusion Zone
FEIS	Final Environmental Impact Statement
FR	Federal Register
G&G	geological and geophysical
GLS	Grouped Land Segment
GIUE	Government-initiated Unannounced Exercise
ha	hectare(s)
Hz	hertz
IHA	Incidental Harassment Authorizations
ITL	Information to Lessees and Operators
ITS	Incidental Take Statement
kHz	kilohertz
KKAPMU	Kodiak, Kamishak, Alaska Peninsula Management Unit

km/km^2	kilometer(s)/square kilometers
LA	launch area
LNG	liquefied natural gas
LOA	Letters of Authorization
LS	Lease Sale / Land Segment
m	meter(s)
Mbbl	thousand barrels
MMbbl	million barrels
MMPA	Marine Mammal Protection Act
MODU	mobile offshore drilling unit
MU	management units
M/V	motor vessel
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWR	National Wildlife Refuge
O&G	oil and gas
OCS	Outer Continental Shelf
OSRA	Oil Spill Risk Analysis
PCB	polychlorinated biphenyl
PCE	Primary Constituent Element
PL	Pipeline
PSO	Protected Species Observer
PTS	permanent threshold shift
RMS/rms	root mean square
SE	standard error
SEL	sound exposure level
Service	U.S. Fish and Wildlife Service
SZ	Safety Zone
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
VSP	Vertical Seismic Profiling
VLOS	very large oil spill
Y-K Delta	Yukon-Kuskokwim Delta
yr	year

1 INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq., ESA), on the Bureau of Ocean Energy Management's (BOEM) proposed oil and gas Lease Sale 258 (LS 258) and its effects on the federally threatened Alaska breeding Steller's eider (*Polysticta stelleri*), the federally threatened Southwest Alaska distinct population segment (DPS) of northern sea otter (*Enhydra lutris kenyoni*), and designated critical habitat for the Southwest Alaska DPS of northern sea otter.

As described in the document, the proposed Action involves exploration, development, production, and decommissioning of leased blocks associated with BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) Lease Sale 258 (LS 258) in lower Cook Inlet.

The BOEM and BSEE have statutory authority (under 43 USC 1331 et seq.) to complete their respective Outer Continental Shelf (OCS) energy development actions in a tiered approach for review under the National Environmental Policy Act (NEPA) and to use an incremental step consultation process under the ESA as described in regulations at 50 CFR 402.14(k). The regulations at 50 CFR 402.14(k) state:

When the action is authorized by a statute that allows the agency to take incremental steps towards the completion of the action, the Service will, if requested by the Federal agency, issue a Biological Opinion on the incremental step being considered, including its views on the entire action. Upon the issuance of such a biological opinion, the Federal agency may proceed with, or authorize the incremental steps of the action if:

- The biological opinion does not conclude that the incremental step would violate section 7(a)(c);
- The Federal agency continues consultation with respect to the entire action and obtains biological opinions, as required, for each incremental step;
- The Federal agency fulfills its continuing obligation to obtain sufficient data upon which to base the final biological opinion on the entire action;
- The incremental step does not violate section 7(d) of the ESA concerning irreversible or irretrievable commitment of resources; and
- There is reasonable likelihood that the entire action will not violate section 7(a)(2) of the ESA.

At BOEM's and BSEE's request, we are conducting an incremental step consultation. Therefore, this biological opinion examines activities in the First Incremental Step that may result from the proposed Action. The First Incremental Step includes all activities associated with the exploration and delineation activities up to submission of a Development and Production Plan (DPP). Future Incremental Steps include all subsequent steps, including development, production, decommissioning, and all associated activities.

This biological opinion has two components. The first component provides analyses and conclusions as to whether the First Incremental Step would violate section 7(a)(2) of the ESA (i.e., whether this step would likely jeopardize listed species or destroy or adversely modify designated critical habitat) and provides incidental take exemptions for listed Alaska breeding Steller's eider and the Southwest Alaska DPS of northern sea otter. In addition, because the First Incremental Step could lead to development, production, and decommissioning, in the second component we also analyze whether there is reasonable likelihood that the entire proposed Action, based on an Exploration and Development Scenario (EDS) prepared by BOEM and BSEE for activities that may result from LS 258, will jeopardize listed species or destroy or adversely modify designated critical habitat.

This section 7 consultation and BO, including the Incidental Take Statement (ITS) with Terms and Conditions, applies to activities associated with Lease Sale 258.

We prepared this Biological Opinion using BOEM's and BSEE's Biological Assessment (BA) (BOEM 2022a) and Final Environmental Impact Statement (FEIS; BOEM 2022b), and published literature, agency consultation and biological survey reports, other information in our files, and personal communication with experts in the Service.

2 DESCRIPTION OF THE PROPOSED ACTION

This section describes the Proposed Action and includes descriptions of the Action Area, associated assumptions, and mitigation measures proposed by BOEM and BSEE for the proposed oil and gas activities.

2.1 Action Area

The Action Area includes "all areas to be affected directly or indirectly by the Federal action" (50 CFR 402.02). The Action Area includes waters and shorelines of lower Cook Inlet and the Shelikof Strait (Figure 1). The analysis considered the extent of onshore activities as well as the Oil Spill Risk Analysis (OSRA) (Ji and Smith 2021) in determining the Action Area.

Onshore activities during the first incremental step are limited to support operations; it is assumed these will use existing facilities at Homer or Nikiski. Future incremental steps are expected to include up to two offshore pipelines from the initial platform to shore, with a landfall probably on the Kenai Peninsula between Homer and Nikiski. Onshore sections of the oil pipeline estimated to be up to 129 kilometers (km) will be constructed. Locations of pipeline routes and landfalls will depend on where a commercial discovery is made but are expected to be within the Action Area.

The Lease Sale Area is within the Action Area and contains all OCS lease blocks to be offered in the Lease Sale (Figure 2). Seventeen OCS blocks located in northern sea otter critic habitats are located within the Lease Sale Area but are excluded from the Lease Sale; no leases will be offered on these blocks. Lease Sale 258 will offer 193 OCS blocks for lease (approximately 399,518 hectares (ha).

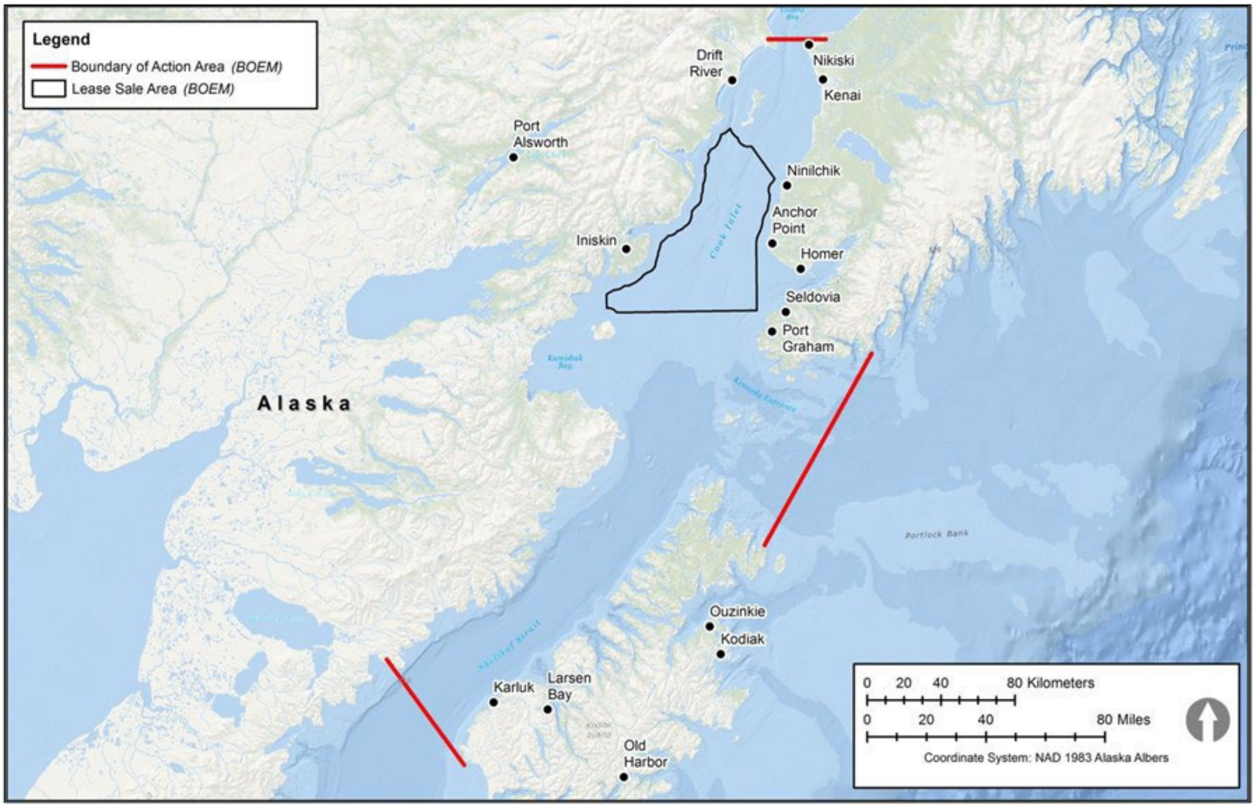


Figure 1 Proposed Action Area for Lease Sale 258, Cook Inlet, Alaska

2.2 Description of the Proposed Action

The Bureau of Ocean and Energy Management (BOEM) held LS 258 pursuant to the Inflation Reduction Act of 2022 (Pub. L. No 117-169, 136 Stat. 1818). Lease Sale 258 was held on December 31, 2022, in accordance with the Record of Decision approved by the Secretary of the Interior on January 17, 2017, notwithstanding the expiration of the 2017-2022 National OCS Oil and Gas Program. The BOEM prepared a Final Environmental Impact Statement (FEIS) for LS 258 (BOEM 2022b), which describes BOEM's "Preferred Alternative." The Proposed Action is the Preferred Alternative in the FEIS, which includes the Lease Sale and post-lease activities, associated assumptions, and mitigation measures.

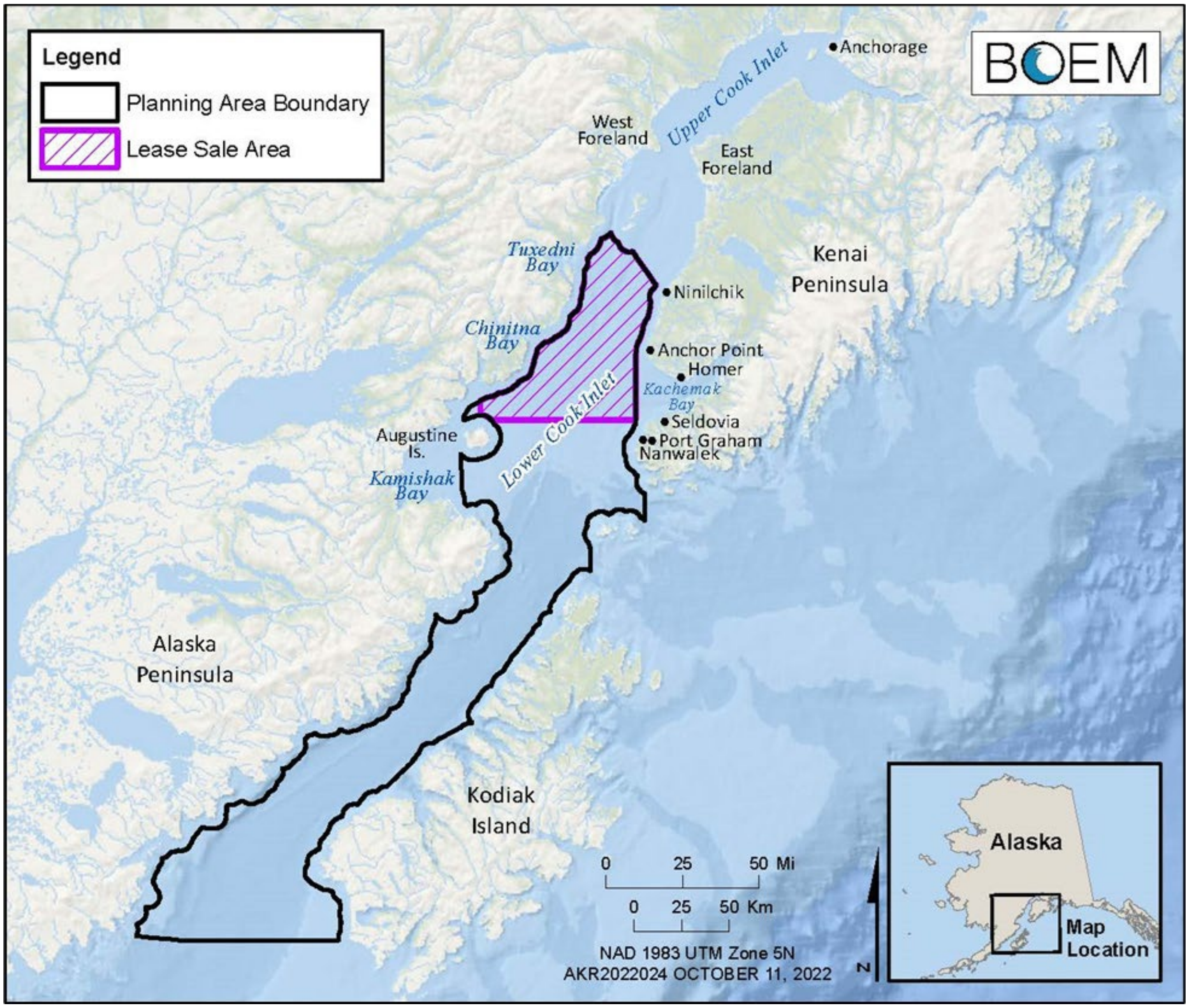
The BOEM's BA analyzed the potential impacts on listed marine mammals and critical habitat from post-lease activities resulting from LS 258. Post-lease activities could include seismic and drilling exploration, development, production, and decommissioning of fields, and the Proposed Action is divided into first and future incremental steps. The first incremental step includes all activities associated with the exploration and delineation of a hypothetical field with commercially viable oil and gas resources. The BOEM considers all activities that would occur after the initial exploration, and delineation to be components of future incremental steps and include development, production, and decommissioning. Future incremental steps beginning with the submission of a Development and Production Plan (DPP), would be the subject of separate ESA section 7 consultations on the specific project(s) at that time. Development activities would include installing production platforms, installing and connecting pipelines to existing onshore pipelines, drilling production and service wells, disposing of drilling wastes, and constructing facilities. Production activities would include the processing of produced oil, gas, and water; treatment and reinjection of produced water and gas for reservoir pressure maintenance; facility, well, and process equipment maintenance; and transportation of materials, process waste, and personnel to support these ongoing production activities. Decommissioning would include removal of equipment, plugging of pipelines, disassembling and removal of platforms, geohazard surveys, and debris cleanup.

The BOEM developed a detailed hypothetical Exploration and Development (E&D) Scenario to provide a basis for analysis of potential effects, which is detailed in the FEIS, section 4.1 (BOEM 2022b). The E&D Scenario describes the types of oil and gas activities that could occur as a result of the LS 258 and provides an estimate of their timing, frequency, and duration (BOEM 2022b). The E&D Scenario is based on both modeling and professional judgment of the interpreted geologic features, coupled with an analysis of current and historic exploration and production activities. Scenario estimates for levels of post-lease oil and gas activity are based on interpretation of available geologic data and specific assumptions about the methods required to extract oil and gas from a given number of fields. It identifies a range of low, medium, and high hydrocarbon production levels. Estimates of oil production range between 0 and 192.3 MMbbl (million barrels). Natural gas production ranges between 6.5 and 8.5 billion cubic meters (Bcm). A high hydrocarbon production level was used in the BOEM's analysis so that the potential impacts of the Proposed Action were not underestimated. The E&D schedule is provided in Table 1.

Table 1 Exploration and Development Scenario Schedule for Cook Inlet Lease Sale 258

Exploration and Development Scenario Schedule for Cook Inlet Lease Sale 258			
Activity	**Beginning Year**	**Ending Year**	**Total Years**
First Incremental Step			
Perform Deep Penetrating 3D Seismic Surveys	1	1	1
Perform Geohazard Surveys	2	40	12
Perform Geotechnical Surveys	2	40	12
Drill Exploration and Delineation Wells	3	5	3
Future Incremental Steps			
Install Platforms	7	19	6
Drill Production and Service Wells	7	21	15
Install Onshore Oil Pipeline	5	6	2
Install Onshore Gas Pipeline	6	6	1
Install Offshore Oil Pipelines	6	18	5
Install Offshore Gas Pipelines	6	18	6
Oil Production	7	38	32
Gas Production	7	38	32
Decommissioning	24	39	16

Source: BOEM (2022a)



Source: BOEM 2022a.

Figure 2 Cook Inlet LS258 Planning Area and Lease Sale Area, Southcentral Alaska

2.3 First Incremental Step (Exploration)

The First Incremental Step includes all activities associated with exploration and delineation of oil and gas resources in the Lease Sale Area. These activities include seismic surveys, geophysical and geotechnical surveys, exploration and delineation drilling, transportation, and oil spill response drills. The first incremental step activities are based on the Exploration and Development Scenario (E&D Scenario) and are expected to occur in the first 5 years. A summary of the First Incremental Step activities is provided in Table 2.

Table 2 Summary of Cook Inlet Lease Sale 258 First Incremental Step Activities

Activity	Year(s)	Restrictions	Estimated Operations	Associated Transportation
Geophysical and Geotechnical Surveys				
Deep penetrating 3D seismic surveys	1	Not allowed on any OCS block between Nov 1 and Apr 1. Not allowed on beluga whale nearshore feeding areas OCS blocks between July 1 and Sept. 30. Not allowed on any OCS block above Anchor Point during drift gillnetting season, if opened (usually mid-June to mid-Aug).	1 survey. 28 blocks. Survey methods could include towed streamer, ocean bottom node, and ocean bottom cable.	Vessel(s) dependent on survey type, may include marine mammal monitoring vessel. No aircraft.
Geohazard and geotechnical surveys	2-5	Not allowed on any OCS blocks between Nov 1 and Apr 1.	1-4 surveys Could include echosounders, side scan sonar, bubble pulsers or boomers, controlled source electromagnetic sounding.	1 survey vessel. Additional vessel for marine mammal monitoring may be needed. No aircraft.
Airborne geophysical survey	1-5	n/a	1 airborne survey. 1 million acres Year-round.	1 survey aircraft.
Exploration Drilling Operations				
Exploration and delineation drilling	3-5	No discharge of drilling fluids and cutting or seafloor-disturbing activities on the 7 available OCS lease blocks located within 1,000 m of northern sea otter critical habitat.	A maximum of 3 wells per drilling rig could be drilled, tested, and plugged per season. Drilling would take 30- 60 days per well. A total of up to 8 exploration and delineation wells would be drilled. Wells would produce 588 cy of dry rock cuttings and use 9,000 bbl of drilling fluids per well.	1 drilling rig with a maximum of 1 per prospect. 1-2 resupply vessel trips per week per drilling rig during exploration drilling (likely from Nikiski or Homer). 1-2 helicopter flights per day per drilling rig while on location. 7-14 helicopter trips per week (likely from Nikiski or Homer).
Government-initiated oil spill response exercises	3-5	Year-round.	1-2 exercise per year, each lasting no more than 1 day. Exercises could involve offshore and shoreline-based equipment deployment.	Number and type of transportation would vary on exercise A likely scenario could include vessels, helicopter, fixed wing aircraft and/or landing craft, all-terrain vehicles, and motor vehicles.

Source: BOEM (2022a).

2.3.1 Deep Penetrating 3D Seismic Surveys

In the E&D Scenario, lessees would use deep penetrating three-dimensional (3D) seismic survey data to determine the optimal location for drilling the first well on their lease acreage. Deep-penetrating 3D seismic surveys generally cover a large area of leased acreage. The BOEM assumes that one deep penetrating 3D seismic survey could be conducted during the first year of the E&D Scenario. The most likely support base for seismic operation would be Kenai/Nikiski or Homer.

For 3D surveys, the sounds source array typically consists of two to three subarrays of six to nine airguns each. An energy source (e.g., airgun, water gun, or marine vibrator) would be used to transmit energy into the subsurface and generate seismic waves. Seismic waves reflect and refract off subsurface strata and travel back to acoustic receivers. The acoustic receivers may be towed streamers which consist of multiple hydrophone elements normally towed behind the vessel, or ocean bottom nodes that are places on the seafloor.

Airguns release a high-pressure air pulse into the water, which produce an air-filled cavity (bubble) that expands and contracts. A group of airguns is usually deployed in an array to produce more downward-focused sound signal. Airgun array volumes are expected to range from 29,497 to 81,935 cubic centimeters but may range up to 98,322 cubic centimeters. While most of the energy is focused downward, the sound can propagate horizontally for several kilometers (km) (Greene and Richardson, 1988; Hall et al. 1993).

The sound-source level (zero-to-peak) associated with typical deep penetrating 3D seismic surveys ranges between 233 and 255 decibels (dB) referenced to 1 microPascal (μPa) at 1 meter (m) (dB re: 1 μPa @ 1 m)[2], with most of the energy emitted between 10 and 120 hertz (Hz). Marine 3D surveys are acquired at typical vessel speeds of 8.3 km per hour. A source array would be activated approximately every 10 to 15 seconds, depending on vessel speed. The timing between outgoing sound signals can vary for different surveys to achieve the desired "shot point" spacing to meet the geological objectives of the survey; typical spacing is either 25 or 37.5 m but may vary depending on the objective of the survey. Airguns can be fired between 20 and 70 times per km.

The vessels conducting this type of survey are generally 70 to 120 meters long. Vessels tow one to three source arrays of six to nine airguns each. Arrays are towed below the water surface but above the seafloor. Most operations use a single source vessel, however more than one source vessel would be used when working in shallow waters. Vessel transit speed are highly variable, ranging from 14.8 to 37.0 km per hour depending on several factors such as the vessel, sea state, and urgency. Seismic vessels operate day and night, and a survey may continue for days, weeks, or months depending on the size of the survey, capabilities of the vessel, and weather conditions.

Ocean bottom node and ocean bottom cable deep penetrating surveys are used in Cook Inlet primarily to acquire seismic data in transitional zones where water is too shallow or where tides make acquisition with streamers very difficult. Ocean bottom node seismic surveys require the use of multiple vessels. A typical survey includes: (a) two vessels for cable or node layout per pickup; (b) one vessel for recording ocean bottom cable data only; (c) one or two source vessels; and (d) possibly one to three smaller (10 to 15 m) utility boats. It is unlikely that helicopters would be used for vessel support and crew changes unless there are safety concerns. An additional support vessel may be used to monitor for marine mammals ahead of the survey vessel.

Ocean bottom node or ocean bottom cable operations would begin by deploying nodes or cables off the back of the layout boat. Node or cable length typically is 5 to 8 km but can be up to 12 km. Multiple lines of nodes or cables are laid on the seafloor parallel to each other, with a cable spacing of between hundreds of meters to several kilometers. Ocean bottom node surveys may use an acoustical positioning system (or "pinger" system), which consists of a vessel-mounted transceiver and transponders that attach to nodes. A pinger system used by SAExploration in Cook Inlet consisted of a transceiver that generated sonar at transmission source levels of 197 dB at frequencies between 35 and 55 kilohertz and a transponder that produced short pulses of 184 to 187 dB at frequencies also between 35 and 55 kilohertz (NMFS 2015a, 2015b).

2.3.2 Geohazard and Geotechnical Surveys

Geohazard and geotechnical survey are a different type of seismic survey which would include side-scan sonar and shallow penetrating reflection-seismic profiling. These surveys would be conducted on a more specific site to detect archeological resources or seafloor feature that might be problematic for operations. The BOEM assumes that between one to four geohazard and geotechnical surveys would be conducted throughout the duration of the projects. Surveys could occur in a leased block from April 2 to June 30 and October 1 to October 31 (timing restrictions for federally endangered Cook Inlet beluga whales (*Delphinapterus leucas*) and drift gillnetting season).

The suite of equipment used during a typical shallow hazards survey may be single beam and multibeam echosounders, a side scan sonar, a subbottom profiler, a bubble pulser or boomer, and a multichannel seismic system. An equipment and summary table was provided by BOEM (BOEM 2022, p. 13) and based on information from Crocker and Fratantonio (2016). For analytical purposes, BOEM lists the highest power settings and source levels, though source levels could be below the levels indicated. The mean sounds from all potential source range between 180 and 224 decibels. Peak sounds from sources range from 186 to 226 decibels.

The echosounders and subbottom profilers are generally hull-mounted while all other equipment is usually towed behind the vessel. The towed multichannel seismic system consists of a single small airgun or an array of small airguns, usually two to four. The source array would be towed about 3 meters behind the vessel with a firing interval of approximately 12.5 meters of travel or about every 7 to 8 seconds. A single 300- to 600-meter channel streamer with a 12.5-meter hydrophone spacing and tail buoy functions as the passive receiver for the reflected seismic waves. The ship would travel at 5.6 to 8.3 km per hour. These ships are designed to reduce vessel noise, as the higher frequencies used in high-resolution work are easily masked by the vessel noise. Surveys are site specific and can cover less than one lease block, but the survey extend depends on the number of potential drill sites.

Aerial gravitational or magnetic geophysical surveys would be conducted from a fixed-wing aircraft or helicopter. Flight lines follow transects over the area of interest and are generally conducted over the course of several days. The BOEM estimates that one aerial survey may be conducted.

Geotechnical surveys would be conducted to collect bottom samples to obtain data on sediments. Sediment samples are typically collected using a gravity/piston corer, grab sampler, or dredge sample. Shallow coring (0.3 to 152 meters deep), using conventional drilling from a boat or drilling barge is another method that could be used.

The E&D Scenario estimates 11 to 36 well site clearances in total would be conducted, including both geophysical and geotechnical survey. Multiple well sites would be combined for a total of up to four geotechnical and four geophysical survey efforts. A single vertical well site survey would collect about 74 line-kilometers of data per site and take approximately 24 hours. If there is a high probability of archaeological resources, the 150-meter by 300-meter grid must be extended to 1200 meters from the drill site.

2.3.3 Exploration and Delineation Drilling

Potential operators would drill exploratory wells based on mapping of subsurface structures using 3D deep penetrating seismic data and historical well information, as well as information from geohazard and geotechnical surveys. Exploration drilling operations are likely to employ Mobile Offshore Drilling Units (MODUs; e.g., drill ships, semisubmersibles, and jack-up rigs). The BOEM expects drilling operations in Cook Inlet to range between 30 to 60 days at different well sites, depending on well depth, any delays, and testing operations. The BOEM estimates three wells per drilling rig could be drilled, tested, and abandoned or plugged during a single drilling season using one MODU. The BOEM assumes only one MODU would be using in the Lease Sale Area. Based on the size and reservoir characteristics, as many as eight wells could be drilled during exploration activities. Exploration drilling could occur at any time of the year; however, unpredictable winter weather conditions may limit drilling operations either by logistics or additional expenses. Assuming a discovery is made by an exploratory well, an operator would use drilling rigs to drill delineation wells to determine the spatial extent of possible economic production.

2.3.4 Transportation

Marine vessels would be the primary form of transportation during the first incremental step. Aircraft would support exploratory drilling activities and could be used during government-initiated oil spill response exercises. Operations at remote locations in the Lease Sale Area would require transportation of supplies and personnel by different means, depending on seasonal constraints. While vessels would be the typical transportation used, seasonal conditions may warrant helicopters be used for basic resupply and crew rotation.

- Seismic surveys: The number of vessels would be dependent on survey type. No aircraft would be required. Smaller support vessels would make occasional trips (one to two roundtrips per week) out of Homer or Nikiski. A mitigation vessel might accompany the seismic survey vessel(s) if directed by the National Marine Fisheries Service (NMFS) or the Service.
- Exploration and delineation drilling: Operations would be supported by both helicopters

and supply vessels. Helicopters probably would fly from Nikiski or Homer once or twice per day. Support-vessel marine traffic would fly from Nikiski or Homer up to five trips per week.

- Government-initiated oil spill response exercises: The numbers and types of transportation would vary depending on the exercise, but would likely include vessels, helicopters, fixed-winged aircraft, and land transportation.

2.3.5 Accidental Oil Spills

While oil spills are illegal and not authorized by BOEM, they may occur during activities associated with LS 258. In their analysis, BOEM makes a distinction between small oil spills (less than 1,000 barrels of oil (bbl)), large oil spills (greater than 1,000 bbl), and very large oil spills (great than 120,000 bbl) because there are substantial differences in likelihood of occurrence by spill type. Spills during the first incremental step are estimated to be small (50 bbl or less) and consist of refined oils. Crude and/or condensate oil would not be produced for commercial sale during the exploration phase.

Based on a review of potential discharges and the historical oil spill occurrence data for the Alaska OCS, most spills are typically small. From 1975 to 2015, industry drilled 85 exploration wells in the entire Alaska OCS (BOEM, 2016a, b). During this time the drilling industry had approximately 53 small spills totaling about 32 bbl. Of the 32 bbl spilled, approximately 24 bbl were recovered or cleaned up. The total annual number and volume of small, refined oil spills during exploration activities was estimated by BOEM by applying historical spill data (BOEM 2012, 2016a, 2016b) to the E&D Scenario for LS 258 and is displayed in Table 3. Up to six spills are projected to occur during exploration, ranging in size from less than 1 bbl up to 50 bbl per spill.

Table 3 Cook Inlet Lease Sale 258 Action Area Oil Spill Estimates: First Incremental Step

Activity	Type of Small Oil Spills	Total Number of Small Spills	Total Volume of Small Spills (bbl)	Annual Number of Small Spills	Annual Volume of Small Spills (bbl)
Exploration Geological and Geophysical Activities	Refined	0–3	0–13	0–1	0–<1 or <13
Exploration and Delineation Drilling	Refined	0–3	0–60	0–1	0–<5 or <50

Note: [1] Geological and Geophysical Activities include deep penetrating 3D seismic surveys, geohazard surveys, and geotechnical surveys.
Source: BOEM (2022a; Appendix A).

2.3.6 Oil Spill Response Drills

Government initiated oil spill response exercises or spill response practice activities may occur during the first incremental step. The response drills could include equipment deployment, vessels and/or aircraft traffic, unmanned aerial surveillance, and personnel or vehicle movement. Typical deployment exercises last only a few hours and rarely longer than a day. Deployment exercises are generally limited to a single skimming system involving from one to six vessels.

Sorbent booms would likely be deployed and could include up to 914.4 meters of ocean for offshore response and up to 609.6 meters of coastal boom for near shore and shoreline protection tactics. This would represent a very large-scale exercise that simultaneously tests the operator's competency at response in both types of environments; the most likely scenario would be much smaller testing of a single tactic. Open water drills would most likely require between 27.4 and 152.4 meters of conventional boom. Shoreline protection drills would most likely require between 76.2 meters and 152.4 meters of coastal boom.

2.4 Future Incremental Steps (Development, Production, and Decommissioning)

Future Incremental Steps include all activities that would occur after exploration and delineation, and the approval of a DPP. These activities include development, production, and decommissioning. Table 4 details the activities anticipated during Future Incremental Steps, including associated transportation.

The Cook Inlet Planning Area has a nearby market for both oil and gas. Cook Inlet gas has become a valuable commodity to be used locally or potentially transported as liquefied natural gas (LNG). The existing natural gas distribution system in southcentral Alaska could be extended to transport gas from the Cook Inlet OCS to the greater Anchorage and Kenai Peninsula areas (BOEM, 2022b). Development of the field would begin in approximately Year 7, where the majority of development activities would likely occur through Year 21. The BOEM anticipates production activities would begin in approximately Year 7 and production of oil and gas would continue through Year 38. Decommissioning would commence after oil and gas reserves at a given platform are depleted, and income from production no longer pays operating expenses (anticipated to occur after Year 38). To comply with BSEE regulations (30 CFR 250.1710—wellheads/casings, and 30 CFR 250.1725—platforms and other facilities), lessees will be required to remove all seafloor obstructions from their leases within 1 year of lease termination or relinquishment.

The schedule of activities assumes there would be no construction delays for platforms, regulatory delays, or other delays of any kind (BOEM 2022a). The Proposed Action also assumes immediate commitment from the operator(s) after a successful exploration program, with no funding delays, and that all operators coordinate and cooperate successfully. These assumptions help ensure the potential impacts of the Proposed Action will not be underestimated, while the actual timeline for development of a prospect in the Lease Sale Area would be determined by the lessee and could be affected by any of the variables mentioned above.

2.4.1 Development and Production Activities

Development activities include installing production platforms, installing and connecting pipelines to existing onshore pipelines, drilling production and service wells, disposing of drilling wastes, and constructing facilities. Production activities include the processing of produced oil, gas, and water; treatment and reinjection of produced water and gas for reservoir pressure maintenance; facility, well, and process equipment maintenance; and transportation of materials, process waste, and personnel to support these ongoing production activities. Tables 4 and 5 describe development and production activities and infrastructure for this E&D Scenario based on the following assumptions:

- A reservoir could be discovered and developed at any location leased under this sale.
- Offshore developments resulting from LS 258 would use existing facilities in the Cook Inlet region such as airfields, docks, storage, and processing facilities.
- Production platforms would have a single drilling rig capable of year-round drilling.
- Each platform could have up to 24 well slots, processing equipment, fuel and production storage capacity, and quarters for personnel.
- All processing would be done on platforms; there would be no new onshore processing facilities.
- Produced water would be separated and reinjected into the reservoir using service wells.
- Domestic wastewater from the crew quarters and mess facilities on the platforms would be disposed in service wells.
- Up to 128.7 km of offshore and 128.7 km of onshore oil pipelines would be installed to connect the offshore oil field to the oil refinery at Nikiski.
- Up to 193.1 km of new offshore gas pipelines would be installed with 1.6 km of new onshore gas pipeline installed that would connect to the existing gas pipeline that runs from Homer to Nikiski.

Table 4 Production and Development Activities Associated with Lease Sale 258

Element	Number	Footprint Area (Acres)	Season	Comment
Production wells	8-81	n/a – area within platform footprint	Year Round	Production wells area disturbance is included in the platform seafloor disturbance.
Service wells	4-27	n/a – area within platform footprint	Year Round	Production wells area disturbance is included in the platform seafloor disturbance.
Rock cuttings from production and service wells (cy)	7,056–63,504	0	Year Round	Production and service wells would average 449 cubic meters of dry rock cutting, which would be disposed of in-service wells or barged to shore for disposal and established treatment facilities.
Drilling fluids from service and production wells (bbl)	9,360–84,240	0	Year Round	On average, 2,369 bbls of drilling fluid would be used to drill each production well. 80 percent of the drilling fluid is expected to be recycled; 20 percent would be injected into disposal wells or discharged[1].
Steel jacketed platforms installed	1-6	<1	Open Water	0.1057 hectare footprint/platform (26 m by 21m).
New shore bases	0			

Element	Number	Footprint Area (Acres)	Season	Comment
New onshore drilling and production waste handling facilities	0			
Total oil production (MMbbl)	192.3	n/a	Year Round	
Total gas production (Bcm)	8.75	n/a	Year Round	
Peak oil rate (Mbbl/day)	36.7	n/a	Year Round	
Peak gas rate (MMcm/day)	2.43	n/a	Year Round	

Notes: bbl = barrels, Bcm = Billion cubic meter, MM bbl = Thousand million barrels, Mbbl = thousand barrels, MMcm = million cubic meter, n/a = not applicable
All values are for entire lifespan of the E&D Scenario.
[1] Water-based drilling fluids and cuttings would be discharged under the NPDES in accordance with the Clean Water Act.
Source: BOEM (2022, Appendix A).

Table 5 Pipelines Associated with Lease Sale 258

Element	Number	Footprint Area (ha)	Season	Comment
Onshore Oil Pipeline (mi)	0–80	0–117	Year Round	Footprint based on an estimated 9.1m wide disturbance for pipeline installation. Onshore pipeline would be buried where practical.
Onshore Gas Pipeline (mi)	1	1.6	Year Round	Footprint based on an estimated 9.1m wide disturbance for pipeline installation. Onshore pipeline would be buried where practical.
Offshore Oil Pipeline (mi)	0–80	0–118	Open water	Footprint based on an estimated 9.1m wide disturbance for pipeline installation. Offshore pipeline would be buried where practical.
Offshore Gas Pipeline (mi)	40–120	59–176	Open water	Footprint based on an estimated 9.1m wide disturbance for pipeline installation. Offshore pipeline would be buried where practical.
New Pipelines to shore	1–2	n/a	n/a	Number of new pipelines crossing the shoreline.

Notes: All values are for entire lifespan of the E&D Scenario.
n/a = not applicable
Source: BOEM (2022, Appendix A).

2.4.2 Decommissioning Activities

Operators would begin well and facility shutdown when income from production no longer covers operating expenses. Decommissioning activities are regulated by BSEE under 30 CFR Part 250, Subpart Q.

- Decommissioning would be completed in stages with hub platforms remaining in service the longest, because production would continue to flow through them from satellite platforms to nearshore facilities.
- Wellhead equipment would be removed, and wells would be permanently plugged with cement. Processing modules would be moved off the platforms.

- Subsea pipelines would be decommissioned by cleaning out inner diameter, plugging both ends, and leaving them buried in the seabed.
- Platforms would be disassembled and removed from the area and the seafloor site restored to a practicable predevelopment condition.
- Post decommissioning geohazard surveys would be required to confirm that no debris remains and pipelines were decommissioned properly.

2.4.3 Transportation

Personnel and materials would be transported to exploration and production sites by helicopter, and/or marine supply vessels from an existing onshore base or dock. The highest number of trips by helicopter or supply vessel would occur during platform installation and then during decommissioning. Supply vessel trips may drop to two per week per platform during normal production operations. Table 6 describes transportation activities estimated to occur during future incremental steps.

Table 6 Transportation Activities for Exploration, Development, and Production, and Decommissioning for Lease Sale 258

Element	Number of Activities	One Way Distance (km)	Season	Comment
Maximum flights per week during peak exploration activity	14	1,126[1]	Year- Round	Approximately 2 flights per day. Flights would depart from Homer or Nikiski.
Maximum boat trips per week during peak exploration activity	5	402[1]	Open Water	Vessels would depart from Homer.
Flights per week during peak development, production, and decommissioning phases	7–42	563–3,380[1]	Year Round	One flight could service multiple platforms. Number of platforms range from 1–6. Flights would depart from Homer or Nikiski.
Boat trips per week during peak development, production, and decommissioning phases	7–42	563–3,380[1]	Open Water	Number of platforms range from 1–6. Vessels would depart from Homer.

Notes: All values are for entire lifespan of the E&D Scenario.
[1] Distance assumes maximum number of trips to likely development locations within the sale area (80 km from Homer or Nikiski).
Source: BOEM (2022).

The OCS construction (i.e., platform and pipeline installation) and development drilling operations would be supported by both helicopters and supply vessels from existing facilities located in either Homer or Nikiski. Helicopters would fly from either Homer or Nikiski at a frequency of one to three flights per day during development operations. One flight could service multiple platforms. Support vessel traffic is estimated to consist of one to three trips per platform per week from either Homer or Nikiski (Table 6).

During normal production operations, the frequency of helicopter flights offshore would remain the same as during development (one to three per day), but marine traffic would drop to about one to two trips per week to each platform. Marine traffic would occur year-round since this area remains ice free during the winter. If barges are used to transport the drill cuttings and spent mud from production wells during drilling operations, a dedicated barge could make one to two trips per platform per week to an onshore disposal facility and would contribute to the totals shown in Table 2-5 in the BA.

The number and types of vessels, aircraft, and onshore equipment would vary depending on the decommissioning activities. Use of vessels, including barges with cranes and tugs for platform removal, is anticipated. Terrestrial transportation and equipment for onshore decommissioning would be similar to that used during installation. Aircraft and terrestrial transportation to support decommissioning efforts and possible post-decommissioning surveys likely would occur (Table 2-5 of the BA).

2.4.4 Accidental Oil Spills or Gas Release

Oil spills could potentially occur as illegal, unauthorized events resulting from activities in the first and future incremental steps (Tables 7 and 8). The BOEM developed hypothetical oil spill scenarios using technical data about Cook Inlet's oil and gas resources and data from spill events during activities similar to those of the Proposed Action. Scenario models predicted the probable spill volumes and geographical trajectories. The models were then used to evaluate the likely effects of spill events given seasonal timing (BOEM, 2022b). Small spills are reasonably certain to occur, but large spills are unlikely. The BOEM considered effects of a large spill to ensure effects to listed species and critical habitat are not underestimated. The BOEM and BSEE estimate up to 6 small spills could occur during the first incremental step (Table 6) and an additional 405 small spills plus 1 large spill could occur during future incremental steps Table 7), for a total of 412 spills over the life of the Proposed Action. Although a large spill of oil or release of gas is an unplanned and unlawful event, and is unlikely to occur, BOEM provided analysis of this contingency to ensure that potential effects are not underestimated. The chance of a large spill occurring is estimated to be 19 percent, and the chance of no large spills occurring is 81 percent over the E&D Scenario lifecycle. The estimated chance of a gas release is 4 percent, and the likelihood of no gas release is 96 percent over the life of the Proposed Action. These estimates are based on historical data on spills greater than 1,000 bbl (ABS Consulting, 2016), statistical estimates of the mean number of large spills from platforms and pipelines, the number and size of large spills on the OCS, and project-specific information from the E&D Scenario. An "oil spill scenario" was developed and summarized to estimate the effects of a large spill. It is presented in full in the BA (BOEM 2022a) and in the FEIS (BOEM 2022b).

2.4.4.1 Small Spills (less than 1,000 bbl)

An estimated 405 crude, condensate, or refined small oil spills could occur during development, production, and decommissioning. Of those, about 389 would be less than 1 bbl, 14 would be between1 and 50 bbl, and 2 would be between from 50 bbl and 500 bbl (Table 6).

2.4.4.2 Large Spills (greater than or equal to 1,000 bbl) or Gas Releases

A large spill is not an expected outcome of the Proposed Action. However, to ensure effects are not underestimated, this BA assumes one large spill (3,800 bbl) of crude, condensate, or refined (diesel) oil would occur during development and production activities. The BOEM (2022a) assumed one loss of well control or one pipeline rupture (offshore or onshore) over the 32 years of gas production. The gas release would result in a loss of up to 30 million cubic feet (MMcf) of natural gas over one day.

Table 7 Total and Annual Potential Small Spills for Identified Oil and Gas Activities for Lease Sale 258

Activity	Type of Small Oil Spills	Total Number of Small Spills	Total Volume of Small Spills (bbl)	Annual Number of Small Spills	Annual Volume of Small Spills (bbl)
Development and Production, Decommissioning	Refined, Crude, or Condensate	0–405	0–310	0–13	0–10

Source: BOEM (2022).

Table 8 Generalized Size, Oil Type, and Timing of Potential Spill or Release over E&D Scenario Lifespan

Spill Size	Oil Type	Exploration (Years 1-5)		Development and Production (Years 6-13)				Production (Years 14-34)	Production and Decommission (Years 35-40)		
		YEARS 1 THROUGH 40									
		1-2	3-5	6	7-8	9-10	11	12-34	35-38	39	40
Small	Refined	G&G Surveys									
			Drilling								
				Development, Production and Decommissioning							
	Crude Condensate				Oil Production						
Large	Crude Condensate				Oil Production						
Large	Diesel				Oil and Gas Development and Production						

Source: BOEM (2022a).

Although a large spill of oil or release of gas is an unplanned and unlawful event and is not an expected outcome of the proposed action, an analysis of this contingency was included to ensure that potential effects are not underestimated. The chance of a large spill occurring is estimated to be 19 percent, and the chance of no large spills occurring is 81 percent over the E&D Scenario lifecycle. The estimated chance of a gas release is 4 percent, and the likelihood of no gas release is 96 percent over the life of the Proposed Action. These estimates are based on historical data on spills greater than 1,000 bbl (ABS Consulting 2016), statistical estimates of the mean number of large spills from platforms and pipelines, the number and size of large spills on the OCS, and project-specific information from the E&D Scenario. See Appendix A, section A-2, of the FEIS (BOEM 2022b).

2.4.4.3 Oil Spill Analysis

BOEM studied how and where large offshore spills move by using an oil spill trajectory model, known as the Oil Spill Risk Analysis (OSRA) model, which calculates the probability of oil spill contact (conditional probabilities) and occurrence and contact (combined probabilities) with specific geographic areas within and outside of Cook Inlet (Ji and Smith, 2021). Using this approach, BOEM ran simulations of a 3,800-bbl spill originating from any of six Launch Areas (LAs) and four Pipeline Segments (PLs) – hypothetical locations in the Lease Sale Area shown in the FEIS (BOEM, 2022b, Appendix A). The locations are not meant to represent or suggest any particular development scenario or outcome. The BOEM then modelled more than 800,000 trajectory simulations to calculate the likelihood that a large spill from one of the LAs or PLs would contact certain geographic areas in Cook Inlet and the surrounding region. The specific geographic areas are categorized as Environmental Resource Areas (ERAs), Land Segments (LSs), or Grouped Land Segments (GLSs).

The OSRA presents the conditional and combined probabilities (expressed as a percent chance) of a large oil spill contacting or occurring and contacting an ERA, LS, or GLS. Conditional probabilities estimate the chance that the spill contacts an area based on the assumption that a large oil spill has occurred (see BOEM 2022, Appendix A). Combined probabilities factor in the chance of a large oil spill occurring and the probability of contacting a specific geographic resource area (ERA, LS, or GLS). The conditional probabilities are discussed first, followed by the combined probabilities.

A large spill is not a likely outcome from the Proposed Action, but for the purpose of the analysis, BOEM assumes that a large spill originating from an offshore LA or PL would occur at 39.9 m water depth or less and that the released oil would reach the sea surface within a short period of time. The OSRA trajectory model is based on the movement of un-weathered oil with no effective mitigation from oil spill response activities. The BOEM also performed weathering calculations to estimate the fate of spilled oil. Potential mitigating factors, such as spill response strategies, are not incorporated into the model and are only considered when assessing potential impacts from spills.

Evaluating the potential effects of the Proposed Action, which entails oil and gas exploration, development, production, and decommissioning activities projected to take place over 40 years, is complicated by uncertainty in several respects. First, there is uncertainty inherent in the E&D Scenario provided by BOEM. The Proposed Action includes a detailed hypothetical scenario based on the best available information. It projects reasonably foreseeable activities and locations, and thereby provides a reasonable and suitable basis for impact evaluation. There is uncertainty in the number, volume, timing, and location of possible oil spills. The FEIS and this BA estimate the number and volume of spills that may take place based on mean spill rates and median spill sizes derived from OCS data, and the volume of oil estimated to be produced. A trajectory model calculates the chances of a large spill contacting important resource areas and then tabulates the chance of a large spill occurring and contacting these same resources. As with any projection or forecast, forward-looking statements are inherently susceptible to uncertainty and changes in circumstances. Actual events would be unlikely to exactly match the projections provided.

2.4.4.4 Very Large Oil Spills (greater than or equal to 120,000 bbl)

Very large oil spills (VLOS) and gas releases are very low probability, high impact events. Although very unlikely (probability modeled between 0.0001 and 0.00001) and not considered part of the Proposed Action, BOEM considered a hypothetical long duration loss of well control resulting in 120,000 bbl of oil and released gas. For an analysis of a VLOS (greater than 120,000 bbl) and gas release, which is not reasonably certain as a result of Cook Inlet OCS oil and gas activities, refer to section 4.12, Impacts of a Very Large Oil Spill, and A-7, Very Large Oil Spill in the document: *Cook Inlet Planning Area Oil and Gas Lease Sale 244 in the Cook Inlet, Alaska Final Environmental Impact Statement* (BOEM, 2016). The 2016 FEIS includes a discharge analysis methodology, general effects of oil and gas on physical, biological, social, and economic resources, and impacts to resources from the initial loss of well control event to long-term recovery.

2.4.4.5 Oil Spill Response Drills

Government-initiated unannounced exercises (GIUE) or spill drills conducted by the lessee are discussed in the first incremental step (section 2.2.3.6 in the BA (BOEM 2022a) and will continue throughout the future incremental steps. The BSEE anticipates up to one spill drill per year through production (Year 33). The GIUEs for each individual operator or facility generally occur every 3 years unless additional drills are warranted based on inadequate performance on previous exercises. Multiple operators or facilities may occur in the Lease Sale Area, and although rare, two spill drill exercises could occur in one year. Field activities would occur during a single day. The spill drill location would be adjacent to the facility or in the local area (within 25 km of the staging area). Spill response practice activities could include oil spill response equipment deployment, vessels and or aircraft traffic, unmanned aerial surveillance, and personnel or vehicle movement. There is some potential for a small, refined spill to result from spill response or an oil spill response exercise. Oil spill response equipment and vessels or aircraft may be staged in or near the drilling or production area or onshore in the Cook Inlet Region.

2.5 Mitigation Measures

The following section describes mitigation measures typically required for the types of activities comprising the Proposed Action throughout the first and future incremental steps. As specific projects are proposed in this multi-stage oil and gas program, more precise information about the nature and extent of the activities, including the scale and location of the activities and a description of the technologies to be employed, will be considered and evaluated in additional ESA consultations and other analyses (e.g., National) as appropriate. Through this process, a dynamic analysis of the potential effects of actual oil and gas activities is ensured, and additional mitigation measures and protections may be developed at any stage based on the details of the projects.

Mitigation measures are applied at several stages. At the lease sale stage, BOEM applies mitigation measures in the form of lease stipulations, which are fully enforceable as required conditions for the sale on all leases. Proposed lease stipulations are summarized below and provided in full in Appendix B of the BA (BOEM 2022a). Final lease stipulations were published in the Final Notice of Sale document before LS 258 was held on December 31, 2022 (87 FR 65247, October 28, 2022). Post-lease activities may have mitigation imposed through conditions of approval of plans, permit conditions, or other mechanisms. Oil and gas activities on the OCS must comply with all applicable Federal, State, and local laws and regulations, some of which also impose mitigation measures.

Leaseholders and other permittees also routinely request and are expected to obtain authorizations for activities that could result in the "take" of marine mammals under the Marine Mammal Protection Act (MMPA). These Incidental Harassment Authorizations (IHAs) or Letters of Authorization (LOAs) contain mitigation measures to ensure the authorized activities will result in take of no more than small numbers of marine mammals and have no more than a negligible impact on marine mammal stocks. The MMPA identifies a different threshold for impacts than the jeopardy standard under the ESA, but mitigation measures to prevent and minimize take under the MMPA also serve to reduce take under ESA. The mitigation measures typically required for activities in Cook Inlet are described below and in full in the BA (BOEM 2022a). Each IHA or LOA would specify final design features and operational procedures to mitigate impacts to marine mammals and may differ from those described here. The BOEM will review any proposed differences and will reinitiate consultation or request project-specific consultation if the activities or effects differ from those considered here.

2.5.1 Lease Sale 258 Stipulations

Several LS 258 stipulations offer protections to ESA-listed species and are considered part of the Proposed Action. Stipulations for LS 258 are provided in Appendix B of the BA (BOEM 2022a) and on the BOEM website as part of the Final Notice of Sale package (87 FR 65247). Relevant stipulations are summarized here:

- Protection of Biological Resources. This stipulation gives BOEM and BSEE authority to require the lessee to conduct biological surveys to determine the presence, extent, and composition of biological features when a previously unidentified biological population or habitat is discovered. The lessee or operators may be required to relocate and/or modify the types and timing of operations to minimize impacts to the biological population and/or habitat.
- Orientation Program. This stipulation requires lessees and operators to include in their Exploration Plan (EP) or DPP an annual orientation program for addressing the importance of avoiding disturbance of endangered species, bird colonies, and marine mammals.
- Protection of northern Sea Otter Critical Habitat. On any lease block that does not contain northern sea otter designated critical habitat but is located within 1,000 m of northern sea otter critical habitat, the Lessee(s), its operators, and subcontractors are prohibited from the discharge of drilling fluids and cuttings and seafloor-disturbing activities (including anchoring and placement of bottom-founded structures).

2.5.2 Information to Lessees and Operators

BOEM's Final Notice of Sale for LS 258 includes Information to Lessees and Operators (ITLs) and is available on BOEM's LS 258 web site (https://www.boem.gov/AK258). The ITLs notify lessees of their obligations to comply with statutes, regulations, and relevant permit conditions. ITLs are listed fully in Appendix B of BOEM's BA (2022a).

2.5.3 Mitigation Measures for First Incremental Step Activities

Mitigation measures are specific to the type and phase of oil and gas development. A variety of typical design features and operational procedures are used to mitigate potential impacts of petroleum from these activities. Our analysis of the Effects of the Action assumes all mitigation measures identified in the BA (BOEM 2022a) will be implemented with compliance of all applicable Federal, state, and local laws and regulations.

Mitigation measures and typical monitoring protocols for exploratory seismic operations and exploratory and delineation drilling are presented. Mitigation measures for vessel, aircraft, and terrestrial vehicle operations and onshore development activities are also presented.

If First Incremental Step activities delineate oil and gas reserves of sufficient size and companies choose to move into production, additional consultation would take place when BOEM receives a DPP. The DPP describes development and production activities proposed by an operator for a lease or group of leases. The description includes the timing of these activities, information concerning drilling vessels, the location of each proposed well or production platform or other structure, and an analysis of both offshore and onshore impacts that may occur as a result of the plan's implementation. The DPP would identify the precise location of the production well and associated facilities such as pipelines to shore and onshore processing facilities, providing BOEM, BSEE, and the Service with project-specific details of future incremental step activities that enable the agencies to evaluate impacts on listed species at a more detailed level and to identify potential mitigations of such impacts.

This section provides a general description of mitigation measures that, in addition to the lease stipulations and ITLs, BOEM will require for the first incremental step activities. Mitigation measures may be updated in the future through coordination with Service. The BOEM will review each plan that is submitted by a lessee that requires approval to ensure the activities are within the scope of activities covered in this BA and consulted on by Service. The BOEM's project-specific review will also include an evaluation of the mitigation measures to ensure they will be implemented in accordance with the intended purpose and effectiveness of mitigation measures presented here and/or terms and conditions of any biological opinions.

2.5.3.1 General Requirements

1) In the event of an unanticipated spill, the operator will comply with the National Oceanographic and Atmospheric Administration's (NOAA's) most current Marine Mammal Oil Spill Response Guidelines (Ziccardi et al. 2015), and the Alaska Regional Response Team's Wildlife Protection Guidelines (ARRT 2020).

2) For all activities that may cause harassment of marine mammals, as defined by the MMPA, notification will be required prior to the start, when activities are completed, and when any unplanned delays occur.

2.5.3.2 Monitoring

To ensure mitigations measures are appropriately implemented, BOEM proposes the following monitoring protocols.

2.5.3.2.1 Acoustic Sound Source Verification Measurements

The operator or leaseholder may elect to conduct acoustic measurements of their equipment (including source arrays) at the source for deep penetrating 3D seismic and sub-bottom profiler activity prior to or at the start of the survey. These underwater sound source verification tests may be used to confirm appropriate sizing of safety radii. Based on these results, safety and exclusion zones may be increased or decreased after consulting with the Service and submitting a report on the preliminary results to the BOEM and the Service within 5 days after collection and analysis of those measurements.

2.5.3.2.2 Protected Species Monitoring

Protected Species Observers (PSOs) will monitor for ESA-listed species during activities listed in Table 9 that generate high levels of noise. PSOs are biologists or local experts who have previous marine mammal observation experience. If requested, qualifications for these individuals will be provided to Service for review and acceptance. All PSOs will complete a training session on marine mammal monitoring shortly before the start of their season. Duties of the PSOs will include watching for and identifying marine mammals, recording their numbers, distances from, and reactions to the survey operations, initiating mitigation measures, and reporting the results. The PSOs will usually be stationed aboard the source vessel. At least one PSO must be on watch during all daylight periods when the specified activities are being conducted. A shift will not exceed 4 consecutive hours, and no observer will work more than three shifts in a 24-hour period (12 hours total per day) in order to avoid fatigue. The PSOs will have no other duties during their watch. An example of specific protected species monitoring protocols can be found in the NMFS 2019 Hilcorp Cook Inlet Seismic Biological Opinion (NOAA, 2019).

The following are the standard monitoring methods BOEM will require to ensure that appropriate mitigation measures are initiated at the appropriate times.

- Vantage point: The PSOs will watch for marine mammals from the best available vantage point on the operating source vessel, which is usually the bridge or flying bridge. Personnel on the bridge will assist the PSOs in watching for marine mammals.

- Observer equipment: Operators will provide or arrange for the following equipment for use by the PSOs: reticule binoculars, 20x50 image stabilized binoculars, Big Eye binoculars, laser rangefinders, inclinometers, and laptop computers. Night vision equipment will be available for use when needed.

- Exclusion zones: Deep penetrating 3D seismic surveys, vertical seismic profiling, and certain types of geophysical equipment may generate levels of sound that exceed NMFS' established thresholds for injurious noise (NMFS, 2018). For these sources, PSOs will monitor an exclusion zone. If an ESA-listed species is seen in the applicable exclusion zone (Table 9), noise-producing equipment will be shut down immediately.

- Safety zones: The PSO(s) will monitor the "safety zone" around the source (Table 9). In this zone, received sound levels may exceed NMFS' thresholds for broadband underwater sound pressure levels that cause behavioral disturbance, referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA. If a marine mammal is seen within the safety zone, the vessel crew will be notified immediately. The PSO will maintain a watch to determine when the mammal is outside the safety zone such that regular operations can resume. The observers will also monitor all areas within the 160-dB radius for Level B harassment and estimate the size of this effective "monitoring zone." The number of animals and the size of the monitoring zone will then be used to calculate a conservative estimate of the number of animals taken during operations.
- Sighting information: When a marine mammal sighting is made, the following information about the sighting will be recorded: (1) species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the source vessel, apparent reaction to the source vessel (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace; (2) time, location, heading, speed, activity of the vessel, and operational state (e.g., operating airguns, ramp-up, etc.), sea state, ice cover, visibility, and sun glare; and (3) the positions of other vessel(s) in the vicinity of the source vessel.
- General information: The ship's position, heading, and speed; the operational state (e.g., number and size of operating energy sources); and the water temperature (if available), water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a substantial change in one or more of those variables.
- Estimated distances: Distances to nearby marine mammals (e.g., those within or near the safety zone applicable) will be estimated with binoculars containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers will use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water.

2.5.3.2.3 Field Data Recording and Verification

The following procedures for data recording and verification will be implemented to allow initial summaries of data to be prepared during and shortly after the field season and will facilitate transfer of the data to statistical, graphical, or other programs for further processing. Quality control of the data will be facilitated by the start-of-season training session, subsequent supervision by the onboard field crew leader, and ongoing data checks during the field season.

- Recording: The PSOs will record their observations onto datasheets or directly into handheld computers.
- Database: During periods between watches and periods when operations are suspended,

data will be entered into a laptop computer in an electronic database format that can be transmitted to and read by BOEM and Service computer systems.

- Verification: The accuracy of the data entry will be verified in the field by computerized validity checks as the data are entered and by subsequent manual checking of the database printouts.

2.5.3.2.4 Reporting

Observation reports typically are submitted to the Service and BOEM on a weekly basis and include the general information, sighting information, and estimated distances described previously. Reports will be filed with the Service and BOEM within 24 hours when any lethal or injurious take of a marine mammal occurs due to project activities or when marine mammals are observed within the exclusion zone. A report that summarizes the monitoring results and operations must be received no later than 90 days after completion of the project. The reports will include:

- Summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through study period versus operational state, sea state, and other factors affecting visibility and detectability of marine mammals).
- Summaries of the occurrence of shutdowns, ramp-ups, and ramp-up delays.
- Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare).
- Species composition, occurrence, location, and distribution of marine mammals, including date, water depth, mammal numbers, age/size/gender categories (if determinable), group sizes, and ice cover.
- Sighting rates of marine mammals versus operational state (and other variables that could affect detectability).
- Initial sighting distances versus operational state.
- Closest point of approach versus operational state.
- Observed behaviors and types of movements versus operational state.
- Numbers of sightings/individuals seen versus operational state.
- Distribution around the acoustic source vessel versus operational state; and
- Estimates of take by harassment. To ensure a conservative approach to estimation of take, reports will include possible Level B take by harassment.
  - Number of takes estimated using the following methods to provide both minimal and maximal estimates:
    - The minimum estimate based on the numbers of marine mammals directly seen within the safety zone and the Level B zone by observers on the source vessel during activities.

    - The maximal estimate calculated using densities of marine mammals from data collected during (a) vessel-based surveys in non-operational areas, or (b) observations from the source vessel or supply boats during non- operational periods. The estimated densities in the observable monitoring zone in areas without data acquisition activity are applied to the amount of area exposed to the relevant levels of sound to calculate the maximum number of animals potentially exposed.
- The total count of all behavioral responses which may indicate harassment by disruption of behavioral patterns:
    - For Steller's eiders these behaviors have not been specifically identified but may include flying away from preferred foraging and resting sites, disrupting foraging, or disturbance during resting periods.
    - For sea otters (84 FR 37725, August 1, 2019):
        - Responses which may indicate the potential for disturbance by disruption of behavioral patterns (Level B)
            - ✓ Swimming away at a fast pace on belly (*i.e.,* porpoising)
            - ✓ o Spyhopping repeatedly in an agitated manner while swimming away (or in the case of a pup, spyhopping repeatedly while hiding behind and holding onto its mother's head)
            - ✓ Abandoning prey or feeding area
            - ✓ Ceasing to nurse and/or rest (applies to dependent pups)
            - ✓ Ceasing to rest (applies to independent animals)
            - ✓ Ceasing to use movement corridors along the shoreline
            - ✓ Ceasing mating behaviors
            - ✓ Shifting/jostling/agitation in a raft so that the raft disperses or sudden diving of an entire raft
            - ✓ One-time flushing off a haulout
            - ✓ Brief separation of mother and pup
        - Responses by sea otters which may indicate the potential for injury (Level A)
            - ✓ Prolonged or permanent separation of mother and pup (*i.e.,* mother and pup vocalizing repeatedly)
            - ✓ Repeated flushing off a haulout or repeated dispersal/diving of raft
            - ✓ Prolonged fleeing from pursuit These reports are due 90 days after termination of the survey season.

2.5.3.3 Geological and Geophysical Surveys

Mitigation measures vary with the specific category of survey being conducted. The BOEM's mitigations for vessel-based high-resolution G&G surveys include:

- Timing and location restrictions: Timing and locating survey activities to reduce the potential for disturbing marine mammals, protected species, and fisheries.
- Minimized energy: Selecting and configuring the energy source array in such a way that it minimizes the amount of energy introduced into the marine environment by using the lowest sound levels feasible to accomplish data collection needs.
- Safety and Exclusion zones: The PSOs will establish and monitor the appropriate zones to minimize disturbance and for the prevention of exposure to injurious levels of underwater noise. Safety and exclusion zones (Table 9) will be established based on sound source levels and distances to the sound exposure thresholds.

2.5.3.4 Deep-Penetrating 3D Seismic Surveys

The potential disturbance of marine mammals during deep penetration 3D seismic survey operations will be minimized through implementation of several ship-based mitigation measures, speed and course alterations, ramp-up (or soft start) procedures, shutdown procedures, and provisions for poor visibility conditions. Furthermore, the LS 258 excludes critical habitat and contains timing restrictions to minimize adverse effects to sea otters and their food sources (Table 2-1).

- Safety and exclusion zones: Operators are required to use approved observers onboard the survey vessel to monitor the safety and exclusion zones for sea otters and other listed species (Table 9) and to implement appropriate mitigation measures, such as ramp-up (see below).
- Ramp-up: Implementing a ramp-up (or "soft start") of a sound source array can provide a gradual increase in sound levels for sound sources that generate sound energy within the frequency spectrum of marine mammal hearing. A ramp-up involves a stepwise increase in the number and total volume of airguns until the desired operating level of the full array is attained. During a survey program, the operator is required to ramp up sound sources slowly at a rate of no more than 6 dB per 5-minute period over no less than a 20-minute period. Full ramp-ups (i.e., from a cold start after a shutdown, when no airguns have been firing) will begin by firing one small airgun. Ramp-ups are required at the start of operations and any time power to the airgun array has been discontinued for a period of 30 minutes or more and the observer watch has been suspended.
- Shutdowns: A shutdown is the immediate cessation of firing of all energy sources. The arrays will be immediately shut down if a marine mammal is sighted within the applicable exclusion zone (Table 9).

Table 9 Exclusion and Safety Zones for Activities Monitored by Protected Species Observers

Activity	Exclusion Zone (m)	Safety Zone (m)
2D/3D Deep Penetrating Seismic	500	1,500[7]
Chirp sub-bottom profiler, boomer, sparker	100	1,500[7]
Vertical Seismic Profiling (VSP)	500	1,500[7]
Other High Resolution Geophysical equipment[1]	N/A	500
Drilling and Well construction activities[2,8]	N/A	500
Tug towing rig[3,8]	N/A	1,500[7]
Dynamic Positioning (DP) thrusters[4,8]	N/A	1,500[7]
Aircraft in route[5]	N/A	500
Aircraft Take off or Landing from Rig[6,8]	N/A	500

Note: If the activity has an EZ, the operator will shut down the activity if a marine mammal(s) is expected to enter or is observed within the associated EZ zone.

1 The small-radius shutdown zones produced by these sources are impractical to implement and monitor because most of the ensonified area is occupied by the vessel. However, the PSO will monitor a radius of 500 m prior to deployment and ensure no marine mammals are within this area.

2 A PSO will monitor waters within 500 m of drilling and well construction sites 30 minutes prior to startup of any activities that produce in-water sound to ensure marine mammals are not within the zone and exposed to an abrupt increase in sound level.

3 Tug operations cannot discontinue controlling rig transport without causing risk to life, property, or the environment, but PSOs will continue to monitor for, and report on, the presence of marine mammals within 1,500 m of a tug.

4 If the use of dynamic positioning (DP) thrusters is anticipated, a PSO will monitor the zone for 30 minutes prior to the vessel engaging the DP thrusters to ensure no marine mammals are within or are likely to enter the zone. Prior to the arrival of a vessel that is likely to engage its DP thrusters, the PSO will monitor waters within 1,500 m of the vessel for 30 minutes and will ensure that the vessel arrival at the modular offshore drilling unit (MODU) occurs when this zone is devoid of marine mammals (or at a portion of the tide cycle that will not require the use of DP thrusters).

5 All aircraft (excluding aircraft participating in pre-seismic aerial surveys) will maintain an altitude of 457 m or higher, to the extent practical, while maintaining Federal Aviation Administration flight rules (e.g., avoidance of cloud ceiling, etc.), excluding take-offs and landings.

6 A PSO on the MODU will monitor a 500-m zone around the MODU prior to landings and take-offs and will contact the helicopter pilot calling for a delay in approach and landing or take-off if any marine mammals are within or are likely to enter the 500-m radius zone during aircraft operations.

7 The Level B zone is larger than the SZ.

8 Either a PSO, diver, or crewmember can monitor the SZ.

- Site clearances: Prior to ramp up or restart, the entire safety zone must be visible and monitored by observers for 30 minutes. The safety zone must be clear of marine mammals for 15 minutes prior to beginning the ramp-up from a cold start to ensure that no marine mammals enter the safety zone. Following a shutdown, operation of the airgun array will not resume until the marine mammal has cleared the applicable safety zone. If a marine mammal(s) is sighted within the safety zone during the 30-minute watch prior to ramp-up, ramp-up will be delayed until the marine mammal(s) is sighted outside of the safety zone or the animal(s) is not sighted for at least 15 minutes for sea otters. The vessel operator and PSOs will maintain records of the times when ramp-ups start and when the airgun arrays reach full power.

- Operations at night and in poor visibility: Most operators conduct seismic operations 24 hours per day. When operating under conditions of reduced visibility attributable to darkness or to adverse weather conditions, infrared or night-vision binoculars will be available for use. It is recognized, however, that their effectiveness is limited. For that reason, PSOs will not routinely be on watch at night, except in periods before and during ramp-ups. Survey operations may continue under conditions of darkness or reduced visibility if ramp up procedures, including complete site clearances, are conducted prior to commencement. Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections of protected species within the pre-start clearance zone in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at night where operational planning cannot reasonably avoid such circumstances. If the acoustic source is shut down for brief periods (i.e., less than 30 minutes) for reasons other than implementation of prescribed mitigation (e.g., mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual or acoustic detections of protected species have occurred within the pre-start clearance zone. For any longer shutdown, pre-start clearance observation and ramp-up are required.

- Speed and course alterations: If a marine mammal (in water) is detected in or near the safety radius and, based on its position and the relative motion, is likely to enter the exclusion radius, the vessel's speed and/or direct course will be changed in a manner that does not compromise safety requirements. The animal's activities and movements relative to the source vessel will be closely monitored to ensure that the individual does not continue its approach. If the mammal continues, further mitigative actions must be taken, i.e., either further course alterations, or shut down the airgun(s) to prevent the animal from entering the exclusion zone.
- Dead or Injured Animal: In the event that an injured or dead marine mammal is sighted within an area where the operator deployed and used airguns within the past 24 hours, the airguns must be shut down immediately and NMFS and Service must be notified. If an assessment, certified by the lead PSO onboard, indicates the marine mammal was not a casualty of project-related vessel/seismic operations, the ramp-up may be initiated, and the survey continued.

2.5.3.5 Exploration and Delineation Drilling

- The PSOs will monitor the safety zone during drilling operations and when rig operations will produce underwater sound pressure levels exceeding 160 dB.
- The PSOs will be subject to vessel and aircraft mitigation, as described in the following sections.

2.5.3.6 Vessel Operations

There are a wide variety of vessels of different types and sizes that could operate in support of exploration activities. Vessels typically conform to the following operational procedures with respect to marine mammals and nesting seabirds (BOEM 2022a and 2022b, Appendix B):

Marine Mammals

- Maximum distance: Operators of vessels should conduct activities at the maximum distance possible from groups of sea otters at all times. At a minimum, vessels would avoid approaching within 91 m of sea otters.
- Changes in direction: Vessel operators should avoid multiple changes in direction when within 274 m of groups of sea otters; however, those vessels capable of steering around such groups should do so.
- Changes in speed: Vessels in transit shall be operated at speeds necessary to ensure no physical contact with sea otters occurs. Vessels should avoid multiple speed changes; however, vessels should reduce speed to 10 knots or less when within 274 m of groups of sea otters, especially during poor visibility, to reduce the potential for collisions.
- Groups of marine mammals: Vessels may not be operated in such a way as to separate members of a group of marine mammals.

Seabirds

- To minimize impacts to nesting seabirds, vessels travelling greater than 5 knots shall not approach within 1.8 km of all seabird colonies.

2.5.3.7 Aircraft Operations

Aircraft are typically required to operate within specific height and distance parameters with respect to marine mammals and birds. These include the following:

- All aircraft: Aircraft will typically be required to operate at least 457 m above sea level when within 457 m of marine mammals, except for an emergency or navigational safety. Aircraft shall avoid approaching within 1 km of any seabird colony April 15 through August 31 where safety allows. To minimize disturbance to birds, aircraft shall avoid approaching within 1.8 kilometers of all seabird colonies and aircrafts will maintain an altitude of at least 610 meters when flying over seabird colonies.
- Helicopters: Helicopters may not hover or circle above marine mammals. The PSO on the MODU will monitor a 500-m zone around the helideck prior to landings and take-off, will radio the helicopter pilot and call for a delay if any marine mammals are within the zone or are likely to enter the zone during aircraft operation.
- Inclement weather: When weather conditions do not allow a 457-m flying altitude, such as during storms or when cloud cover is low, aircraft may be operated below 305 m, but the operator should avoid known marine mammal concentration areas and take precautions to avoid flying directly over or within 457 m of marine mammals.
- Support aircraft: Support aircraft must avoid extended flights over the coastline to minimize effects on marine mammals and birds in nearshore waters or the coastline.

2.5.3.8 Lighting

To minimize collision impacts to flying birds, including those caused by light attraction, BOEM states that a lighting plan should be developed in cooperation with BOEM, BSEE, and the

Service (BOEM 2022b). The lighting plan would include details on design, installation, and day-to-day operation of lighting on production platforms and large vessels (e.g., marine seismic survey vessels which may be offshore overnight or longer) and incorporate the monitoring and adaptive management strategies listed below:

- Education on lighting attraction and bird collisions shall be provided to relevant contractor/staff.

Where safety allows, the plan shall incorporate the following:

- The number of exterior lights operating at "on" at any one time shall be minimized. Lessees will minimize the use of high-intensity work lights. Exterior lights will only be used as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather; otherwise, they will be turned off.
- Exterior lights shall be down shielded.
- Black-out curtains shall be used on exterior-facing windows.
- All avian mortalities and collisions (i.e., presence of birds, dead or stranded, that are unable to depart on their own) shall be reported in a timely manner to BOEM and the Service for use in potential adaptive management strategies. Records shall be kept and reported according to protocols developed in cooperation with BOEM, BSEE, and the Service, and the data shall be annually submitted in an electronic format to BOEM and the Service.

The plan shall also consider the following for production platforms:

- Green or blue exterior lights shall be used instead of white lights. Green and blue artificial lights have been shown to decrease the number of mortalities among nocturnally migrating birds.
- A strobe-based light-repellant system, similar to that used at the Northstar Unit, shall be designed and implemented for use on production platforms.
- Crane booms shall be lowered when not in use, rather than kept aloft and lighted.
- The height of gas flare booms shall be designed above 20 m (i.e., to include consideration of the mean flight altitude of vulnerable bird species). At-risk birds such as Steller's eider are known to fly relatively low, at about 20 m, during migration.
- Flare boom operating procedures shall minimize gas flaring on low visibility nights during the spring and fall passerine and waterbird migration seasons (approximately March 15 to May 30 and July 20 to October 15).
- An adaptive management component shall be included in the monitoring plan for avian mortalities and collisions. At a minimum, the plan shall include daily surveys and timely identification of any potential causal factors, record-keeping, and reporting to BOEM/BSEE/the Service, including:
    - Daily surveys of the platform for the presence of birds, stranded or dead, and the circumstances of their death. Surveys may be performed in conjunction with other work/surveys.

- Records shall be kept according to protocols described above under Lighting.
- Data shall be submitted to allow for timely potential alteration of lighting protocols (design or operation) that have been specifically indicated as causing increased strikes (where and as soon as feasible and safety allows).
- Surveys shall be conducted until decommissioning is commenced unless all parties (BOEM, BSEE, and the Service) agree to a different timeline.

2.5.3.9 Onshore Operations

Onshore activities during the first incremental step are limited to support operations, which are assumed to use existing facilities at Homer or Nikiski. All onshore activities during the first incremental step would be subject to permits, authorizations, stipulations, required operating procedures, and best management practices as recommended or required by the appropriate land-based resource and management agencies.

2.5.4 Mitigation Measures for Future Incremental Step Activities

The BOEM will request consultation with Service on future incremental step activities. Future activities, including all development and production work, will be described in a DPP. The DPP will be developed by the lessee if exploration and delineation work reveals oil and gas reserves of sufficient size, and companies choose to move into production. The DPP would describe the timing of these activities, information concerning drilling vessels, the location of each proposed production platform or other structure, and an analysis of both offshore and onshore impacts that may result from the plan's implementation. The DPP would identify the precise location of the production well and associated facilities, such as pipelines to shore and onshore processing facilities, providing BOEM, BSEE, and Service with project-specific details that would enable the agencies to evaluate impacts on listed species at a more detailed level and allow identification of potential mitigation needs. All activities during future incremental steps would also be subject to permits, authorizations, stipulations, required operating procedures, and best management practices of applicable resource and management agencies.

3 ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

3.1 Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: 1) the Status of the Species, which describes the range-wide condition of the Alaska-breeding Population of Steller's

Eider and the Southwest Alaska DPS of northern sea otter, the factors responsible for that condition, and their survival and recovery needs; 2) the Environmental Baseline, which analyzes the condition of Alaska-breeding Population of Steller's Eider and the Southwest Alaska DPS of northern sea otter in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Alaska-breeding Population of Steller's Eider and Southwest Alaska DPS of northern sea otter; 3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Alaska-breeding Population of Steller's Eider and Southwest Alaska DPS of northern sea otter; and 4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the Alaska-breeding Population of Steller's Eider and the Southwest Alaska DPS of northern sea otter.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the Alaska-breeding Population of Steller's Eider and the Southwest Alaska DPS of northern sea otter, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the Alaska-breeding Population of Steller's Eider and the Southwest Alaska DPS of northern sea otter in the wild by reducing the reproduction, numbers, and distribution of that species.

3.2 Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The "destruction or adverse modification" analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the Environmental Baseline, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) Cumulative Effects, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the “destruction or adverse modification” determination, the Service evaluates if the effects of the proposed Federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the range-wide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of the listed species based on the Environmental Baseline analysis.

4 STATUS OF THE SPECIES AND ITS CRITICAL HABITAT

4.1 Alaska-breeding Population of Steller’s Eider

The Steller’s eider (*Polysticta stelleri*) is a small sea duck with circumpolar distribution and the sole member of the genus *Polysticta*. The Alaska-breeding population of Steller’s eiders was listed as threatened on June 11, 1997 (62 FR 3174; June 11, 1997), based on:

1) Substantial contraction of the species’ breeding range on the Arctic Coastal Plain (ACP) and Yukon-Kuskokwim (Y-K) Delta; Steller’s eider on the North Slope historically occurred east to the Canada border (Brooks 1915) but have not been observed on the eastern North Slope in recent decades (Service 2002).
2) Reduced numbers breeding in Alaska.
3) Resulting vulnerability of the remaining Alaska-breeding population to extirpation (62 FR 31748).

In 2001, the Service designated 7,330 km^2 of critical habitat for the Alaska-breeding population of Steller’s eiders, including historical breeding areas on the Y-K Delta, molting and staging areas in the Kuskokwim Shoals and Seal Islands, molting wintering, and staging areas at Nelson Lagoon, and Izembek Lagoon (Service 2001, 66 FR 8850; February 2, 2001). These areas total approximately 7,330 km^2 and 1,363 km^2 of shoreline. No critical habitat for Steller’s eiders has been designated on the ACP. Critical habitat for Steller’s eider does not occur within the Action Area and is not discussed further.

4.1.1 Species Description

Steller’s eider plumage is sexually dimorphic (Figure 3). Males are in breeding plumage from early winter through mid-summer. They have a large white shoulder patch contrasting with chestnut breast and belly that darkens centrally, and a black spot on each side in front of their wings. Their head is white to silver with pale green on the lores, a distinctive black spot surrounding the eye, and a dark olive patch flanked by black on the nape. Their neck is black, extending in an arrow shape down the back. The non-breeding male plumage resembles the female but maintains white upper wing coverts. Females are dark mottled brown with a white-bordered blue wing speculum. Juveniles are dark mottled brown until the fall of their second year, when they acquire breeding plumage. During flight, adult Steller's eiders are distinguished from other eiders by their faster wing beat, small size, black back, white belly, and white-bordered blue speculum (Service 2019).

Figure 3 Male and female Steller's eider in breeding plumage

4.1.2 Life History

The average lifespan of Steller's eiders is 16 to 21 years, with first breeding occurring at 2 to 3 years of age. They spend most of their lives in the marine environment and occupy terrestrial habitats only during the nesting season. Steller's eiders arrive in small flocks of breeding pairs on the ACP in early June. Nesting on the ACP is concentrated in tundra wetlands near Utqiaġvik, Alaska and occurs at lower densities elsewhere on the ACP from Wainwright east to Sagavanirktok River (Quakenbush et al. 2004).

Steller's eiders initiate nesting in mid-June, but timing of nest initiation is affected by timing of snowmelt, which varies annually (Graff 2018). Eiders arrive in small flocks of breeding pairs and typically nest in tundra wetlands (Quakenbush et al. 2000, 2004). Mean clutch size at Utqiaġvik, Alaska, was 5.4 eggs over 5 nesting years, between 1992 and 1999 (Quakenbush et al. 2004).

Breeding males depart following onset of incubation by the female. Nest survival is affected by predation levels and averaged 0.23 from 1991 to 2004 before fox control was implemented near

Utqiaġvik, and 0.47 from 2005 to 2012 during years with fox control (Service, unpublished data). Steller's eider nest failure has been attributed to depredation by jaegers (*Stercorarius spp*.), common ravens (*Corvus corax*), Arctic fox, (*Vulpes lagopus*), glaucous gulls (*Larus hyperboreus*), and, in at least one instance, polar bears (*Ursus maritimus*) (Quakenbush et al. 1995; Rojek 2008; Safine 2011, 2012).

Breeding site fidelity of adult female eiders is high, while temporary emigration is also high (Safine et al. 2020). Long-term studies of Steller's eider breeding ecology near Utqiaġvik indicate periodic non-breeding by the entire population. From 1991 to 2010, Steller's eider nests were detected in 12 of 20 years (Safine 2011). Periodic non-breeding by Steller's eiders near Utqiaġvik seems to correspond to fluctuations in lemming (*Lemmus trimucronatus*) populations, and the risk of nest predation (Quakenbush et al. 2004). During years of peak abundance, lemmings are a primary prey species for predators, including jaegers, owls (Strigidae family), and foxes (Pitelka et al. 1955a; Pitelka et al. 1955b; MacLean et al. 1974; Larter 1998; Quakenbush et al. 2004). It is hypothesized that Steller's eiders and other ground-nesting birds increase reproductive effort during lemming peaks because predators preferentially select (prey-switch) for hyper-abundant lemmings, and nests are less likely to be depredated (Roselaar 1979; Summers 1986; Dhondt 1987; Quakenbush et al. 2004). Furthermore, during high lemming abundance, Steller's eider nest survival (the probability of at least one duckling hatching) has been reported as a function of proximity to nests of jaegers and snowy owls (Quakenbush et al. 2004). These avian predators aggressively defend their nests against other predators, and this may indirectly impart protection to Steller's eiders nesting nearby.

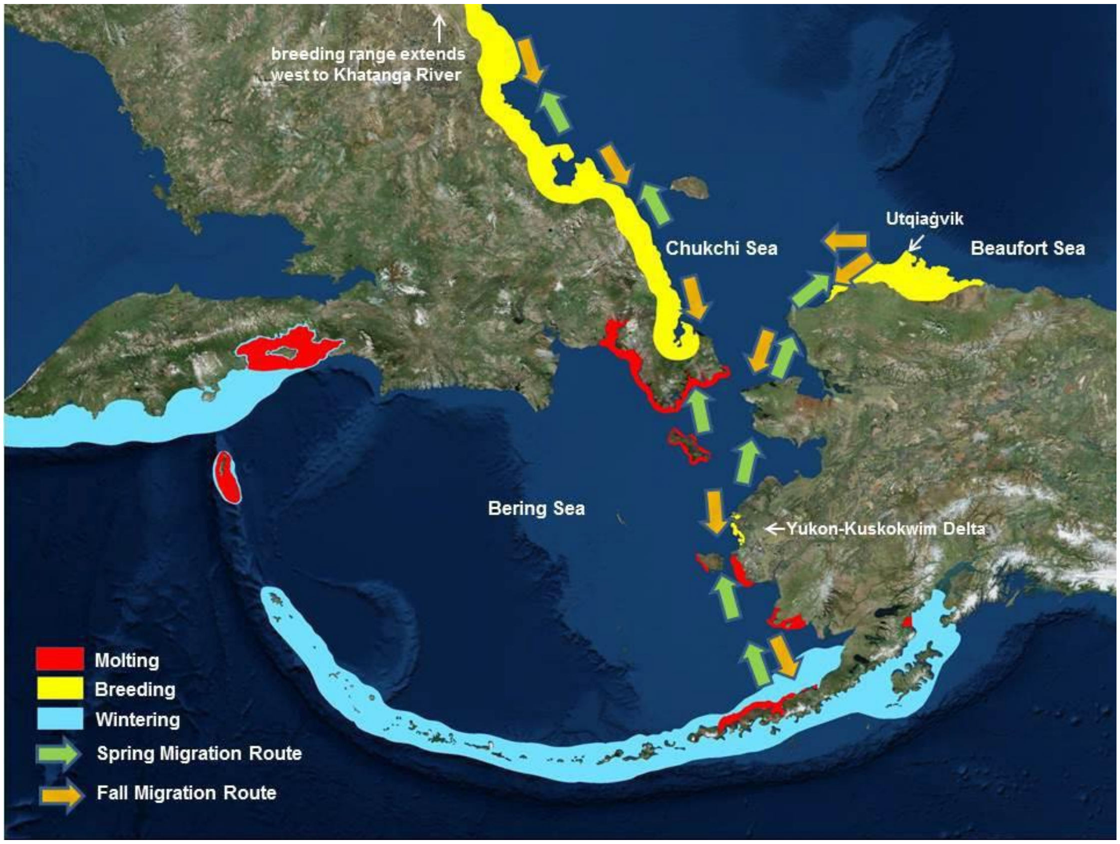
Hatching typically occurs from mid-July through early August, after which hens move their broods to adjacent ponds with emergent vegetation dominated by *Carex* spp. and *Arctophila fulva* (Quakenbush et al. 2000; Rojek 2006, 2007, and 2008). In these brood-rearing ponds, hens with ducklings feed on aquatic insect larvae and freshwater crustaceans. In general, broods remain within 0.7 km of their nests (Quakenbush et al. 2004), although movements of up to 3.5 km from nests have been documented (Rojek 2006, 2007). Large movements from hatch sites may be a response to drying of wetlands that would normally have been used for brood-rearing (Rojek 2006). Fledging occurs 32 to 37 days post hatch (Obritschkewitsch et al. 2001; Quakenbush et al. 2004; Rojek 2006, 2007).

4.1.3 Distribution

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population, which nests along the Russian eastern Arctic coastal plain, and the Alaska-breeding population. During the molt and over winter, the Alaska-breeding population of Steller's eider mixes with the majority of the Russia-breeding population in southcentral Alaska. Figure 4 shows breeding, molting, and wintering areas used by the Russia-breeding and Alaska-breeding populations of Steller's eiders (together, the Pacific-wintering population; Service 2019).

4.1.3.1 Breeding Distribution

In Alaska, Steller's eiders breed almost exclusively on the ACP. While they historically nested on the Y-K Delta, only a few nests have been found there in recent years. They do not nest within the proposed project area. Prior to migration, some Steller's eiders rest and forage in Nelson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea, in the vicinity of the northern most point of the Utqiaġvik Spit.



Combined, referred to as the Pacific-wintering population; Service 2019.

Figure 4 Distribution and General Migration Pathways of the Russia-breeding and Alaska-breeding Populations of Steller's Eider

4.1.3.2 Molt Distribution

After breeding, Alaska-breeding Steller's eiders move to marine waters, where they mix with birds from the Russia-breeding population and undergo a 3-week flightless molt. After the populations mix on the molting and wintering areas, there is no way to confirm whether an individual belongs to the Alaskan-breeding population.

The Pacific-wintering population molts in several main areas along the Alaska Peninsula: Izembek Lagoon (Metzner 1993; Laubhan and Metzner 1999), Nelson Lagoon, Herendeen Bay, and Port Moller (Gill et al. 1981). Over 15,000 Steller's eiders have also been observed in Kuskokwim Bay (Larned and Tiplady 1996). Smaller numbers of molting Steller's eiders have been reported around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991). Larned (2005) reported greater than 2,000 eiders molting in lower Cook Inlet near the Douglas River Delta. A few band recoveries indicate that the Alaska-breeding birds molt in Izembek Lagoon and Kuskokwim Shoals. Satellite telemetry studies by Martin (2001) marked 14 Steller's eiders near Utqiaġvik, Alaska (within the range of the listed Alaska-breeding population) in 2000 and 2001. Although samples sizes were small, results suggested disproportionately high use of Kuskokwim Shoals by Alaska-breeding Steller's eiders during wing molt, compared to the Pacific-wintering population as a whole. Flocks of Steller's eiders may use the same molting areas each year (Larned 1998). Up to 95 percent of recaptured molting Steller's eiders were found at the same site where they were banded (Flint et al. 2000).

4.1.3.3 Winter Distribution

After molting, many of the Pacific-wintering Steller's eiders congregate in select near-shore waters throughout the Alaska Peninsula, the Aleutian Islands, around Nunivak Island, the Kodiak Archipelago, and in lower Cook Inlet, although thousands may remain in lagoons used for molting (Bent 1987; Larned 2000a; Martin 2001; Larned and Zwiefelhofer 2002). Winter ice formation often temporarily forces birds out of shallow protected areas such as Izembek and Nelson Lagoons. Wintering Steller's eiders usually occur in shallow waters less than 10 m deep, which are generally found within 400 m of shore, or at offshore shallows (Service 2002).

However, Martin et al. (2015) reported substantial use of habitats greater than 10 m deep during mid-winter. Use of these habitats by wintering Steller's eiders may be associated with nighttime resting periods, or with shifts in the availability of local food resources (Martin et al. 2015).

There is good evidence to suggest that individual eiders return to the same seasonal use areas each year, but individual fidelity to wintering areas is unknown. Eiders are known to overwinter in select near-shore waters year after year (Bent 1987; Larned and Zwiefelhofer 1995; Larned 2000a). Telemetry data from Steller's eiders captured near Unalaska showed high within-season site fidelity on wintering areas (Reed and Flint 2007).

In Cook Inlet, Steller's eider regularly winter along both the eastern coast, where the population between Clam Gulch and Kachemak Bay has been estimated at 1,499, and at other times greater than 2,000 between Anchor River and Kenai (Larned 2006); and the western coastline from Tuxedni Bay to Cape Douglas with as many as 4,284 surveyed (Larned 2006), with a total estimate of 5,783 in lower Cook Inlet for a single season survey (BOEM 2016b). Steller's eiders are present in Cook Inlet from late July through the winter to as late as April, with numbers reportedly peaking in January and February (Larned 2006, Martin et al. 2015, Rosenberg et al. 2014).

4.1.3.4 Spring Distribution

In the spring, Steller's eiders form large flocks along the north side of the Alaska Peninsula and move east and north (Larned et al. 1993; Larned 1998; Larned 2000b). Larned (1998) concluded that Steller's eiders show strong site fidelity to "favored" habitats during migration, where they congregate in large numbers to feed before continuing their northward migration. Spring migration usually includes movement along the coast, although birds may take shortcuts across water bodies such as Bristol Bay (William Larned, Service, unpublished data). Several areas receive consistent use during spring migration, including Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port

Heiden, Cinder River State Critical Habitat Area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island (Larned et al. 1993; Larned 1998; Larned 2000b). Like other eiders, Steller's eiders probably use spring leads for feeding and resting as they move northward, but there is little information on habitat use after departing spring staging areas.

4.1.3.5 Non-breeding Summer Distribution in Southern Alaska

A small number of Steller's eiders are known to remain along the Alaska Peninsula and Kachemak Bay during the summer; approximately 100 have been observed in Kachemak Bay, while a few may spend the summer at Izembek Lagoon (Chris Dau, Service, unpublished data).

4.1.4 Species Abundance and Trends

Available data suggest that very few Steller's eiders, perhaps tens of individuals, breed in western Alaska (Service 2019), and the Alaska-breeding population primarily consists of individuals breeding in northern Alaska. Three surveys provide information on the number of Steller's eiders present on the ACP annually – the ACP Waterfowl Breeding Population Survey, the Utqiaġvik Triangle Survey, and the Utqiaġvik ground-based breeding pair survey. Designs and caveats of each survey are described in detail in the Steller's Eider Species Status Assessment (Service 2019).

The ACP Survey covers the largest portion of the range of Steller's eiders in northern Alaska (92,273 km^2), but its low coverage and the small number of Steller's eiders present in the study area contributes to bias in the resulting estimates. However, estimation methods and inclusion of a detection rate, albeit from a surrogate species (long-tailed duck, *Clangula hyemalis*), has improved our ability to estimate the number of Steller's eiders in the survey area in recent years. After removing data from transects that overlap with the other two surveys described below, the mean number of Steller's eiders present annually from 2007 to 2019 in the ACP survey area is 83 (95% confidence interval (CI) = 0-332, range 29-205; E. Osnas and C. Frost Service, pers. comm. In Service 2019).

Two surveys provide more intensive coverage of the areas of the ACP with the highest densities of breeding Steller's eiders: the aerial Utqiaġvik Triangle Survey and complementary ground-based surveys closer to Utqiaġvik. The Utqiaġvik Triangle Survey (or "Barrow Study Area", Figure 3.9), conducted annually since 19994, provides coverage of 25 to 50 percent of a 4,437 km^2 area, from just south of the community of Utqiaġvik to the Mead River (Obritschkewitsch and Gall 2019 in Service 2019). Using estimation methods similar to that used for ACP survey results, the mean number of Steller's eiders present annually from 1999 to 2019 in the Utqiaġvik Triangle Survey area is 198 (95% CI = 177-221, range = 177-221; C. Bradley, Service, pers. comm. in Service 2019).

Standardized ground surveys for eiders have also been conducted near Utqiaġvik since 1999 (Graff 2018), with nearly 100 percent spatial coverage of the study area surrounding the Utqiaġvik road system. After removing the portion of the study area that overlaps with the Utqiaġvik Triangle Survey, the mean number of Steller's eiders observed during the most recent half of the survey, 2007 to 2019, is 45 (SD = 29, range = 6–94; N. Graff, Service, unpublished data).

By combining the mean estimates from each survey, the number of Steller's eiders present annually in northern Alaska is approximately 326 (Service 2019). However, this estimate should be interpreted with caution when characterizing the size of the Alaska-breeding population.

Several caveats are outlined in the Steller's eider Species Status Assessment, including low confidence given the number of actual observations, and the high annual variation in estimates resulting in low precision (Service 2019). Most importantly, however, the estimate is likely an underestimate of the abundance of the entire Alaska-breeding population. These surveys enumerate the birds present on the breeding area, but the proportion of the overall Alaska-breeding population that breeds likely varies annually. Non-breeding birds may remain in marine areas, stage in other terrestrial areas prior to molt, or visit northern Alaska briefly before moving back to marine habitat. It is also possible some birds nest in Russia in years when they are not present in Alaska. Thus, some unknown portion of the population is not available to be detected in the breeding surveys. Because we do not have an estimate of annual breeding propensity, we cannot directly translate these estimates to population abundance (Service 2019).

4.1.4.1 Y-K Delta sub-population

The Service has conducted three breeding waterfowl surveys annually on the Y-K Delta. These include two aerial surveys, the North American Breeding Waterfowl Survey (1957 to 2017; Service 2017a) and the Yukon-Kuskokwim Delta Breeding Pair Survey (1986 to 2017, USFWS 2017b), and one ground survey aimed at estimating the number of waterfowl nests on the central coast of the Y-K Delta (1985 to 2017, Service 2017c). In addition to the three annual surveys focused on breeding pairs of waterfowl, field research is conducted throughout the central coastal zone by the U.S. Geological Survey, the Service, universities, and other government agencies. Observations of Steller's eiders would likely be recorded during these activities and reported, given the species' rarity and interest in the species (Service 2019).

Contemporary (1960s to present) observations of Steller's eiders are limited to the central coastal zone of the Y-K Delta. Observations of 44 adult Steller's eiders, plus 8 nests and 1 brood, were reported during nest plot surveys and other avian research from 1997 to 2017 (Flint and Herzog 1999; USFWS, unpublished data). Nests were found at Kigigak Island and near the Tutakoke and Kashunuk Rivers (Service 2019). No Steller's eiders were recorded during aerial surveys from 1997 to 2017 (J. Fischer, Service Biologist, pers. comm.). When the species was listed in 1997, no Steller's eider nests had been found in this region for approximately 20 years (since 1975, Kertell 1991). The small number of Steller's eider observations in nesting habitat, despite substantial research and activity, suggests that Steller's eiders breeding in western Alaska remain rare. In the most recent Steller's eider Species Status Assessment, the Service considered the Y-K Delta sub-population to be functionally extirpated (Service 2019). Thus, no additional birds are added from the Y-K Delta sub-population to our estimate for eiders in the Alaska-breeding population and we continue our analysis with 326 Steller's eiders as the best estimate for breeding eiders present in Alaska.

4.1.5 Threats to the Species

Factors identified in the listing rule as potential causes of Steller's eider decline include predation, disease, hunting, ingestion of spent lead shot in wetlands, and changes in the marine environment that could affect Steller's eider food or other resources (62 FR 31748). Additional potential threats such as collision with man-made structures, contact or ingestion of oil and other contaminants, and exposure to fish processing facility wastes, have been identified, and are included in the Steller's Eider Recovery Plan (Service 2002).

4.1.5.1 Predation

In extreme cases, nest predation can seriously limit waterfowl production, and even cause population declines. Kertell (1991) hypothesized that changes in predation pressure may have contributed to the near-disappearance of Steller's eiders from the Y-K Delta. Steller's eider predators include snowy owls (*Bubo scandiacus*), short-eared owls (*Asio flammeus*), peregrine falcons (*Falco peregrinus*), gyrfalcons (*Falco rusticolus*), pomarine jaegers (*Stercorarius pomarinus*), rough-legged hawks (*Buteo lagopus*), common ravens, glaucous gulls, Arctic foxes, red foxes (*Vulpes vulpes*), and bald eagles (*Haliaeetus leucocephalus*) (Quakenbush et al. 1995; Rojek 2008; Safine 2011). Human activities may have disrupted normal predator-prey relationships in Alaska, by providing nesting sites for common ravens (*Corvus corax*) which can allow them to breed in otherwise unsuitable areas; and by providing food sources for avian and mammalian predators such as ravens, gulls, and foxes, which can affect their distribution and abundance by increasing fecundity and survival (Service 2002). In addition, Steller's eider nest depredation by a family group of polar bears was documented in 2011 (Safine 2011).

4.1.5.2 Disease

Disease is not suspected to have caused the decline of eider populations however it is a risk factor for extirpation due to the small population size of Alaska-breeding eiders (Service 2019). Steller's eiders and other sea ducks in Alaska may have significant exposure to a virus in the family Adenoviridae (Hollmen and Franson 2015), which could decrease their survival rates. The Steller's Eider Recovery Plan does not include any tasks to address diseases, but states that for Steller's eiders to be considered recovered, continued sampling must demonstrate that viruses or other diseases are not thought to threaten or endanger the population.

4.1.5.3 Hunting

Although not cited as a cause of decline of Steller's eiders, the take of this species by subsistence hunters near Utqiaġvik was cited as a factor in the decision to list the Alaska-breeding population of Steller's eider (62 FR 31748). Hunting for Steller's eiders was closed in 1991. In 2003, spring/summer subsistence harvest of migratory birds in Alaska was opened pursuant to the Migratory Bird Treaty Act (50 CFR Part 92), but harvest of Steller's eiders remained prohibited. Estimates of Steller's eider subsistence harvest predicted that approximately 97 Steller's eiders were shot each year before this regulation took effect (Service 2007). After 2003, it was predicted that approximately 59 Steller's eiders were killed each year (Service 2007).

Historically, Alaska Natives at several villages hunted Steller's eiders and their eggs for food, but many communities along the population's migration route had not been surveyed at the time of the 1997 listing decision, so the total annual subsistence harvest at that time was unknown (62 FR 31748). However, Steller's eiders were not a preferred subsistence species (Quakenbush and Cochrane 1993, in 62 FR 31748; June 11, 1997) and harvest data from 1993 through 2012 show that the Cook Inlet and Gulf of Alaska region harvests few if any eider species (Rothe et al. 2015). Among all the regions for which data were available, Steller's and spectacled eiders (another federally listed species) were the two sea duck species harvested the least, with takes an order of magnitude less than that of other species (Rothe et al. 2015).

4.1.5.4 Lead Poisoning

The primary source of lead contamination for Steller's eiders is ingestion of spent lead shot deposited in nearshore wetlands, or nearshore marine waters used for foraging (Service 2002). The effect of exposure varies, but lethal and sublethal responses can occur (Hoffman 1990). Blood samples from hens breeding near Utqiaġvik in 1999 showed that all (seven individuals) had been exposed to lead (indicated by greater than 0.2 parts per million (ppm) lead in their blood), and one had experienced lead poisoning (greater than 0.6 ppm). Lead isotope analysis confirmed the lead in these samples originated from lead shot, rather than other potential environmental sources (Trust et al. 1997; Matz et al. 2004). Use of lead shot for hunting waterfowl is prohibited nationwide, and its use for hunting all birds is specifically prohibited in Alaska, where birds are harvested on the North Slope. The Service collaborated with other government and Tribal organizations to minimize the sale and use of lead shot. Reduced availability of lead shot in stores, and low levels of spent shell casings from lead shot at popular hunting sites, suggest that the use of this type of ammunition has been greatly reduced in Alaska. Because Steller's eiders continue to feed near their nesting sites, before and during incubation, they may have an increased risk of exposure to lead shot when compared to other tundra waterfowl species that largely forego feeding during nesting.

4.1.5.5 Collision with Man-made Structures

Migratory birds suffer considerable risk from collisions with human-made structures (Manville 2005), including light poles, buildings, drill rigs, towers, wind turbines, and overhead powerlines. Steller's eiders are known to collide with anthropogenic structures, including radio communication towers, guy wires, ship rigging, radar domes, mobile offshore drilling units, and other on-land and marine structures. Johnson and Richardson (1982) reported that 88 percent of eiders observed in a study along the Beaufort Sea coast flew below an estimated altitude of 9.7 meters, and well over half flew below 1.5 meters. Day et al. (2003) estimated a mean flight altitude of 1.8 meters for eider species flying past St. Lawrence Island, Alaska in the fall. The tendency of Steller's eiders to fly low puts eiders at risk of striking even relatively low objects in their path.

Flock size, as well as flight height and speed, can increase the number of eiders killed or injured during a single event. Like other species of eiders, Steller's eiders are known to fly low and fast over water. Johnson and Richardson (1982) reported that 88 percent of eiders observed in a study along the Beaufort Sea coast flew below an estimated altitude of 9.7 meters, and well over half flew below 1.5 meters. Day et al. (2003) estimated a mean flight altitude of 1.8 meters for eider species flying past St. Lawrence Island, Alaska in the fall. Day et al. (2004) studied common eiders (*Somateria mollissima*) and king eiders (*S. spectabilis*) off the coast Utqiaġvik, Alaska.

They found eider flock size averaged 110.4, plus or minus (±) 7.1 birds, mean flight altitude of 12.1 ± 0.8 m above sea level, and groundspeed velocities averaged 83.5 ± 0.3 km per hour. They found speeds were significantly higher with good visibility and strong winds, higher with good visibility at night than with poor visibility at night, higher with crosswinds and tailwinds than with headwinds, higher with weak headwinds than with strong ones, and higher with strong tailwinds and crosswinds than with weak ones.

Most collisions are likely to involve one or two birds, but "bird storms" have been documented to occur when vessels use bright lights during inclement nighttime weather. The actual number of birds injured and killed through collisions is likely higher than reported; many injured and killed birds are believed to go unreported or become scavenged before humans detect them. For example, carcass removal rates from scavengers on the Alaska Peninsula could be as high as 50 percent per 24 hours (Flint et al. 2010). Therefore, unless obstructions are checked every day, few carcasses would ever be documented. Searcher efficiency can also affect bird mortality estimates, as has been documented following oil spills (Ford 2006).

4.1.5.6 Habitat Loss and Change

Destruction or modification of habitat is not thought to have played a major role in the decline of the Alaska-breeding population of Steller's eider. However, habitat changes near the Village of Utqiaġvik could be a threat (Service 2002). The region surrounding the Village of Utqiaġvik is the core of the Steller's eider current breeding distribution in northern Alaska, and this area is disproportionately important to the survival and recovery of the Alaska-breeding population.

Utqiaġvik is also an important human population center. As a result of the significant human presence and rapid village growth, Steller's eiders near Utqiaġvik are exposed to disturbance associated with human activity, such as all-terrain vehicle (ATV) traffic through nesting areas and loss or alteration of habitat due to development. Additionally, on-going research efforts (including those directed at Steller's eider) may result in disturbance.

4.1.5.7 Oil Spills and Other Contaminants

A significant proportion of the world's population of Steller's eiders winter in shallow, nearshore waters from the eastern Aleutian Islands to southern Cook Inlet in Alaska, where they may be exposed to spills of petroleum and other contaminants (Service 2002). Harbors and bays (e.g., Akutan, Sand Point, Unalaska Bay, King Cove, and Cold Bay), and areas with proposed harbors or harbor expansions, have substantial current or potential future maritime traffic. Many of these areas are occupied by hundreds of wintering or staging Steller's eiders (Martin et al. 2015, Larned 2012b).

Steller's eiders have been observed roosting and feeding in nearshore waters near industrial activity, and amid ship traffic in these areas. Conservative estimates indicate that at least 68,137 liters of petroleum products were spilled from activities associated with the commercial fishing/seafood processing industry from 1995 to 2000, and that at least 68,781 liters of petroleum products are spilled annually in harbors in southwest Alaska (Day and Pritchard 2000). Much of the petroleum is spilled at Dutch Harbor, near where hundreds of Steller's eiders winter. Other contaminants found in industrial marine wastes, such as organochlorine pesticides and polychlorinated biphenyls (PCBs), may occur in or near Steller's eider wintering areas.

Thus, it is plausible that Steller's eiders associated with nearshore waters influenced by industrial marine activity are being exposed to petroleum and other organic contaminants (Service 2002; Reed and Flint 2007).

In addition, discharge from seafood processors has recently become an increasing concern for its potential impacts to marine life, including seabirds and sea ducks. Fish-waste from seafood processing plants could potentially harm Steller's eiders indirectly by degrading foraging habitat, and directly by exposing individuals to contaminants, disease, and increased predation (Service 2015a).

4.1.5.8 Climate Change

Steller's eiders, like other Arctic breeders, may be especially vulnerable to the effects of climate change (Prowse et al. 2006). The most prominent effects of climate change on Steller's eider habitat are likely to occur within their Arctic breeding grounds; climate change could modify both the physical environment and the biota within the Arctic breeding grounds of the Steller's eider population. Impacts already observed in Alaska include earlier snowmelt, reduced sea ice, glacial retreat, warmer permafrost, drier landscapes, increased wildfires, and more extensive insect outbreaks (Chapin et al. 2014). The Arctic climate directly affects a range of physical, chemical, and biological processes in aquatic systems, and creates indirect ecological effects through the control of terrestrial hydrologic systems and processes, particularly those associated with cryospheric components such as permafrost, freshwater, ice and snow accumulation, and melting (Prowse et al. 2006). With the reduction in summer sea-ice, the frequency and magnitude of coastal storm surges has increased. These can cause breaching of lakes and inundation of low-lying coastal wetland areas, killing plants and altering soil and water chemistry, and hence, the fauna and flora of the area (Jorgenson and Ely 2001). These changes may alter the nesting habitat of eiders on the Y-K Delta. Thawing permafrost and the inundation of the shoreline due to lack of sea-ice has significantly increased coastal erosion rates (Mars and Houseknech 2007), potentially reducing the quality or quantity of Steller's eider habitat throughout the population's range.

Existing studies suggest that Steller's eider survival rates may be influenced by climate variability. Modeling results by Frost et al. (2013) indicate that the lowest estimates of annual survival of Steller's eiders in the Pacific-wintering population during 1993 to 2003 coincided with a brief warming event in the Pacific Decadal Oscillation; and the return to cooler temperatures in the Bering Sea that followed coincided with the highest estimated annual Steller's eider survival rates, and an increasing trend in annual survival. The authors note, however, that conclusions cannot be drawn from apparent correlation with a single climatic event. Similarly, some evidence indicates that short-term changes in populations of common eiders may have been influenced by non-breeding habitat issues such as food shortages, although data does not support direct correlation between these non-breeding factors and climate change at this time (Coulson 2010). It seems likely that a complex relationship exists between climate change, resource availability, and eider population effects (Dunham 2016).

4.1.6 Steller's Eider Recovery Criteria

The Steller's Eider Recovery Plan (Service 2002) presents research and management priorities that are re-evaluated and adjusted periodically, with the objective of recovery and delisting of the Alaska-breeding population of Steller's eiders when protection under the ESA is no longer required. When the Alaska-breeding population was listed as threatened, factors causing the decline were unknown, although possible causes identified (see 4.1.5 Threats). Causes of decline and obstacles to recovery remain poorly understood.

The Recovery Plan (Service 2002) identifies the following high-priority actions to address threats to the Alaska-breeding population of Steller's eiders, and help achieve recovery: 1) reduce exposure to lead; 2) reduce nest predation; 3) reduce hunting and shooting mortality; 4) elucidate distribution and abundance; 5) acquire information on marine ecology; 6) acquire information on breeding ecology; 7) acquire demographic information needed for population modeling efforts; 8) maintain or re-establish subpopulation on Yukon-Kuskokwim Delta; and 9) develop partnerships for recovery efforts.

Criteria used to determine when species are recovered are often based on historical abundance and distribution, or on the population size required to ensure that extinction risk, based on population modeling, is tolerably low. For Steller's eiders, information on historical abundance is lacking, and demographic parameters needed for accurate population modeling are poorly understood. Therefore, the Recovery Plan for Steller's Eiders (Service 2002) establishes interim recovery criteria based on extinction risk, with the assumption that numeric population goals will be developed as demographic parameters become better understood.

Under the Recovery Plan (Service 2002), the Alaska-breeding population of Steller's eider would be considered for delisting from threatened status when:

1) The Alaska-breeding population has less than 1 percent probability of extinction in the next 100 years; and
2) Subpopulations in each of the northern and western subpopulations have less than 10 percent probability of extinction in 100 years, and are stable or increasing.

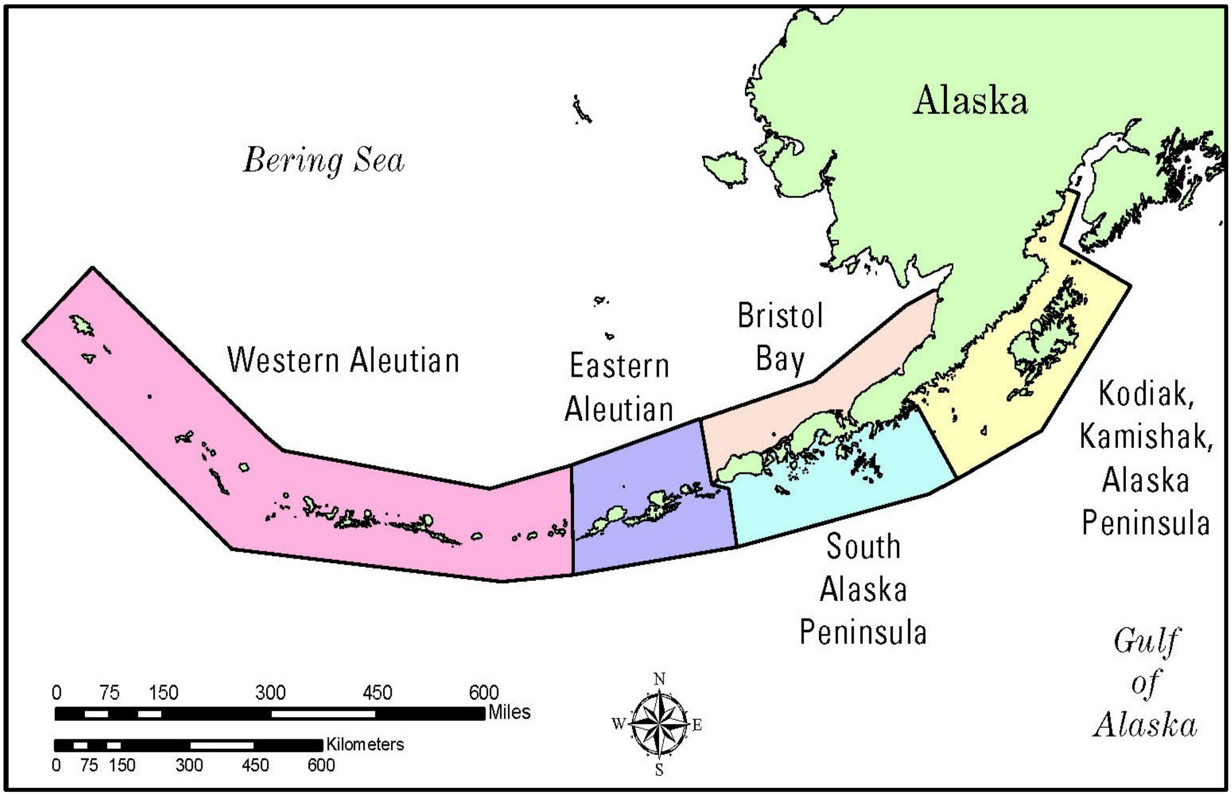
At present independent analysis suggests that if there is no permanent immigration or emigration between Russian breeding and Alaska-breeding Steller's eiders, if declining trends continue, and if the available estimates of vital rates are accurate and precise, the listed Steller's eiders have a high probability of extinction in the foreseeable future (Swem and Matz 2008).

4.2 Southwest Alaska DPS of Northern Sea Otter

4.2.1 Species Description

The northern sea otter (*Enhydra lutris kenyoni*) is a marine mammal related to mink and river otters that lives in shallow water areas along the shores of the North Pacific, including the Action Area. The Service recognizes three "stocks" of northern sea otters in Alaska: southeast Alaska, southcentral Alaska, and southwest Alaska (Service 2013a). The term "stock" is used by the Service and NMFS in the context of managing marine mammal species under the MMPA. The Southwest Alaska DPS is listed as threatened under the ESA and is the same as the Southwest

Alaska stock. The range of the Southwest Alaska DPS (Figure 5) includes the west side of Cook Inlet, the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands. The Service identified five Management Units (MUs): 1) Western Aleutian Islands; 2) Eastern Aleutian Islands; 3) South Alaska Peninsula; 4) Bristol Bay; and 5) Kodiak, Kamishak, Alaska Peninsula (Service 2013a). The Action Area is within the Kodiak, Kamishak, Alaska Peninsula management unit. The southcentral Alaska stock also occurs in the Action Area but is not ESA-listed. The southcentral Alaska stock extends from Cape Yakataga to Cook Inlet, including Prince William Sound, the Kenai Peninsula coast, and Kachemak Bay.



Notes: The Action Area is within the Kodiak, Kamishak, Alaska Peninsula Management Unit (MU 5; Service 2013a).

Figure 5 Management Units and Range of the Southwest Alaska DPS of Northern Sea Otter

4.2.2 Listing Status and Critical Habitat

The Southwest Alaska DPS of the northern sea otter was designated as a threatened species in 2005 (70 FR 46366; August 9, 2005). Critical habitat was designated in 2009 (74 FR 51988, October 8, 2009). Key documents for this species include the Service Recovery Plan (Service 2013a), Species Status Assessment (Service 2020), and 5-Year Reviews (Service 2013b, 2021).

At the time of the 2005 final listing rule for the species, the Service estimated that the Southwest DPS had experienced a rapid decline in abundance of more than 50 percent since the late 1980s and consisted of approximately 42,000 sea otters. The cause of the overall decline is not known with certainty, but the weight of evidence points to increased predation, probably by the killer whale (*Orcinus orca*) (Service 2013a).

The following Primary Constituent Elements (PCEs) are important physical and biological features identified in the critical habitat designation. All five MUs in the critical habitat designation contain some or all of the PCEs and support multiple life processes.

1) Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 2 m depth;
2) Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m from the mean high tide line;
3) Kelp forests that provide protection from marine predators, which occur in waters less than 20 m depth; and
4) Prey resources in sufficient quantity and quality to support the energetic requirements of the species.

Prey resources within the areas identified by PCEs 1, 2, 3, and 4 are present in sufficient quantity and quality to support the energetic requirements of the species. This final critical habitat designation encompasses those areas containing the PCEs necessary to support one or more of the species' life history functions and laid out in the appropriate quantity and spatial arrangement essential to the conservation of the DPS. Critical habitat may be found in the Action Area along the western shore of the Alaska Peninsula extending northward into Cook Inlet to Redoubt Point (Figure 6).

The physical habitat of sea otters is largely unaltered from natural conditions throughout the vast majority of the range of the Southwest Alaska DPS. The human populations in most of the designated critical habitat are small, and development has been limited to the few, widely scattered towns, villages, and military installations. Developments that have physically modified sea otter habitat consist of docks, piers, and boat harbors, which are limited to nearshore waters immediately adjacent to towns, villages, and military bases. Some sea otters continue to use these sites. No trends in the condition of sea otter critical habitat are identified in the critical habitat designation, and the Service's Recovery Plan rates habitat loss as a low threat to recovery of the population (Service 2013a).

4.2.3 Distribution and Abundance

Figure 6 shows the range of northern sea otters in the Cook Inlet area. Sea otters typically inhabit nearshore waters less than 40 m deep and rarely range beyond the 55 m depth contour (Garshelis 1987; Kenyon 1969).

Large sea otter populations in Alaska were discovered by the Russian Bering expedition in 1741, resulting in a commercial fur harvest that lasted 170 years and extirpated sea otters from much of their historic range (Service 2013a). When the species was finally given protection under the International Fur Seal Treaty of 1911, the worldwide population may have consisted of fewer than 1,000 individuals in 13 remnant colonies. Throughout much of the 20th century, these remnant colonies grew and expanded their range, eventually recolonizing much of the species' historically occupied habitat. In the late 1960s and early 1970s, the process of recolonization was enhanced by the translocation of otters from areas of high abundance to sites from which they had been extirpated by the fur harvest.

During the 1990s, sea otter surveys in the Aleutian Archipelago indicated that the population trend had shifted from growth and expansion to rapid decline (Doroff et al. 2003). Additional surveys throughout southwest Alaska (Burn and Doroff 2005) helped define the scope and magnitude of the population decline, which led to listing the Southwest Alaska DPS as threatened (70 FR 46366; August 9, 2005). The cause of decline is unclear, but the theory with the most evidence is predation by killer whales (Tinker et al. 2021).

Population size estimates are periodically released in stock assessment reports. The last stock assessment report for the Southwest Alaska DPS of northern sea otters estimated a population size of 54,771 sea otters (Service 2014a). Since 2014, no comprehensive estimate has been produced, although several surveys have been completed. Areas of Western Cook Inlet were surveyed in 2018, Kodiak Island in 2014, the north and south Alaska Peninsula in 2016, Eastern Aleutians in 2017, and the Western Aleutians in 2015. From these efforts, the minimum population size in 2020 was estimated to be 52,232 otters (Table 10); however, these surveys were not designed to cover all suitable habitat within each MU (with the exception of the Eastern Aleutians survey in 2017), and therefore represent the relative abundance for the surveyed areas only, not the entire area of each MU (Service. 2020).

The Kodiak, Kamishak, and Alaska Peninsula MU contains almost half of the population of the Southwest Alaska DPS (Service 2014a). A comparison of the 2014 stock assessment data with recent survey results shows increasing populations in this MU. Population estimates from the Kodiak Archipelago indicated there were 11,005 (standard error [SE] = 2,138) sea otters in 2004 and 13,274 (SE = 1,885) in 2014 (Cobb 2018). In western Cook Inlet, including Kamishak Bay, population estimates increased from 6,918 (SE = 2,290) in 2002 to 10,737 (SE = 2,323) in 2017 (Garlich-Miller et al. 2018). Surveys of Katmai National Park in the Alaska Peninsula region estimated 7,095 (SE = 922) otters in 2008, 8,644 (SE = 1,243) in 2012, 6,873 (SE = 959) in 2015, and 6,647 (SE = 1,283) in 2018 (Coletti et al. 2016, Esslinger et al. 2021). The pattern of growth and decline, together with data collected from sea otter carcasses that had washed ashore, suggested that the population in the Katmai region grew then declined after exceeding the habitat's carrying capacity (Coletti et al. 2016).

The South Alaska Peninsula MU experienced drastic declines in the 1990s and today contains relatively few sea otters. Population estimates reported in 1986 ranged from 13,900 to 17,500 otters (95 percent CI up to ±6,456) (Brueggeman et al. 1988; Burn and Doroff, 2005). In 2001, Burn and Doroff (2005) reported 1,005 otters (95 percent CI: ±1,597). Estimates from surveys in 2016 consisted of 546 otters (95 percent credible interval [CrI]: 322–879; Beatty et al. 2021).

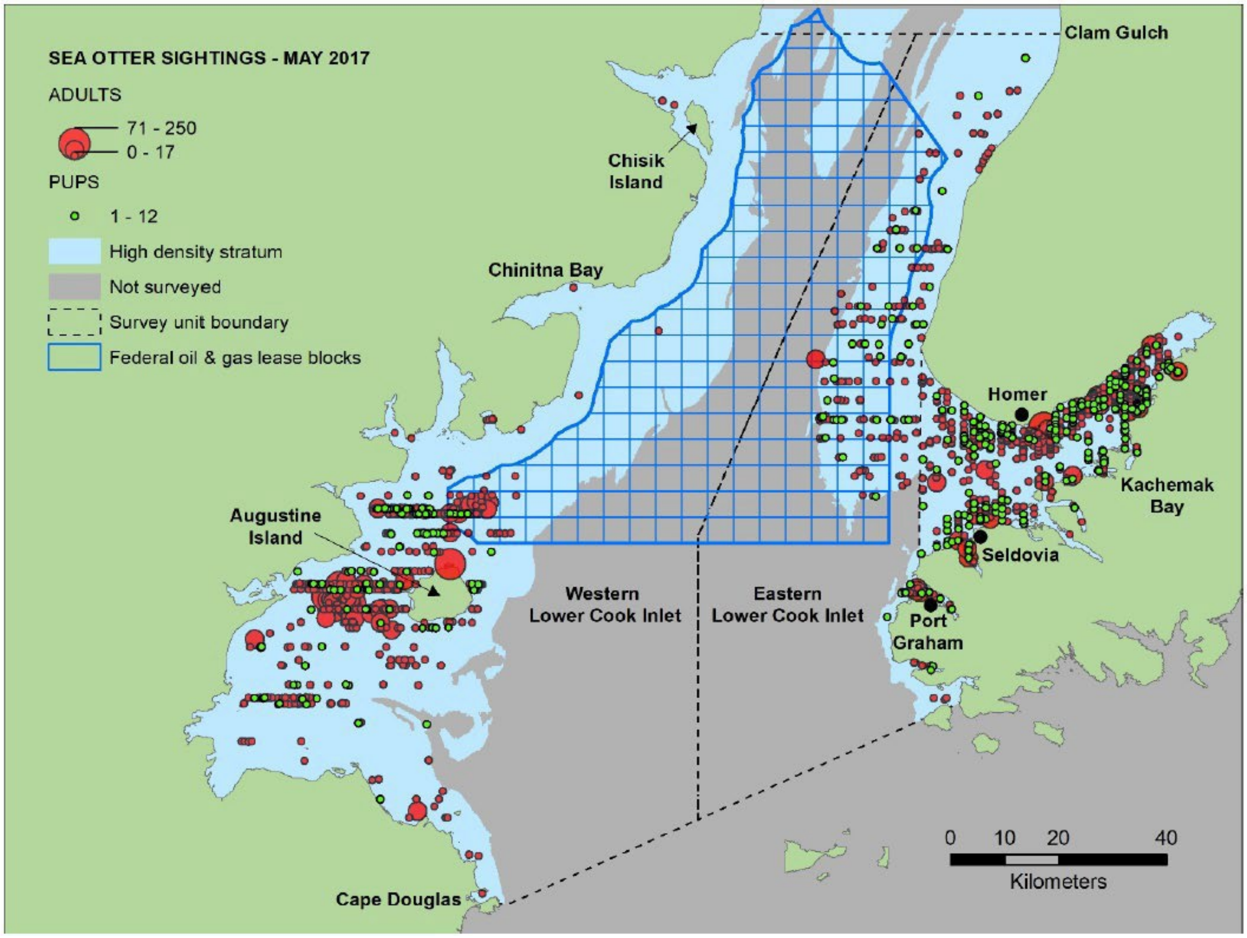
Differences between the 2001 and 2016 estimates may be due to different survey and analysis techniques, but the decrease after 1986 is too large to be attributed to anything other than a substantial population decline (Service. 2020). The consistently low numbers indicate the population has not recovered from the declines of the 1990s that led to listing under the ESA.

In the Bristol Bay MU, sea otter populations showed evidence of recovery between 2000 and 2016. The 2016 survey estimated total sea otter abundance in both subunits as 9,733 sea otters (95 percent CrI: 6,412–17,819; Beatty et al. 2021), up from 4,728 in 2000 (Brueggeman et al. 1988; Burn and Doroff 2005). The 1990s population declines in Bristol Bay were significant, although less severe than those of the South Alaska Peninsula. Results from the survey in 2000 indicated declines of 27 to 49 percent compared with estimates from 1986 when Bristol Bay had an estimated 6,474 to 9,215 otters (Burn and Doroff 2005).

In 2017, the Service conducted surveys of the Eastern Aleutians MU, which includes the 10 volcanic islands from Unimak Pass in the east to the community of Nikolski in the west. They estimated 8,593 sea otters (95 percent CrI: 7,450–9,984; Wilson et al. 2021). This represents a probable increase of estimates from the early 2000s in which population size was predicted to be around 2,291 (Doroff et al. 2003). The difference in population estimates cannot be considered a precise reflection of rate of increase, as Doroff et al. (2003) did not account for differences in perceptibility, availability, or sampling effort across different study strata; but these estimates indicate the current population size is now probably as large or larger than that of the early 1990s prior to widespread declines (Service. 2020). Evans et al. (1997) reported 3,470 otters in the Eastern Aleutians in 1992 (95 percent CI ±594).

The islands of Adak, Amchitka, Attu, Kagalaska, Kiska, and the Semichis in the Western Aleutians MU were surveyed in 1992 and 2000. Agattu, Little Tanaga, and Rat Island were also surveyed during the 2000s, although not every island was surveyed each time. Data indicated a decline in sea otter densities of 17.7 percent (SE ± 2.98 percent) between 1992 and 2000 (Doroff et al. 2003), followed by continued declines until 2003. After 2003, sea otter abundance remained low (Service 2020). The most recent survey in 2015 counted 620 independent sea otters at 7 islands, which when extrapolated to all 37 islands produced an estimate of 1,852 sea otters (95 percent CI: 1,368–2,514; Tinker 2018, in Service 2020).

Since listing under the ESA, progress toward recovery of healthy sea otter populations has been variable among the management units. The recovery plan for the Southwest Alaska DPS (Service 2013a) established goals for delisting northern sea otters from the ESA. It included three objectives: (1) achieve and maintain a self-sustaining population of sea otters in each MU, (2) maintain enough sea otters to ensure a functional role in the ecosystem, and (3) mitigate threats sufficiently to ensure persistence of sea otters. Prior to delisting, at least three of the five MUs must have met these objectives, and no unit should qualify for uplisting to endangered. As of 2022, the Kodiak, Kamishak and Alaska Peninsula MU has likely recovered, and may have exceeded carrying capacity around 2012. Surveys of the Bristol Bay MU indicate the population is near the pre-decline numbers and is recovering. The Eastern Aleutians MU shows good indicators of recovery as well. In contrast, the Western Aleutian MU shows stable but suppressed population numbers, indicating little progress toward recovery, and the South Alaska Peninsula MU has not recovered and contains relatively few otters.



Garlich-Miller et al. 2018.

Figure 6 Distribution of northern sea otter in Cook Inlet Area

Table 10 Population Estimates for the Southwest Alaska DPS of the Northern Sea Otter from the Most Recent Survey Data Available for each Management Unit

Management Unit	Survey Year(s)	Area Surveyed (km^2)	Population Estimate	Lower 95% CI	Upper 95% CI	Reference
Kodiak, Kamishak, & Alaska Peninsula	2014–2018	14,697	30,658 13,274 – Kodiak 10,737 – W. Cook Inlet (incl. Kamishak) 6,647 – Katmai (AK Pen)	19,896	41,420	Cobb 2018 Garlich- Miller, et al. 2018 Esslinger et al. 2021
Bristol Bay	2016	11,935	9,733	6,412	17,819	Beatty et al. 2021
South Alaska Peninsula	2016	9,575	546	322	879	Beatty et al. 2021
Eastern Aleutians	2017	11,079	8,593	7,450	9,984	Wilson et al. 2021
Western Aleutians	2015	Not available	1,852	1,368	2,514	Tinker 2018, cited in Service 2020

Tinker (2018) conducted a population viability assessment for the Western Aleutian MU. The estimated risk of extinction was greater than 5 percent when there were fewer than 357 independent otters (95 percent CI 293–436) or approximately 0.9 percent of the unit's carrying capacity. Based on this analysis, the recommended uplisting threshold was set to 500 animals. The corresponding risk of becoming endangered was predicted to be less than 5 percent when there were at least 5,741 independent otters (95 percent CI 5,129–6,450). Thus, the recommended down-listing threshold for the Western Aleutians was set to 6,450 independent otters or 13.4 percent of carrying capacity. These thresholds (adjusted to 1 percent and 14 percent of carrying capacity for uplisting and downlisting, respectively) were also recommended for the other MUs. Based on these parameters, Service's most recent ESA 5-year review recommended no changes to the threatened status of the Southwest Alaska DPS of the northern sea otter (Service 2021).

The variability in demographic patterns and trends among MUs demonstrates the spatial ecology of sea otter populations. The geographic structure of the population is also reflected in the sea otters' genes. Severe overharvest during the commercial fur trade of the 1800s nearly caused extinction and resulted in the prolonged isolation of a few surviving subpopulations. Limited dispersal occurs between suitable coastal habitat areas, and the continued survival of the species has relied both on the survival of a minimum number of subpopulations and the continuity of habitat between them. Flannery et al. (2021) evaluated the genetic structure of the DPS and found that current sea otter subpopulations could be grouped by their remnant populations of origin. Comparison of genetic markers between individual otters indicated that average dispersal distance was 103 km and individuals with shared lineages were likely to be found within approximately 400 km (Flannery et al. 2021)

Steep population declines and limited dispersion capability has led to extremely low genetic diversity. Flannery et al. (2021) found evidence of low genomic diversity caused by population bottlenecks. Beichman et al. (2019) also assessed northern sea otter genetics and found evidence of recent inbreeding and demographic histories marked by population declines. They observed a level of increase in putatively deleterious gene variants that could impact the future recovery of the sea otter (Beichman et al. 2019). Flannery et al. (2021) postulated that the estimated effective size of Southwest DPS populations (after adjusting for limited genetic variation) may not be at levels that would cause immediate risk from loss of genetic diversity beyond what has already occurred but may not be sufficient to maintain the genetic diversity needed to adapt to environmental change in the future. The Service's Species Status Assessment (St. Martin et al. 2020) for the listed population of northern sea otters concluded the low genetic diversity has not been an important factor limiting population growth.

The status of the Southwest Alaska DPS of northern sea otter and its designated critical habitat was evaluated and summarized in the Service's Species Status Assessment (Service 2020). Indicators of resiliency, redundancy, and representation ("the three Rs") were ranked for each MU. Species with high levels of these indicators can maintain viability over the time period analyzed (here, 2020 to 2050). Low levels signify a possibility of extinction. This assessment concluded the overall combined condition of the three Rs was low to moderate for all MUs except for the Eastern Aleutians, which had high rankings and therefore a high level of viability through 2050. The viability ranking of each MU was as follows: Kodiak, Kamishak, Alaska

Peninsula: moderate; Bristol Bay: Moderate; South Alaska Peninsula: low; Eastern Aleutians: high; and Western Aleutians: low (Service 2020).

4.2.4 Life History

Both male and female sea otters can attain sexual maturity by age 3, although where food resources limit population growth, sexual maturation may be delayed to 4 to 5 years of age (Von Biela et al. 2009). Sea otters mate at all times of the year, and gestation requires about 6 months. Although young may be born in any season, most pups are born in late spring in Alaska. Like other marine mammals, they have only one pup during each breeding cycle. The female's maternal instinct is strong, and she seldom leaves her pup except when diving for food. When the female travels or sleeps, the pup usually rides on its mother's chest as she floats on her back. The pup may weigh 14 kilograms (kg) or more when weaned. Females can produce one pup a year but may produce pups less frequently in areas where food is limited. Many sea otters live for 15 to 20 years, and usually do not migrate. They seldomly travel far unless an area has become overpopulated, and food is scarce. The home range of individual sea otters can vary from only a few km^2 to over 40 km^2 (Schneider and Ballachey 2008).

4.2.5 Foraging Ecology

Sea otters forage in nearshore coastal areas with rocky and soft-sediment substrates, typically close to shore in waters less than 40 m depth (Estes 1980; Van Blaricom and Estes 1988). They dive to gather food (sea urchins, crabs, clams, mussels, octopuses, other marine invertebrates) from the seafloor in relatively shallow water (Riedman and Estes 1990). Distribution is largely limited by their ability to dive to the sea floor (Bodkin et al. 2004). Diving depth of sea otters is highly variable and ranges from 2 to 75 m depending on the prey species (Schneider and Ballachey 2008). They usually dive and return with several items of food, roll on their backs, place the food on their chests and eat it piece by piece using their forepaws, sometimes using a rock to crack shells. In the wild, sea otters never eat on land. Feeding dives generally last about 60 to 90 seconds, although some otters have been observed staying underwater in excess of 5 minutes (Riedman and Estes 1990).

Esslinger et al. (2014) showed otters generally spent less time foraging during summer (females 8.8 hours per day, males 7.9 hours per day) than other seasons (females 10.1 to 10.5 hours per day, males 9.2 to 9.5 hours per day). Both sexes showed strong preferences for diurnal foraging and adjusted their foraging effort in response to the amount of available daylight, except for female otters after they have given birth. For approximately 3 weeks post-partum, females switched to nocturnal foraging, possibly to reduce the risk of predation by eagles on newborn pups (Esslinger et al. 2014).

4.2.6 Threats to the Species

Two primary threats have caused historic population declines among Alaska's sea otters. The first was overharvest during commercial hunting. The commercial sea otter fur trade peaked in the late 1800s and then waned with the decrease in availability of sea otters. Overharvest is not currently considered a threat. The second major threat was predation, probably by killer whales. Killer whales are generally assumed to have caused declines in the Southwest Alaska DPS in the

1980s and 1990s and may still threaten sea otters in parts of their range. Other stressors are not currently considered major drivers of sea otter population trends.

4.2.6.1 Predation

Sea otters are preyed on by bald eagles, white sharks, brown bears, coyotes, arctic foxes, and killer whales. Predation by killer whales has been hypothesized to be the primary driver of the recent decline of the northern sea otter population, and it may pose a serious threat to timely recovery of sea otter populations (Service 2013a). Transient killer whales are thought to have shifted to diets containing more sea otters following declining availability of harbor seals (*Phoca vitulina*) and Steller sea lions (*Eumetopias jubata*) during the mid- to late-20th century (Estes et al. 2009). Tinker et al. (2021) conducted a quantitative, probabilistic analysis of the degree of consistency between the available data and each of seven competing hypotheses and found the predation hypothesis had more than two times the support of any other hypothesis.

4.2.6.2 Disease

Sea otters are susceptible to multiple disease agents, including parasites, bacterial and viral infection, and biotoxins. Helminth parasites including tapeworm (Cestoda), flukes (Trematoda), Nematoda, and Acanthacephala species are prevalent among sea otters, including among the southwest Alaska DPS (St. Martin et al. 2020). Disease agents may have minor effects on the overall population if outbreaks are isolated and short-lived. Alternatively, pathogens and biotoxins can cause major declines by increasing morbidity and mortality or by reducing fertility or fecundity among a population segment. The Service evaluated prevalence and severity of infectious disease among the Southwest Alaska DPS in the recovery plan (Service 2013a).

Disease was rated as a low threat to recovery of the northern sea otter in all areas except the Kodiak, Kamishak and Alaska Peninsula MU. In this unit, pathogenic diseases were rated as a moderate threat due to the prevalence of valvular endocarditis caused by the *Streptococcus bovis* or “strep” complex.

Climate change is expected to increase disease prevalence among animal populations in the arctic and subarctic regions through changes in spatial distribution among hosts, pathogens, and vector populations (Dudley et al. 2015). Overall, threats to the Southwest Alaska DPS from exposure to disease agents are expected to increase due to climate change. However, the Service concluded that at this time, it is uncertain what effect the increase in disease and parasites may have on the Southwest Alaska DPS of northern sea otters in the future (St. Martin et al. 2020).

4.2.6.3 Hunting

Commercial harvest of northern sea otters began in the western Aleutians and peaked in the 1800s causing significant population declines across Alaska and Canada (Bodkin 2015). This harvest declined as otters became rare, leaving behind small remnant populations in isolated locations (Kenyon 1969; Bodkin 2015). Harvest of sea otters is currently prohibited except by Native hunters who take otters for subsistence purposes. The reported harvest of otters in Alaska is greatest around coastal villages and can change greatly from year to year. However, in most years from 2010 to 2019, the reported harvests of the Southwest Alaska DPS were generally less than 300 otters per year and appears to be sustainable with minimal population level impacts (Service 2020).

4.2.6.4 Habitat Loss

Commercial activity and construction of coastal facilities including docks, piers, and boat harbors, as well as oil and gas facilities contribute to loss of habitat. Development areas occur near towns such as Unalaska in the Aleutian Islands and Kodiak, Alaska. The primary concern associated with construction activities is the in-water and airborne noise levels these activities generate that can compromise sea otter hearing or temporarily or permanently displace sea otters from important areas. Most of the Alaskan coastline in the range of the Southwest Alaska DPS is undeveloped and habitat loss is not considered a major threat to the northern sea otter (Service 2013a), but local development in busy commercial and industrial centers like the City of Kodiak and Unalaska could limit movements between local population segments.

4.2.6.5 Oil Spills and Other Contaminants

Sea otters are vulnerable to oil contamination. They rely on their fur for thermoregulation and do not have a thick layer of blubber to protect them from cold water (Bodkin et al. 2002). Contact with oil prevents the fur from properly insulating their bodies and leads to hypothermia (Siniff et al. 1982). Oil toxicity can also be harmful to sea otters and has been documented to cause brain lesions, disorientation, liver damage, kidney failure, and damage to eyes and lungs (Peterson et al. 2003). Long-term population impacts can come from contamination of food resources (Dean et al. 2002; Bodkin et al. 2012). Suspension-feeding clams and mussels concentrate hydrocarbons in the tissues later consumed by otters (Jewett et al. 1999). The overall extent of impacts to the Southwest Alaska DPS depends on the size and location of a spill.

While large spills happen infrequently, small-scale spills (such as vessel spills) are more common. Although it is a rare event, a large-scale spill of crude oils, fuels, or other contaminants can have a significant and negative population-level impact. For example, in 1989, a large tanker grounded in northern Prince William Sound and released 260,000 barrels of crude oil contaminating at least 1,990 km of shoreline, known as the Exxon Valdez Oil Spill (EVOS).

When the EVOS occurred in Prince William Sound, several thousand otters were killed despite rehabilitation efforts (Ballachey et al. 1994). Additionally, in December of 2004 a 225-m freighter, the *Selendang Ayu*, ran aground and broke apart near Unalaska Island in the Eastern Aleutians. The rupture resulted in the release of about 1,330 metric tons of oil and diesel. At least two otters were killed due to oiling from this event but the extent to which it affected the Southwest Alaska DPS of northern sea otter and their prey is unknown.

4.2.6.6 Climate Change

Although climate change is a global phenomenon, high latitude regions, including Alaska and the surrounding oceans, are thought to be especially sensitive to its effects (Schindler and Smol 2006; Smol et al. 2005). Data collected during the past 60 years indicate the State of Alaska has warmed more than twice as fast as the rest of the U.S., with average annual air temperature increasing by 1.7°C (Stewart et al. 2013). The waters within the range of the Southwest Alaska DPS of northern sea otter have warmed over the last several decades and are expected to continue to warm. Projected sea surface temperature models for the Gulf of Alaska indicate (a mean temperature increase of 1.7°C by 2050 and 3.3°C by 2080 (Dorn et al. (2018). Eighty percent of these models predicted a range of values between 1.4°C and 3.9°C for both time periods. The resulting temperatures appear to be within the thermal tolerances of otters and may be advantageous in terms of maintaining thermal neutrality, and the warmer trend may allow for otters to expand their range further north due to lack of sea ice. However, increasing sea surface temperatures may result in distribution shifts, recruitment dynamics, and changes in abundance of various members of benthic communities, including some prey species and other predators to those prey.

Climate change is expected to modify both the physical and biological environments within sea otter critical habitat (Service 2013a). Although it is difficult to predict how climate change will affect sea otter critical habitat, potential changes that may affect kelp forests (PCE 3) prey resources (PCE 4) are:

- PCE 3 – Kelp forests that provide protection from marine predators, which occur in waters less than 20 m depth. Kelp forests are a key component of sea otter critical habitat. Climate change is projected to result in broad shifts in the distribution of seaweeds in polar and cold-temperate waters (Muller et al. 2009).
- PCE 4 – Prey resources in sufficient quantity and quality to support the energetic requirements of the species. Ocean acidification, a consequence of rising atmospheric carbon dioxide (CO_2) levels, may affect the ability of sea otter prey species such as bivalves, snails, and crabs to form exoskeletons (Green et al. 2004).

4.2.7 Sea Otter Recovery Criteria

The Southwest Alaska DPS ranges from west to east across more than 2,414 km of shoreline, and sea otters occur in several distinct habitat types. The magnitude of the population decline has varied over the range. In some areas, numbers have declined by more than an order of magnitude, while in other areas no decline has been detected. To address such differences, the recovery plan identifies five management units within the DPS: 1) Western Aleutian Islands; 2) Eastern Aleutian Islands; 3) South Alaska Peninsula; 4) Bristol Bay; and 5) Kodiak, Kamishak, Alaska Peninsula (KKAPMU, Service 2013a). The relative importance of threats is assessed for each of the five MUs, with predation judged to be most important (moderate to high importance) followed by oil spills (low to moderate importance). Threats from subsistence harvest, illegal take, and infectious disease are assessed to be of moderate importance in the KKAPMU, but of low importance elsewhere. Specific actions to achieve recovery and delisting of the Southwest Alaska DPS that are specified in the Recovery Plan are:

- Demographic criterion: The probability of the sea otter becoming endangered within 25 years would be less than 5 percent. Because of this criterion, population monitoring and population modeling are considered high priorities.
- Ecosystem-based criterion: Greater than 50 percent of the islands need to be in the kelp-dominated state. This criterion applies to the Western Aleutians and Eastern Aleutians MUs only. Monitoring the status of the kelp forest ecosystem in these MUs is considered a high priority, as results from such monitoring will be needed to evaluate the ecosystem-based delisting criteria.

- Threats-based criterion: Predation is considered to be the most important threat to recovery, so additional research on that threat is also a high priority. Other high- priority actions include identifying characteristics of sea otter habitat and ensuring adequate oil spill response capability exists in southwest Alaska.

5 ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR §402.02) define the environmental baseline to include the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area. Also included in the environmental baseline are anticipated impacts of all proposed Federal projects in the Action Area that have undergone section 7 consultation, and the impacts of State and private actions contemporaneous with the consultation in progress. The Action Area for this biological opinion is shown in Figure 1 and includes waters and shorelines of lower Cook Inlet and the Shelikof Strait. In this section, the baseline for each species and their critical habitat in the Action area are discussed first, followed by past oil and gas activities, and other activities occurring in the Action Area.

5.1 Alaska Breeding Steller's Eider in the Action Area

The Action Area includes the easternmost extent of the molting and wintering range for pacific wintering Steller's eiders. As discussed in the *Status of the Species*, listed Alaska-breeding Steller's eiders mix with birds from the Russian breeding population in the non-breeding season, forming what is referred to as the "Pacific-wintering Steller's eiders." Therefore, only a portion of the Steller's eiders found in the action area are from the listed Alaska-breeding population.

Spring surveys from 1992 to 2011 have provided population estimates for Pacific-wintering Steller's eiders ranging from 54,888 (year 2010) to 137,904 (year 1992) and averaging 81,453 individuals (Larned 2012). This average is likely an overestimate because there has been a declining trend in the Pacific-wintering population of 2.4 percent annually between 1992 and 2012. Therefore, we will use the population estimate of 74,369 birds from the most recent reliable survey[1] (year 2011; Larned 2012a). This number is a best estimate for this Biological Opinion; however, it has numerous caveats which are further discussed in the Species Status Assessment (Service 2019). The Alaska-breeding Steller's eider populations is estimated to be 326 birds, as discussed in the *Status of the Species.* We therefore assume that 0.5 percent of all Steller's eiders occurring on the molting and wintering grounds in Alaska, including the proposed action area, are from the listed Alaska breeding population. This estimate is derived by taking the best estimate for the listed Alaska-breeding population (326 eiders) and dividing by the population estimate of Pacific-wintering eiders from 2011 (74,369 eiders; Larned 2012a); thus, 326/74,369*100 = 0.5 percent.

Steller's eiders use two habitat types throughout the non-breeding season – shallow, nearshore intertidal sand flats and mudflats, and rocky or mud-bottomed deep water nearshore areas.

[1] The Pacific-wintering population was surveyed more recently, in 2012, however the number was lower than expected likely because of delayed migration due to late sea ice dispersal (Larned 2012).

During the fall molting and spring staging periods, large numbers of Steller's eiders are associated with expansive beds of eelgrass on intertidal mudflats (Fredrickson 2001, Hogrefe 2014, Martin et al. 2015). Steller's eiders do not feed on eelgrass, but on the invertebrates associated with eelgrass habitat. The characteristics of eelgrass-associated invertebrate prey that are most important to Steller's eider demographic rates has not been measured. However, their association with eelgrass communities during a large portion of their annual cycle suggests it is an important habitat factor. Eelgrass beds can be found adjacent to the southwest extent of the project area, within Kamishak Bay. Larned (2005) reported greater than 2,000 eiders molting in lower Cook Inlet near the Douglas River Delta.

During winter, particularly from January to April, a portion of the Pacific-wintering population of Steller's eiders moves to rocky intertidal areas or deeper nearshore waters such as areas on the south side of the Alaska Peninsula, the Aleutian Islands, Cook Inlet, and Kodiak Island (Rosenberg et al. 2014, Martin et al. 2015), while others stay in intertidal mudflats dominated by eelgrass. Observations at Izembek Lagoon indicate that when intertidal flats freeze in winter, Steller's eiders move to deeper (up to 30 m), gravel and mud-bottomed nearshore areas (Laubhan and Metzner 1999). Martin et al. (2015) also reported substantial use of habitats greater than 10 m deep during mid-winter. The same may be true for eiders in Cook Inlet.

Individuals arrive in Cook Inlet habitats in late fall, with numbers peaking in January and February, then declining as birds depart in March through mid-April on spring migration to nesting grounds (Larned 2006, Martin et al. 2015). However, birds may be present in lower Cook Inlet as early as late July or as late as late April (as they are in Kodiak), with numbers reportedly peaking in January and February (Larned 2006, Martin et al. 2015, Rosenberg et al. 2014). The chronology likely varies somewhat among and within years depending on weather and sea ice dynamics, and perhaps also as a function of the physiological condition of the birds.

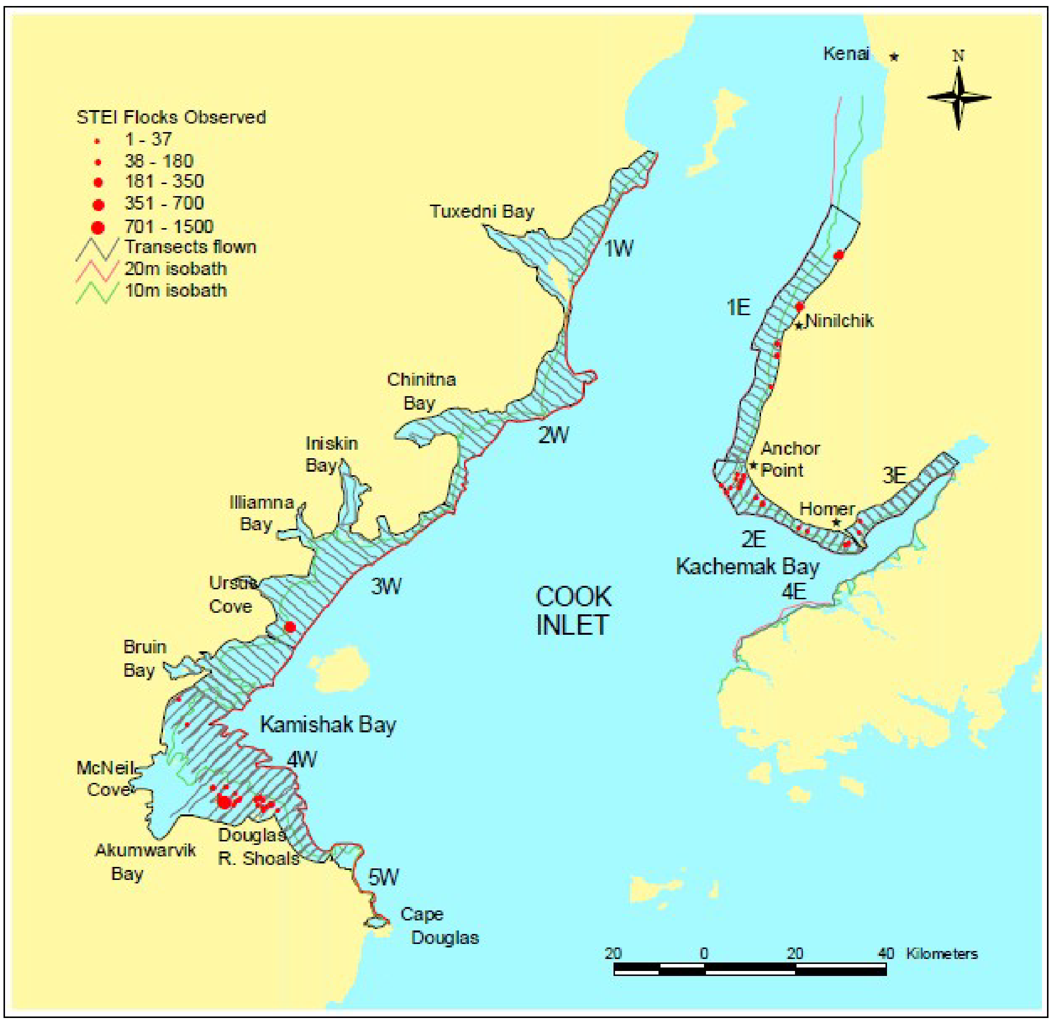
Winter aerial surveys of lower Cook Inlet in 2004 and 2005 identified concentrations of Steller's eiders in Kachemak Bay, along the shoreline of the lower Kenai Peninsula near Ninilchik, and along the southcentral shore of Kamishak Bay (Larned 2006, Rosenberg et al. 2014). Figure 7 shows the distribution of eiders recorded during survey efforts in February 2004. The largest monthly Steller's eider estimates in the 2004 to 2005 study were 1,499 in February 2004, for eastern Cook Inlet survey areas, and 4,284 in January 2005, for western survey areas (Larned 2006). A small number of Steller's eiders are known to remain along the Alaska Peninsula and Kachemak Bay during the summer; approximately 100 have been observed in Kachemak Bay (Service, unpublished data).

ABR, Inc. (2011) collected marine wildlife observations in a lower western Cook Inlet study area as part of baseline studies for the proposed Pebble Mine. Surveys were conducted via boat and helicopter between June 2004 and December 2009, and more than 100 eiders were observed in each monthly survey conducted between January and April of 2006 to 2008. Overall, eiders were observed from the second half of November through the first half of April, "primarily as large flocks resting and foraging within the centers of Iliamna and Iniskin Bays, with one small flock seen near the Iniskin Islands and none seen in Chinitna Bay." They found mean group size averaged 156 birds in late winter and spring in these western Cook Inlet areas, with no significant difference between seasons. More recent data gathered for the Pebble Project indicate

Pacific-wintering Steller's eiders use areas near Anchor Point, Iniskin Bay, Iliamna Bay, and Ursus Cove (USACE 2020a).

5.1.1 Threats and Potential Stressors in the Action Area

Threats to the species' recovery have been summarized in *Status of the Species*. These factors include predation, disease, hunting, ingestion of lead shot, habitat loss and change, collisions with human-made structures, contact or ingestion of oil, exposure to fish processing facility wastes, and climate change. Threats in the action area typically mirror those previously described for range-wide threats to the species so they will not be elaborated on here. For further discussion of existing anthropogenic activities in the action area, refer to section four of the BOEM LS258 BA (BOEM 2022a). The activities described include oil and gas, marine transportation, coastal development, mining, fisheries, scientific research, wastewater discharges and runoff, subsistence and commercial harvest, military activities, and climate change.



Notes: Flock symbol sizes are proportional to ranges of numbers of eiders, as noted in the legend (Larned et al. 2006).

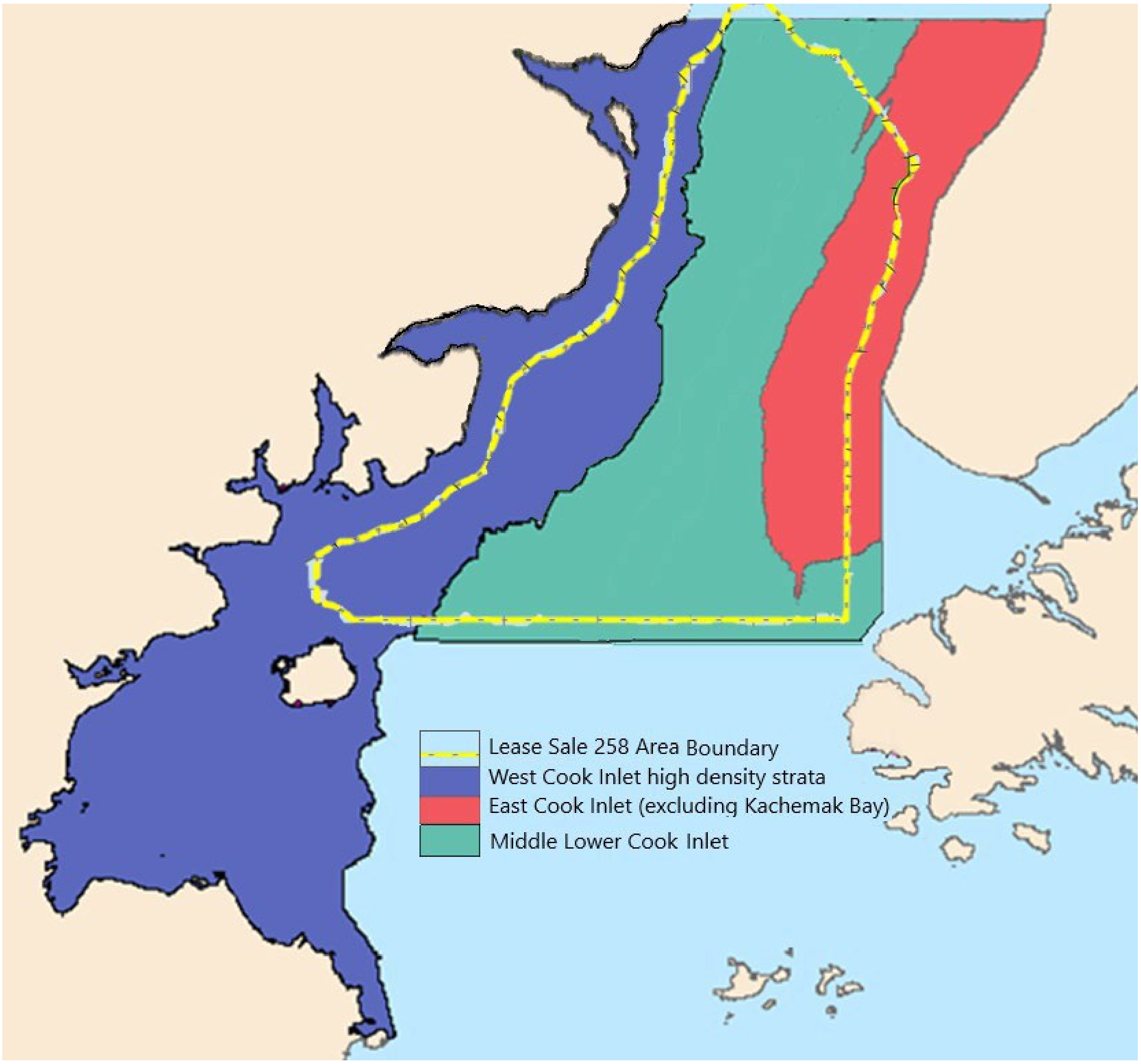
Figure 7 Transects Flown and Locations of Steller's Eider Groups Recorded During an Aerial Survey, Cook Inlet, Alaska, February 11-16, 2004

5.2 Sea Otters in the Action Area

The most recent estimate of the size of the Southwest Alaska DPS of northern sea otters is 51,382 individuals (95 percent CI: 35,448–72,616) (St. Martin et al. 2020). This represents an increase from the previous estimate of 45,064 sea otters (Service 2014a). The approximate range of sea otters within the Action Area extends along both shorelines of Cook Inlet as far north as approximately Ninilchik on the eastern side of Cook Inlet, and south of Kalgin Island on the western side. Sea otters are year-round residents in the Action Area. Sea otters in the Action Area are within the MU that includes Kodiak, Kamishak, and the Alaska Peninsula, which has more than half of the population of the DPS (approximately 30,658 individuals (SE = 5,491) (St. Martin et al. 2020).

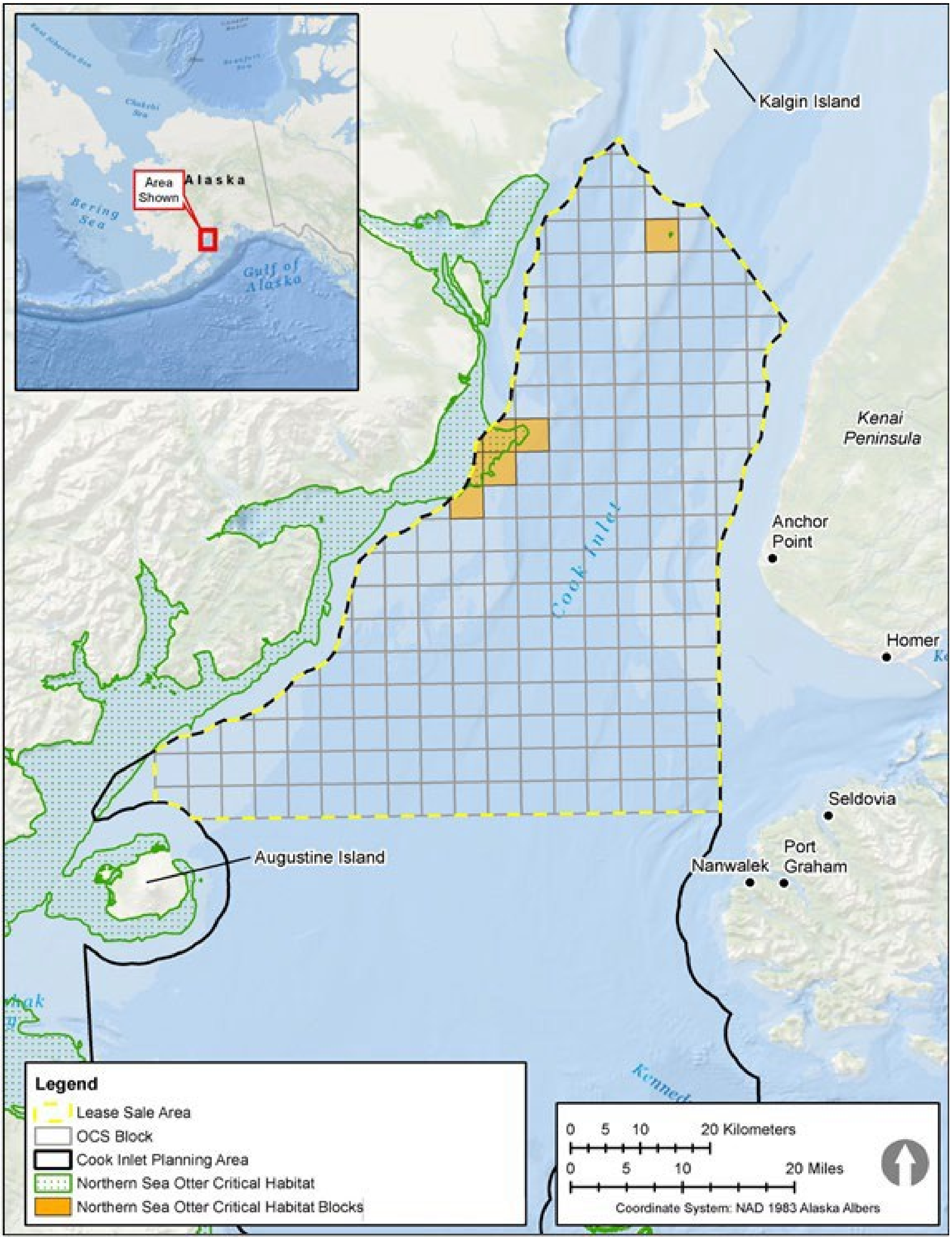
Figure 8 shows estimated sea otter density in the Lease Sale Area. In May of 2017, eastern lower Cook Inlet along the shores of the Kenai Peninsula had 3,164 otters (SE = 685) with a density of 1.89 otters per km^2 (SE = 0.41) based on aerial surveys in eastern Cook Inlet (Esslinger et al. 2021). St. Martin et al. (2020) reported the density of the western Cook Inlet high density strata (as defined by the bathymetry) at 2.25 otters per km^2. The Service estimated sea otter density in the middle reaches of lower Cook Inlet to be 0.026 otters per km^2 (84 FR 37716, August 1, 2019).

The Cook Inlet Lease Sale Area overlaps seven OCS lease blocks that are identified as critical habitat for the Southwest Alaska DPS of the northern sea otter (Figure 9). Six of the blocks are along the western edge of the Lease Sale Area. One additional block in the north-central portion of the Lease Sale Area also contains a small area of critical habitat. These blocks are excluded from LS 258. No leases will be issued in these lease blocks.



BOEM 2022a.

Figure 8 Sea Otter Density Zones in the Lease Sale 258 Area



Note: The OCS blocks that overlap with the critical habitat are shaded in orange and will not be offered for lease in LS 258 BOEM 2022a.

Figure 9 Northern Sea Otter Critical Habitat in the Lease Sale Area

5.2.1 Threats and Potential Stressors in the Action Area

Threats to sea otter recovery were summarized in *Status of the Species*. These factors include predation, disease, subsistence harvest, habitat loss, oil spills and other contaminants, and climate change. Threats in the Action Area typically mirror those previously described as range-wide threats. Activities that have, are, or are expected to occur in the Action Area and their potential impact to sea otter are described below. Other natural and existing anthropogenic activities that may affect sea otters in the action area are excerpted below from BOEM's LS258 BA (BOEM 2022a). These activities include oil and gas activities, marine transportation, coastal development, mining, fisheries, scientific research, wastewater discharges and run-off, subsistence and commercial harvest, and military and Homeland Security activities.

5.2.1.1 Predation

The Service recovery plan for the sea otter DPS rates predation as a moderate threat to recovery of the Bristol Bay, and Kodiak, Kamishak, Alaska Peninsula MUs (Service 2013a). This ranking recognizes the likely role that predation has played in the overall population decline, but predation has not been recognized as a negative impact for sea otter populations in Cook Inlet.

The Kodiak, Kamishak, Alaska Peninsula MU did not experience the large-magnitude declines of the other MUs in the early to mid-1990s and may have provided increased protection from predation.

5.2.1.2 Oil Spills

Sea otters are particularly vulnerable to oil spills because of the potential for: 1) fouling of their highly insulative fur; 2) toxicity of oil ingested during grooming; 3) ingestion of toxic hydrocarbons stored in benthic invertebrate prey; and 4) the fact that they often form large aggregations, creating the potential for large numbers of animals to be exposed to the effects of a spill. Large, bulk oil tanker traffic within the range of the Southwest Alaska DPS occurs from Valdez to Nikiski with occasional tankers transiting from other locations in the world (ABM 2012). An additional source of potential harm from oil spills comes from fuel supplies aboard freighters and fishing vessels (Service 2013a). Many of those vessels use diesel fuel, which is less toxic and disperses and evaporates much more rapidly than crude oil.

Most spills would be relatively small and have limited local impacts. Fuel storage facilities in ports throughout the range of the DPS are also a potential source of localized spills. Due to the large linear extent of the DPS, even a large spill from a crude oil tanker in Cook Inlet would be unlikely to affect a substantial proportion of the overall listed DPS of the northern sea otter, but local populations could be heavily impacted. The sea otter recovery plan (Service 2013a) rates oil spills as a moderate threat to recovery of the Kodiak, Kamishak, Alaska Peninsula MU. Kodiak Island has the highest human population within the range of the DPS and is adjacent to a major shipping route into Cook Inlet, thus justifying the moderate ranking for that stock (Service, 2013a).

5.2.1.3 Subsistence Harvest

Harvest of sea otters by Alaska Native peoples is authorized under section 101(b) of the MMPA and section 10 of the ESA, provided the take is for subsistence purposes, or for the purpose of creating and selling authentic native articles of handicrafts and clothing, and is not wasteful. The recovery plan rates subsistence harvest as a moderate threat to recovery in the Kodiak, Kamishak, Alaska Peninsula MU (Service 2013a). This classification was based on the relatively large human population within the range of the Kodiak, Kamishak, Alaska Peninsula MU and the fact that in much of that range the sea otter population is readily accessible to subsistence hunters using small boats. Kodiak Island has the largest human population and largest reported subsistence harvest. Between 1989 and 2005, 1,857 otters were reportedly harvested from the Southwest Alaska DPS, with the Kodiak Archipelago accounting for 80 percent of that total (Service, 2013a). At this time, annual harvest rates as a percentage of the estimated population size were low in all MUs and progressively increased from west to east, with a maximum of 0.32 percent in the Kodiak, Kamishak, Alaska Peninsula MU. In addition to being low, the harvest consisted largely of males (73 percent), suggesting that it has less of an impact on population growth than if more females were taken.

Between 2013 and 2018, approximately 491 northern sea otters were harvested from Cook Inlet, averaging 98 per year. The large majority were taken in Kachemak Bay. Harvest occurs annually, but peaks in April and May, with about 40 percent of the total annual harvest occurring during those months. February and March are also high harvest periods, with about 10 percent of the total annual harvest occurring in each of these months (Service 2019b). The current level of harvest is not thought to be a population-regulating factor.

5.2.1.4 Disease

The recovery plan rates infectious disease as a moderate threat to recovery in the Kodiak, Kamishak, Alaska Peninsula MU (Service 2013a). This is a result of the relatively large number of carcasses recovered in recent years in Kachemak Bay in the adjacent Southcentral Alaska Stock. However, cases were documented across all three population stocks. Valvular endocarditis caused by *Streptococcus bovis* complex was the primary cause of death in almost half of the fresh carcasses examined in Kachemak Bay between 2002 and 2006. This spike in mortality did not appear to have population-level effects, as the number of otters around the Kenai Peninsula has increased.

5.2.1.5 Disturbance

Disturbance of sea otters results primarily from boat traffic. Because sea otters are slow swimmers relative to other marine mammals and spend much of their time at the surface resting, grooming, and nursing their young, they would appear to be highly vulnerable to disturbance by boats. However, boat traffic is light throughout most of the range of the Southwest Alaska DPS. Traffic is highest in the eastern MUs (including Cook Inlet), where sea otter populations are at the highest levels. Otter populations have thrived in areas with much greater volumes of boat traffic, such as southeast Alaska and British Columbia. For these reasons, the Service recovery plan rates disturbance as a low threat to recovery for all MUs (Service 2013a).

5.2.2 Existing Anthropogenic Activities in the Action Area

The discussion of Environmental Baseline includes a description of past and ongoing human and natural factors that have either led to the status of a listed species in the Action Area or are currently affecting the listed species or critical habitat in the Action Area. Relevant factors may have beneficial impacts on some species, but many are stressors or threats. This section includes background information about principal human stressors common to Service listed species. Also included are proposed Federal projects in the Action Area that have undergone section 7 consultation, the state and private actions contemporaneous with the consultation in progress, and discussion of climate change.

5.2.2.1 Oil and Gas Activities

This section discusses past and present oil and gas (O&G) activities in Federal and State waters in the Action Area, as well as those future activities in Federal waters for which ESA section 7 consultation has been completed or is currently ongoing. Future on-lease activities associated with LS 258 are considered part of the Proposed Action and are addressed in Chapter 6, Effects of the Action.

Federal and State oil and gas lease sales have been regularly held throughout Cook Inlet for over 50 years, with six Federal oil and gas lease sales being held in the Cook Inlet Planning Area in that time. The first lease sale in the Cook Inlet Planning Area occurred in October 1977, Sale CI, which resulted in 88 leases being issued. In September 1981, Sale 60 resulted in 13 leases being issued. A reoffering sale, Sale RS-2, was held in August 1982 but no bids were received. Sale 149, held in June 1997, resulted in two leases being issued. Lease Sale 191 (2004) was held but received no bids. Two other proposed lease sales (Sale 211 in 2009, and Sale 219 in 2011) were cancelled due to a lack of industry interest. The most recent Federal lease sale, Lease Sale 244, was held in June 2017 and resulted in 14 blocks being leased. No production has occurred on the Cook Inlet OCS to date.

The State of Alaska holds lease sales regularly. The most recent, the Cook Inlet Areawide lease sale held by the State of Alaska, was held in May 2022, and yielded two new lease tracts. The Alaska Department of Natural Resources (ADNR) held an oil and gas areawide lease sale in December 2022. This lease sale offered acreage adjacent to the OCS Lease Sale Area for LS 258. Industry lessees currently hold 424,000 acres on 207 leases within the State's Cook Inlet Areawide boundary. One hundred and six leases, encompassing more than 65,000 acres, are currently in production (ADNR 2022). Exploration on the OCS and exploration and production in State waters and onshore on both State and Federal lands are occurring and are expected to continue. Not all exploration activities have led or will lead to resource development. Figure 10 shows the ongoing oil and gas activities in State waters as of June 2022. Seismic surveys and exploration are recurrent in Cook Inlet and would be expected to continue throughout the 40-year lifespan of the E&D Scenario associated with the Proposed Action. In 2019 and 2021, Hilcorp conducted exploratory surveys – deep penetrating 3D seismic surveys and geohazard surveys, respectively. It is anticipated that data from these surveys would be used support Hilcorp's submission of an Exploration Plan for Federal waters.

Offshore infrastructure in Cook Inlet includes operational and "light-housed" (currently non-operational) platforms in State waters. Although some platforms are not currently producing, they are likely to remain in place and in some instances could become operational again. Other existing infrastructure includes subsea oil and gas pipelines, onshore terminal processing, and support facilities. As of 2019, there were approximately 126 km of subsea oil pipelines and 266 km of subsea gas pipelines in Cook Inlet (Nuka 2019).

Planned or ongoing gas-related projects include several pipeline projects. The Alaska Stand-Alone Natural Gas Pipeline (ASAP) and the Alaska LNG Project would each involve the construction of a gas pipeline from the North Slope to southcentral Alaska for export. The ASAP would terminate at Point Mackenzie in upper Cook Inlet where a new LNG plant would be constructed. Alaska LNG proposes to terminate the new gas line at an LNG plant in Nikiski for shipment out of Alaska. The Alaska LNG Project has undergone Section 7 consultation with the Service and NMFS. Other projects include the Trans-Foreland Pipeline. The Trans-Foreland Pipeline is a 46.7-km long, 20.3-cm diameter oil pipeline from the west side of Cook Inlet to the Tesoro refinery at Nikiski and the Nikiski-Kenai Pipeline company tank farm on the east side of Cook Inlet. The pipeline will be used by multiple oil producers in western Cook Inlet to replace oil transport by tanker from the Drift River Tank farm. Trans-Foreland is also continuing work to convert the existing Kenai LNG export terminal to an import facility to supply natural gas to power an existing refinery nearby.

Oil and gas activities in the OCS are unlikely to overlap substantially with nearshore areas used by northern sea otters (Figure 9). The O&G activities that are most likely to continue for the foreseeable future in Cook Inlet are marine seismic surveys. The Service previously determined effects from marine seismic surveys on sea otters would be short-term, site specific, and limited to short-tern changes in behavior and mild stress responses (Service 2014b, c). Impacts to sea otter critical habitat may occur through localized effects to prey and prey habitat from seafloor disturbance. Effects to marine water quality via addition of wastewater discharges, unauthorized discharges, or other contaminants are also generally minimal due to discharge and waste-handling permit requirements. Therefore, past and present O&G activities on the OCS are unlikely to be an important factor affecting the northern sea otter population and the associated critical habitat.

Most of the past and present O&G activities and facilities are in Upper Cook Inlet north of Kalgin Island, or along the eastern shoreline north of Anchor Point. Based on the range of sea otters in the Action Area, most O&G activities on Alaska state lands or waters are unlikely to overlap substantially with areas used by northern sea otters. Therefore, O&G activities on State lands or waters are unlikely to be an important factor affecting the northern sea otter population.

5.2.2.2 Marine Transportation

Cook Inlet is a regional hub of marine transportation throughout the year, and is used by various classes of vessels, including cargo ships, tankers, tugs, cruise ships, commercial fishing boats, sport-fishing vessels, research vessels, and recreational vessels. Vessel traffic poses a risk of accidental oil spills (Nuka and Pearson 2015). Cook Inlet includes six deep-draft ports, four of which are within the Action Area (Nikiski Industrial Facilities, Port of Homer, City of Seldovia, and Drift River Oil Terminal), and several light-draft ports in the Action Area (e.g., Port

Graham, Tyonek, Williamsport). The Port of Anchorage, the third largest port in Alaska, is designated a U.S. Department of Defense National Strategic Port and provides services to approximately 75 percent of the total population of Alaska. According to a 2012 study of vessel traffic in Cook Inlet, most vessel traffic moves along north-south transit lines, with deep-draft vessels generally using the east side of the inlet (Figure 11, Cape International Inc. 2012).

A spill baseline study conducted by The Glosten Associates and ERC (2012) as part of the Cook Inlet Risk Assessment estimated a historical vessel spill rate of 3.4 spills (regardless of size) per year, with 3.9 spills per year forecasted for the years 2015 through 2020 across all vessel categories. Historical rates ranged from 0.7 spill per year for tank ships to 1.3 spills per year for non-tank or non-workboat vessels (The Glosten Associates and ERC 2012). Eight large spills (≥1,000 bbl) from vessels (tankers and, in one case, a tug) were documented in Cook Inlet between 1966 and 2015. No large spills have occurred in the area in recent years.

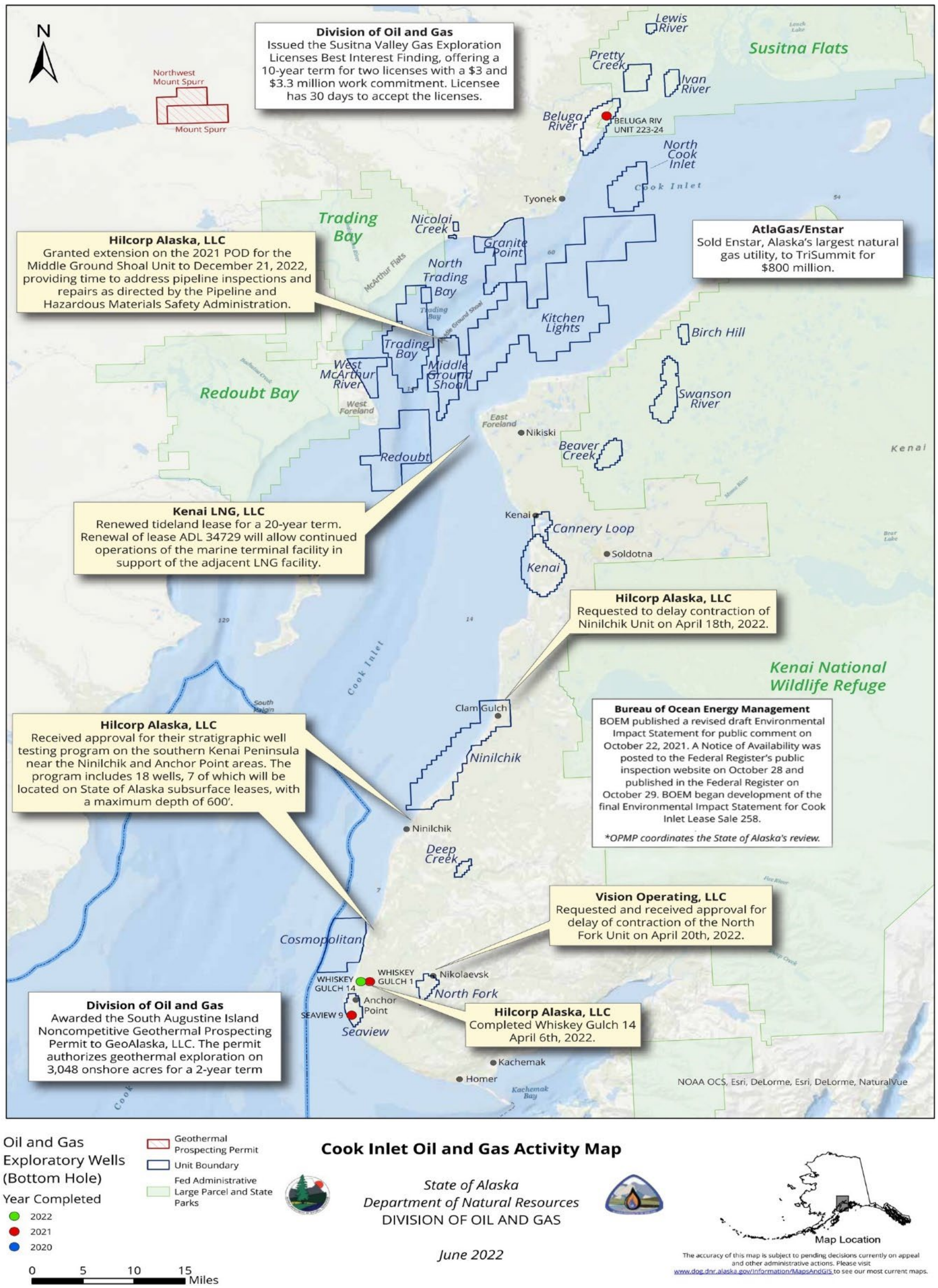
Boat traffic is the main source of disturbance to sea otters (Service 2013a), and Cook Inlet is a regional hub of marine transportation throughout the year. Vessel types include cargo ships, tankers, tugs, cruise ships, commercial fishing boats, and research vessels. According to a 2012 study of vessel traffic in Cook Inlet, most vessel traffic moves along north-south transit lines, with deep-draft vessels generally using the east side of the inlet (Cape International Inc. 2012) (Figure 11). In general, sea otters along the western shorelines of lower Cook Inlet are exposed to lower levels of boat traffic. Also, otter populations have thrived in areas with much greater volumes of boat traffic, as noted in the recovery plan (Service 2013a).

Because of the large volume of vessel traffic in Cook Inlet, sea otters may be exposed to petroleum from spills (Nuka 2013). Sea otters are particularly vulnerable to spills because of the risks from: 1) fouling of their highly insulative fur; 2) toxicity of oil ingested during grooming; 3) ingestion of toxic hydrocarbons stored in benthic invertebrate prey; and 4) the fact that they often form large aggregations, creating the potential for large numbers of animals to be exposed to the effects of a spill for reasons described in section 0. The recovery plan rates spills as a moderate threat to recovery of the Kodiak, Kamishak, Alaska Peninsula MU of northern sea otter.

5.2.2.3 Coastal Development

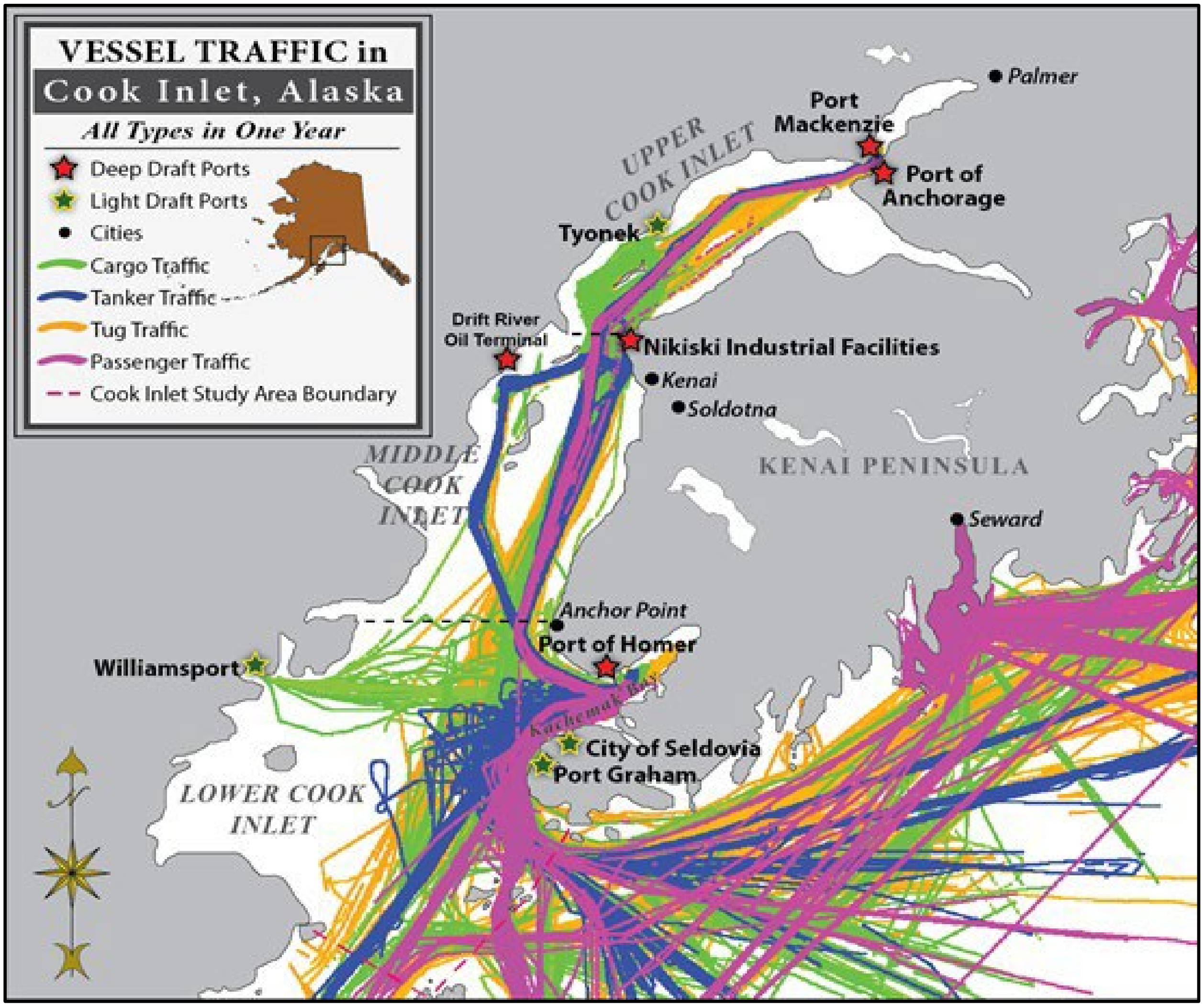
Nearly two-thirds of the Alaskan human population (approximately 470,000 residents) live within southcentral Alaska or the Cook Inlet region. As the site of Alaska's largest city, Anchorage, and other coastal urban hubs, many areas of Cook Inlet (particularly the Upper Inlet and Kenai Peninsula) are well developed. Continued development, especially adjacent to existing infrastructure, is expected. The majority of existing infrastructure and planned construction is concentrated around urban areas, particularly outside of the Action Area in upper Cook Inlet.

In general, coastal development activities in the Action Area broadly include dredging; hard rock quarrying; laying of electrical, communication, or fluid lines; construction of docks, bridges, breakwaters, or other structures; road construction from highway improvement projects; and other activities. Specific development projects in Cook Inlet include dredging for the Anchorage Port Modernization Project (Port of Anchorage 2022), pile driving (e.g., at the Port of Anchorage, Ship Creek boat launch, Port MacKenzie, and several small projects in the



Note: Modified from ADNR 2021; excerpted from BOEM 2022a.

Figure 10 Location of Active Oil and Gas Units in the Cook Inlet Region



Cape International, Inc. 2012

Figure 11 Cook Inlet Vessel Traffic by Vessel Type

Kachemak Bay area), port repair and maintenance (Port MacKenzie), and coastal projects linked to oil and gas development, including the Alaska LNG Project (Alaska LNG 2022). These and other projects are described in depth in section 3.2 of the FEIS (BOEM 2022b).

5.2.2.4 Mining

Several mining projects have been proposed for the Action Area. Of these, only the Diamond Point Granite Rock Quarry has undergone section 7 consultation and is therefore addressed here. In 2012, Diamond Point, LLC proposed to develop a granite quarry at Diamond Point, located on the west side of Cook Inlet at the convergence of Cottonwood and Iliamna Bays. The plan included extensive modification of the shoreline to construct a staging area and dock facility

(Service 2012). The project is not currently in active construction. The U.S. Army Corps of Engineers (USACE) initiated, and completed, ESA section 7 consultation for Steller's eiders, the Southwest Alaska DPS of northern sea otter, and northern sea otter critical habitat. A Service Biological Opinion found that the proposed activities resulting from Diamond Point mine would not jeopardize the Southwest Alaska DPS of northern sea otter or result in adverse modification of critical habitat, and determined that the proposed project was not likely to result in the taking of Steller's eiders or sea otters. (Service 2012).

5.2.2.5 Fisheries

Federal and State-directed commercial fisheries as well as recreational and subsistence fisheries for shellfish, groundfish, herring, and salmon have occurred and continue to occur in the Action Area. These activities are described in detail in sections 4.10 to 4.14 of the FEIS (BOEM 2022b). Although some commercial fisheries operate year-round (e.g., clamming), others such as gillnet fisheries targeting various salmon species, are highly seasonal and occur mainly during June, July, and August. Varying harvest techniques, based on target species, are used within the commercial fishery including pot fishing (shellfish), dredging (scallops, clams), gillnets and purse seines (herring, salmon), trawls (groundfish), and longlines (groundfish). Vessels used during the harvest range from small inland vessels to large ocean-going vessels, depending on the location of the fishery and weather conditions.

5.2.2.6 Scientific Research

The lands and waters of the Action Area have a long history of research activities, from early ecological exploration to quantitative evaluations of aquatic biodiversity. Research activities include: aerial and boat-based wildlife surveys conducted by wildlife and land management agencies and by private entities (e.g., Pebble Limited Partnership marine wildlife baseline data collection (ABR Inc. 2011); onshore and offshore seismic and offshore hydrographic data collection by management agencies (e.g., NOAA 2013); and environmental and socioeconomic data collection funded by BOEM. Research activities normally include close approach by vessel and aircraft for line-transect surveys, behavioral observation, attachment of scientific instruments (tagging), and live capture for health assessments.

5.2.2.7 Wastewater Discharges and Run-Off

Wastewater discharges into State waters are regulated through the Alaska Pollutant Discharge Elimination System (APDES) program administered by the Alaska Department of Environmental Conservation (ADEC). The APDES is Alaska's implementation of EPA's National Pollutant Discharge Elimination System Permit (NPDES) program (ADEC 2012).

Wastewater discharges into Federal OCS waters in Cook Inlet must be authorized by, and comply with, a NPDES permit. Oil and gas discharges must be described in an EP or DPP prior to approval.

Non-point sources of pollution include stormwater and snowmelt that runs over land or through the ground, entraining pollutants and depositing them into the Inlet. The Cook Inlet watershed is home to two-thirds of Alaska's population; therefore, the quality of runoff in the watershed is heavily influenced by human activity. The most common forms of pollution in Alaska's urban runoff include fecal coliform, sedimentation, and petroleum. Snow disposal into the marine environment also introduces oil, grease, antifreeze, deicers, other chemicals, trash, animal waste, salt, and sediments (e.g., sand, gravel, suspended and dissolved solids). Non-point source management programs under Section 319 of the Clean Water Act (CWA) regulate these pollutant sources. The U.S. Environmental Protection Agency (USEPA) and NOAA co-administer the state Coastal Non-Point Pollution Control Programs under Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (NOAA 1993).

Currently, the treated municipal wastes of 10 communities are being discharged into Cook Inlet waters. Levels of treatment of these wastewaters range from primary (only materials easily collected from the wastewater (i.e., oils, fats, greases, sand, gravel, rocks, human waste) are removed), to secondary (further treated to substantially degrade the biological content of the discharge), to tertiary (employing additional technologies to increase quality of discharge). Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria, viruses, and other emerging pollutants of concern (e.g., endocrine disruptors [substances that interfere with the functions of hormones], pharmaceuticals, personal care products, and prions [proteins that may cause an infection]).

6 EFFECTS OF THE ACTION

In accordance with 50 CFR 402.02, effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of all other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see §402.17).

This section of the biological opinion analyzes the direct and indirect effects of the proposed action on listed Alaska-breeding Steller's eiders, the Southwest Alaska DPS of northern sea otter, and critical habitat for the Southwest Alaska DPS of northern sea otter. We describe anticipated effects of the first incremental step and future incremental steps of BOEM LS258 for each species and for critical habitat of the Southwest Alaska DPS of northern sea otter.

6.1 Effects of the Action on Alaska-Breeding Steller's Eiders

6.1.1 First Incremental Step

The first incremental step includes all activities associated with exploration and delineation of O&G resources on leases issued through LS 258, as described in section 2.2. These activities include seismic surveys, geophysical and geotechnical surveys, exploration and delineation drilling, transportation, and oil spill response drills and are expected to occur in the first five years.

6.1.1.1 *Habitat Loss*

Permanent structures in high-quality habitats could affect Steller's eiders by rendering those habitats permanently unsuitable and relegating birds to lower quality habitats. The first incremental step encompasses all activities associated with exploration and delineation drilling over the first five years of the lease sale. During this period, a total of up to eight exploration and delineation wells would be drilled, tested, and plugged from a single drilling rig. These exploratory wells would be the only permanent structures placed in the marine environment. The total area disturbed would depend on rig design however past research estimate each set up of a jack-up rig disturbs approximately one hectare of seafloor (BOEM 2012). Exploratory wells would have a small footprint compared to the extent of available marine habitat in Cook Inlet and in the non-breeding range for Steller's eiders.

Wintering Steller's eiders usually inhabit nearshore shallow waters within the 20-meter depth contour (Larned 2006), although individual birds have been recorded up to 19.5 km from shore (Martin et al. 2015). Most of the first incremental step activities occur at least 4.8 km from the nearest shoreline. This is generally outside the range of wintering eiders, except for in the eastern-most lease blocks between Ninilchik and Anchor Point where eiders regularly occur between the shore and just beyond the 20-meter depth contour at approximately 10 km from shore (Larned 2006). Lease sale activities resulting in a change to, or loss of habitat are unlikely to have detrimental effects on Steller's eiders because much of the project occurs outside of their preferred habitat.

The Service expects effects of permanent foraging habitat loss on listed Steller's eiders in the marine environment would be minor because of the low quantity of permanent structures and because much of the lease sale activities occur outside of the preferred range of wintering eiders.

6.1.1.2 *Disturbance*

6.1.1.2.1 Vessel and aircraft traffic

Aircraft and vessel operations could disturb listed Steller's eiders as they migrate, forage, or molt. Traffic disturbance could cause eiders to fly away from preferred foraging and resting sites, thereby disrupting foraging or resting periods. Disturbance of sufficient frequency, duration, or severity could lower individual fitness through increased time spent in flight and reduced time spent feeding or resting.

The maximum vessel traffic associated with the first incremental step is two trips per week to a drilling rig, plus activity associated with up to three oil spill response drills per year, and vessel activity for seismic survey vessels (see Table 2-3 of BOEM 2022a). Vessels could cause periodic disturbance of eider behavior, but the extent would be limited by the brief duration of exposure and relatively low number of vessel trips. Steller's eiders show variable degrees of tolerance to vessel traffic, as document by ABR Inc. (2013) on Alaska's North Slope. Ward et al. (1994) investigated response of wintering waterfowl to boat traffic and found Steller's eiders flushed when boats came within 300 meters. Despite this, it is known that Steller's eiders commonly overwinter in areas of high vessel traffic near Homer. Lastly, eiders undergo a flightless molt during which they can be more vulnerable to vessel traffic. Steller's eiders are not known to molt on the east side of Cook Inlet where the majority of vessel traffic would be based, so the risk of disturbance during this vulnerable life phase is somewhat reduced.

The BOEM commits to mitigation from vessel disturbance for marine mammals through measures such as: maintain maximum distances, change direction, change speeds, avoid group of marine mammals. We expect some measures implemented to protect otters will also provide benefit to eiders. To minimize impacts to nesting seabirds, the BOEM states vessels travelling greater than 5 knots shall not approach within 1.8 nautical kilometers of seabird colonies (BOEM 2022b). No specific disturbance mitigation for vessels is proposed for Steller's eiders. Slowing vessels for nesting seabirds may indirectly benefit Steller's eiders, but Steller's eiders do not nest in the action area and are more likely to occur as rafts of birds on the water. Not all potential effects to eider will be mitigated absent species specific measures.

Aircraft traffic could disturb Steller's eiders along the eastern shore of Cook Inlet near the likely shore bases between Nikiski and Homer. Aircraft traffic during the first incremental step could include 1 survey aircraft, 7 to 14 helicopter trips per week during exploration and delineation drilling (years 3 to 5), and air traffic for government-initiated oil spill response exercises. Most birds would react and move away from approaching aircraft and, while avoiding direct harm, could be temporarily displaced from foraging or resting areas. This could result in lost foraging opportunities and/or energetic costs from repeatedly moving away from disturbances. While specific information regarding listed Steller's eiders response to aircraft disturbance in the marine environment is lacking, we expect they would exhibit a similar response to king eiders (*Somateria spectabilis*). King eiders in western Greenland dove when survey aircraft approached (Mosbech and Boertmann 1999). Bird response varied with time of day and increased as aircraft elevation decreased. Over 50 percent of birds remained submerged until after the aircraft passed. Although some birds may be temporarily displaced, it is unlikely that the relatively small number of helicopter trips and minimal airplane flights during the first incremental step would disturb substantial numbers of the listed population of Steller's eiders.

The BOEM will require support aircraft to avoid extended flights over the coastline to minimize effects on marine mammals and birds (BOEM 2022a). The BOEM also proposes that aircraft shall avoid approaching withing 1.8 nautical kilometers of any seabird colony April 15 through August 31 (BOEM 2022b). In addition, the aircraft will maintain an altitude of at least 610 m when flying over seabird colonies (BOEM 2022b). These measures may indirectly benefit eiders in the area. However, without minimum aircraft flight heights prescribed for bird rafts, which may include Steller's eiders, aircraft could fly at a low enough elevation to cause disturbance to eiders.

The effects of disturbance from vessel and helicopter traffic would likely be minor and/or temporary because of the brief duration of the disturbance and relatively low level of traffic expected in the first incremental step.

6.1.1.3 Seismic Survey Noise

Steller's eiders in the action area may be disturbed by noise from seismic surveys, however little is known about avian behavioral response to seismic acoustics. In a study of long-tailed ducks (*Clangula hyemalis*) in the Beaufort Sea, Lacroix et al. (2003) found no significant difference in numbers of ducks in an area before and after seismic survey work. In some survey areas, long-tailed ducks were observed to diver more frequently in disturbed areas, but the cause (vessel seismic acoustic source) was unclear. A more recent study of African Penguins (*Spheniscus demersus)* found that the birds moved to areas significantly away from the survey vessel and away from preferred foraging locations during surveys but that the birds reverted to normal behavior soon after (Pichegru et al. 2017).

Eiders foraging in the water column or on the seafloor could be exposed to underwater seismic noise. It is conceivable that birds could be near enough to marine seismic or geohazard survey sound sources to be injured by a pulse, although the threshold for physiological damage for marine birds is unknown. However seismic vessels move slowly, and sound is required to ramp up as seismic activities begin. Steller's eiders would likely depart the area prior to injury.

Seismic survey typically requires only a single pass over so repeated disturbance to eiders at a particular location would not be expected. Potential effects are further reduced because the timing of seismic surveys is limited between April 2 and October 31 when eiders are not at peak abundance in Cook Inlet, and few are expected to be in the area.

The BOEM will watch for ESA-listed species during activities that generate high levels of noise, such as seismic surveys. Mitigation proposed includes PSOs and specifies sighting information and exclusion and safety zones for marine mammals. However, inexperienced observers might not be able to quickly or accurately identify eiders, resulting in the potential for birds to be in the disturbance zone when activities occur. Noise source shutdowns in the presence of Steller's eiders is not specified as a mitigation measure.

While seismic airguns have the potential to alter the availability of invertebrate food sources, Vella et al. (2001) concluded that there are generally few behavioral or physiological effects unless the organisms are very close (within meters) to a powerful noise source. Consequently, noises from seismic airguns are not likely to decrease the availability of eider prey sources.

6.1.1.3.1 Spill Response

Disturbance associated with cleanup activities, including capturing oiled birds, could further stress birds already compromised by contact with oil. Hazing birds away from oiled areas may reduce the number of individuals contacting spilled oil. We expect that the potential effects from cleanup activities on listed eiders would increase with increasing spill volume and oil persistence. While a few individuals could experience disturbance, we would not expect population-level effects to occur from oil spill response efforts.

6.1.1.4 Collisions and disorientation

Migratory birds suffer considerable mortality from collisions with man-made structures (Manville 2004). Birds involved in collisions with man-made structures may also experience severe injuries, such as concussions, internal hemorrhaging, and broken bones. Birds are particularly at risk of collisions when visibility is impaired by darkness or inclement weather (Weir 1976). Most collisions are likely to involve one or two birds, but "bird storms" have been documented to occur when vessels use bright lights during inclement nighttime weather. The actual number of birds injured and killed through collisions is likely higher than reported; many injured and killed birds are believed to go unreported or become scavenged before humans detect them. Steller's eiders have a high collision risk because of their tendency to fly low and fast over the water (Day et al. 2003, 2004). For further discussion of collisions, refer to the *Status of the Species* section. Refer to BOEM LS258 BA for a table of reported Steller's eiders collisions with structures and vessels (Table 5-1).

6.1.1.4.1 Collisions With Aircraft

As discussed in 5.1.1.2, aircraft traffic is expected to be low in the first incremental step. Support aircraft are typically required to operate within specific height parameters to minimize effects on birds in nearshore waters or the coastline (BOEM 2022). Steller's eiders are known to fly low to the ground (8 to 28 meters) above the ground/sea level) and fast over water and shoreline (Alerstam and Gudmundsson 1999; Petersen and Savard 2015). It is unlikely that collisions with aircraft, which travel at much higher altitudes, would occur. However, should a collision occur, it would likely result in injury or death.

The BOEM will require support aircraft to avoid extended flights over the coastline to minimize effects on marine mammals and birds. The BOEM also proposes that aircraft shall avoid approaching within 1.8 nautical kilometers of any seabird colony from April 15 through August 31 (BOEM 2022b). In addition, the aircraft will maintain an altitude of at least 610 m when flying over seabird colonies (BOEM 2022b). These measures will reduce the likelihood of collisions with eiders however collisions could still occur.

6.1.1.4.2 Collisions with vessels

Bird species, including *Somateria* spp., are attracted to offshore vessels and may circle or even ground on the vessel. It is thought that this is due primarily to light attraction at night and associated disorientation (Black 2005; Merkel and Johansen 2011; Montevecchi 2006; Ronconi et al. 2015). Vessel collisions with Steller's eiders are known to occur. Over 150 Steller's eiders were reported to have collided with the *M/V Northern Endeavor* in December 1960 in False Pass when the vessel's crab lights were illuminated on a stormy night. Flock size, as well as flight height and speed, can increase the number of eiders killed or injured during a single event. Like other species of eiders, Steller's eiders are known to fly low and fast over water (as discussed in *Status of the Species*). Steller's eider collisions with vessels have occurred historically and are likely to occur, however the chance is somewhat reduced by the relatively low number of vessel trips expected in the first incremental step. Such collisions can result in injury or death. Injuries can be temporary, such as disorientation, or more severe, such as broken wings. Some eiders have recovered following a collision, flying away from the vessel after a resting. Other cases have required veterinary attention. And in some instances, injuries can be significant enough to warrant euthanasia. Any collisions which occur are likely to be fatal.

Eider movement increases by up to 175 percent at night (Gall et al. 2003). Day et al. (2004) concur movement rates increase at night, especially during good visibility and frequently increase with nocturnal tailwinds. The risk of bright lights at night, especially during inclement weather, increases risk of collision and mortality events. The light increases the risk of birds colliding with vessel gear or rigging, which is difficult to see at night. Weather patterns may reduce visibility and the lower cloud ceiling may enhances lighting affect where birds tend to fly at lower altitudes (Service 2021).

In other similar projects involving vessels, action agencies have committed to recommending vessel operators minimize use of external lighting at night, minimize the use of sodium lighting and other high-wattage light sources, and angle lights downward toward the surface of the water to reduce eider attraction (Service 2021). However, it is unclear how often such measures might be voluntarily implemented. The BOEM has stated that a lighting plan should be developed in cooperation with the Service (BOEM 2022b), however BOEM has not explicitly required implementation of such measures as part of the lease sale. As a result, we expect future bird strikes with vessels to occur, resulting in death or injury to Steller's eiders.

6.1.1.4.3 Collisions During Exploratory Drilling

Steller's eiders may also be attracted to and collide with lighted drilling rigs. In a study of avian interactions with offshore oil platforms in the Gulf of Mexico, collision events were more common, and more severe (i.e., the number of collision incidents increased) during poor weather (Russell 2005). There is also evidence that lights on structures, particularly red steady-state lights, result in disorientation which increases collision risk (Reed et al. 1985, Russell 2005, Manville 2000). The more abundant common eider and king eider have been shown to be at relatively high risk of collision, often as flocks, with offshore oil infrastructure and vessels in northern waters. Common eiders are among the North Sea species placed in the "high-risk" category because they show prolonged circling behavior at platform lights and are found dead on platforms (Bruinzeel et al. 2009). Common eiders also composed 95 percent of the species that struck vessel off western Greenland over three winter seasons (Merkel and Johansen 2011).

Similarities in habits among eider species, particularly flying fast and low above the water surface, indicate that Steller's eiders are also vulnerable to collisions (Day et al. 2005; Greer et al. 2010).

Collisions with exploratory drilling rigs or mobile offshore drilling units are likely to occur. Lighting could cause disorientation, which further increases collision risk (Black 2005; Longcore et al. 2008; Service 2021). Collisions with rigs, platforms, vessels, and other oil infrastructure could cause injury and/or mortality of listed Steller's eiders. The BOEM has stated that a lighting plan should be developed in cooperation with the Service (BOEM 2022b), however BOEM has not explicitly required implementation of any such measures as part of the lease sale. Without commitment of mitigation measures to reduce collisions, Steller's eider collisions with MODUs are relatively likely to occur.

6.1.1.4.4 Summary of collisions

Steller's eiders are susceptible to attraction and collision risk from aircraft, vessels, and lighted drilling rigs. Given the sensitivity of the species to vessel and structure attraction, some injury or mortality of Steller's eiders is expected. The action area overlaps with a relatively small portion of Pacific wintering habitat for the listed Steller's eiders and the majority of project activities occur outside of the nearshore preferred habitat for the species. We expect few listed eiders to be killed or injured by collisions with vessels.

6.1.1.5 Pollution from discharges into the marine environment *Authorized discharges*

Discharge of drilling muds and cuttings, sanitary and domestic waste, desalination unit brine, cooling water, bilge and ballast water, and other miscellaneous discharges may occur during the first incremental step. A plume of turbid water can be expected to extend up to several kilometers down current from each wellsite during drilling. Dispersion to background levels may require several minutes to several hours. The strong tidal current in Cook Inlet would disperse most drilling muds and other discharge into the water column, dilute them rapidly, and then would settle as a thin layer over a large area of the seafloor (FEIS Section 4.4). Benthic impacts including burial and smothering are most likely to occur within an area of 0.78 km^2 per well site.

Exploratory or delineation drilling could increase the turbidity of waters in Cook Inlet. For example, BOEM and BSEE noted changes in species composition, abundance, or biomass of benthic biota were generally detected at distances of 50 m to 500 m from well sites. These biological effects can be attributed to chemical toxicity of discharges, organic enrichment, and deposition of fine particles in drilling wastes (Hurley and Ellis 2004 in MMS 2008). While the recovery of benthic communities was generally documented within 1 year of completion of the well, a decrease in benthic invertebrate species richness and abundance could occur at a distance of 50 m for up to 2 years after exploratory drilling ceased (Hurley and Ellis 2004 in MMS 2008). This change in conditions could alter the ability of listed eiders to forage effectively, especially for benthic prey. These discharges could also impact listed eiders through contamination of individual birds or important benthic feeding habitats.

Only a small proportion of available benthic foraging habitat is expected to be impacted by authorized discharges. Compared to the available benthic foraging habitat, these effects Steller's eiders and their prey availability would be negligible or minor. In addition, authorized discharges are regulated by the Environmental Protection Agency and future permits are subject to ESA Section 7 consultation, which would require avoidance and minimization of impacts to listed Steller's eiders.

6.1.1.5.1 Small oil spills

The BOEM estimates that up to approximately six small, refined oil spills ranging in size from less than 1 bbl up to 50 bbl per spill are reasonably foreseeable during the first incremental step. The BOEM does not expect large oil spills to occur during the first incremental step (for further discussion, see *Description of the Action*). Steller's eiders have been exposed to oil in Alaska harbors and oil was determined to be toxic to the species (Service 2015). The impacts of oil exposure on listed eiders depends on the volume, location, and timing of a spill, as well as the severity of exposure. Impacts to individual birds from contact with oil may include fouling of feathers, ingestion, skin irritation, respiratory effects from vapors, and others.

Waterfowl that contact even small amounts of oil may lose the hydrophobic, insulative properties of their feathers and suffer impaired thermoregulation. These birds may become wet, hypothermic, or potentially drown (Jenssen 1994), particularly if the oil exposure occurs in cold environments (Piatt et al. 1990). Birds exposed to oil may also suffer reduced reproductive success. Mortality of embryos and nestlings has been documented by exposure to small amounts of hydrocarbons (light fuel oil, crude oil, or weathered oil) transferred to offspring by adults with lightly oiled plumage (Szaro et al. 1980, Parnell et al. 1984, Hoffman 1990, and Stubblefield et al. 1995). Furthermore, birds that ingest oil during normal foraging or preening behaviors may experience toxicological effects including gastrointestinal irritation, pneumonia, dehydration, red blood cell damage, impaired osmoregulation, immune system suppression, hormonal imbalance, inhibited reproduction, retarded growth, and abnormal parental behavior (Hartung and Hunt 1966, Epply 1992, Fowler et al. 1995, Briggs et al. 1997, and Albers 2003). Birds also bioaccumulate hydrocarbons and are vulnerable to both acute and sub lethal effects from contaminated food supplies (Albers 2003).

While Steller's eiders are vulnerable to the effects of oil spills, we expect few listed eiders to encounter oil from actions during the first incremental step because: 1) spills are expected to occur infrequently and be of low volumes, 2) Steller's eider density in Cook Inlet and the action area is relatively low, and 3) small spills are expected to be contained or weather quickly.

Therefore, although the effects of small-volume oil spill on listed eiders would depend on the location, timing of the spill, and the success of recovery efforts, small spills are expected to only affect a few, if any, individuals.

6.1.1.6 Summary of the first incremental step

The proposed action would adversely affect Steller's eiders through habitat loss, disturbance, collisions, and pollution from discharges into the marine environment. We anticipate most activities would impact few eiders and result in only minor, temporary changes in eider behavior or habitat. Collisions with vessels and structures are the most likely cause of eider injury or mortality during the first incremental step. Collisions would likely include few birds; however larger bird strikes with flocks are possible. The potential impacts of BOEM's proposed actions on Steller's eiders and their recovery would likely be negligible given the relatively few Steller's eiders using Cook Inlet as wintering habitat. Thus, the overall effect to the listed population would be low.

6.1.2 Future Incremental Steps

Future Incremental Steps include all development, production, and decommissioning activities associated with Lease Sale 258, as described in section 2.2.2 and summarized in Table 2-4.

6.1.2.1 Habitat loss

Human structures in high-quality habitat might affect Steller's eider by rendering those habitats permanently unsuitable and relegating birds to lower quality habitats. The future incremental steps include all development, production, and decommissioning activities associated with LS258. Activities which could result in habitat loss include installation of one to six production platforms, offshore pipeline, and onshore pipeline. Each production platform would have a footprint of 0.057 hectare of seafloor. Offshore oil pipeline would have a maximum footprint of 294.6 hectares (Table 2-7 in BOEM 2022). There would also be a maximum of 119 hectares of onshore oil and gas pipeline; however, Steller's eiders primarily utilize the marine environment when overwintering and changes to the terrestrial habitat are not expected to impact eiders. The landfalls, or transition from offshore to onshore pipeline, would likely be sited where there are bluffs and would not cross shallow mud flats (Alaska LNG 2022).

In total, the future incremental steps would result in maximum loss of approximately 294.9 hectares of marine habitat. Compared to the amount of available habitat for Steller's eiders both across their winter range and in Cook Inlet, this amount of habitat loss would have minor, if any, effects on listed Steller's eiders. Additionally, Steller's eiders typically occupy the nearshore environment, and the majority of this habitat loss would occur outside their preferred habitat in Cook Inlet. Removal of wellhead equipment, well plugging, and other decommissioning activities would further reduce permanent effects to eider habitat.

6.1.2.2 Disturbance Vessel and aircraft traffic

Disturbance from vessel and aircraft traffic has the potential to alter Steller's eiders behavior, potentially with energetic costs (see 6.1.1.2 for further discussion). Like in the first incremental step, many of the routine traffic activities would occur at least 4.8 km from the nearest shoreline and beyond the typical wintering habitat for Steller's eiders in the action area, except in the easternmost blocks. Vessel and air traffic would be year-round and therefore would occur in the winter months when Steller's eiders are the most abundant in Cook Inlet. The level of disturbance from vessels and aircraft is expected to be higher during the future incremental steps because the level of traffic is expected to be higher during the development years and the duration of the future incremental steps is longer. The BOEM estimates the maximum vessel traffic would be up to 42 vessel trips would be made per week during years 7 through 19 to support platform installation. After year 19, vessel supply trips would decrease. A maximum of 42 flights would occur per week, year-round, during peak development, production, and decommissioning phases.

Steller's eider disturbance due to traffic is likely to occur in the future incremental steps. Displacement of eiders by vessel and air traffic would likely be brief and temporary, but because the traffic could occur for up to 40 years there are likely to be adverse impacts to some listed Steller's eiders.

6.1.2.2.1 Development and production activities

Disturbance of Steller's eiders is likely to occur during installation of production platforms, pipelines, drilling, waste disposal, and facility construction. This may include flushing and displacement at some energetic cost to individual birds. The disturbance due to these activities would be localized to the approximately 294.9 hectares that may developed and not the whole lease area, thus we expect development and production activities to impact few listed Steller's eiders.

6.1.2.2.2 Spill response

The disturbance due to spill response activities would mirror those in the first incremental step and scale with spill volume. We would not expect population-level effects to occur as a result of spill response efforts alone.

6.1.2.3 Collisions and disorientation Air traffic

Future incremental steps may include a maximum of 42 flights to occur per week, year-round during peak development. As stated in 6.1.1.3, support aircraft are typically required to operate within specific height parameters to minimize effects on birds. Steller's eiders will most typically be found flying fast and low across the water which is outside the expected path of air traffic. Thus, it is unlikely that collisions with aircraft would occur.

6.1.2.3.1 Vessel traffic

The maximum vessel traffic during the future incremental steps would be up to 42 vessel trips per week during years 7 through 19 to support platform installation and persist at a lower level through the completion of decommissioning. The risk of collisions with vessels is expected to be higher than the first incremental step because the future incremental steps would have more traffic and this traffic would occur over a longer time. Stochastic events involving large flocks of Steller's eider with vessels have historically occurred on wintering grounds (further discussion in *Threats* and *6.1.1.3*). It is therefore possible the vessels will affect, and likely adversely effect, one or more individuals of the listed population during future incremental steps.

6.1.2.3.2 Production platforms

Up to six production platforms would be installed during the first incremental step. These platforms maintain navigational lighting in accordance with U.S. Coast Guard requirements which may act as an attractant to migratory birds such as Steller's eiders. The collision risk with these platforms is similar to the risk expected during the drilling of exploration and delineation wells in the first incremental step. However, these production platforms will also include gas flaring booms which are typically placed at the highest point on the structure. Some bird species, potentially including eiders, are attracted to and disoriented by the bright lights of gas flares from production platforms. This can result in circling, energy depletion, and mortality (Greer et al. 2010; Day et al. 2005).

The amount of eider disorientation and collisions with these platforms is expected to be larger than with the exploration wells of the first incremental step because they will be in place for decades and have the additional potential attraction of gas flares. The persistent, year-round, lighted presence of the platforms is expected to cause attraction and collisions of Steller's eiders. The likelihood of occurrence of these random events, such as large flock entrapment, increases with time.

6.1.2.3.3 Summary of collisions

Steller's eiders are likely to suffer injuries or death due to collisions with vessel and production platforms. There are numerous unknowns that will dictate the risk level, such as proximity of production platforms to shore, the quantity of platforms installed, and the length of time between each platform's installation and decommissioning.

6.1.2.4 Pollution from discharges into the marine environment

6.1.2.4.1 Cuttings, production fluids, and waste

Toxic contamination of Steller's eiders from disposal of drilling and cuttings could occur. The BOEM expects production and development cuttings and fluids to be reused, reinjected, or barge to shore for onshore disposal. Water-based drilling fluids and cutting could be discharged under in accordance with the Clean Water Act and this would require additional ESA-consultation.

Since most waste products would be transported out of the marine environment, we expect minimal effects to listed Steller's eiders.

6.1.2.4.2 Small spills

The BOEM approximates that approximately 405 small spills of refined and crude or condensate oil are reasonably foreseeable during future incremental steps. Many of these small, refined spills would be expected to evaporate and disperse in offshore waters without reaching nearshore waters or shorelines inhabited by Steller's eiders. In the event of a small spill reaching nearshore waters, it is likely that a relatively small number of individuals would be affected. Further discussion of oil contacting eiders can be found in *6.1.1.4.* Based on BOEM's oil spill risk analysis, the low volume and small area expected to be impacted by small spills and the sparse distribution of listed eiders over much of the action area, we anticipate adverse impacts to few listed eiders from small oil spills.

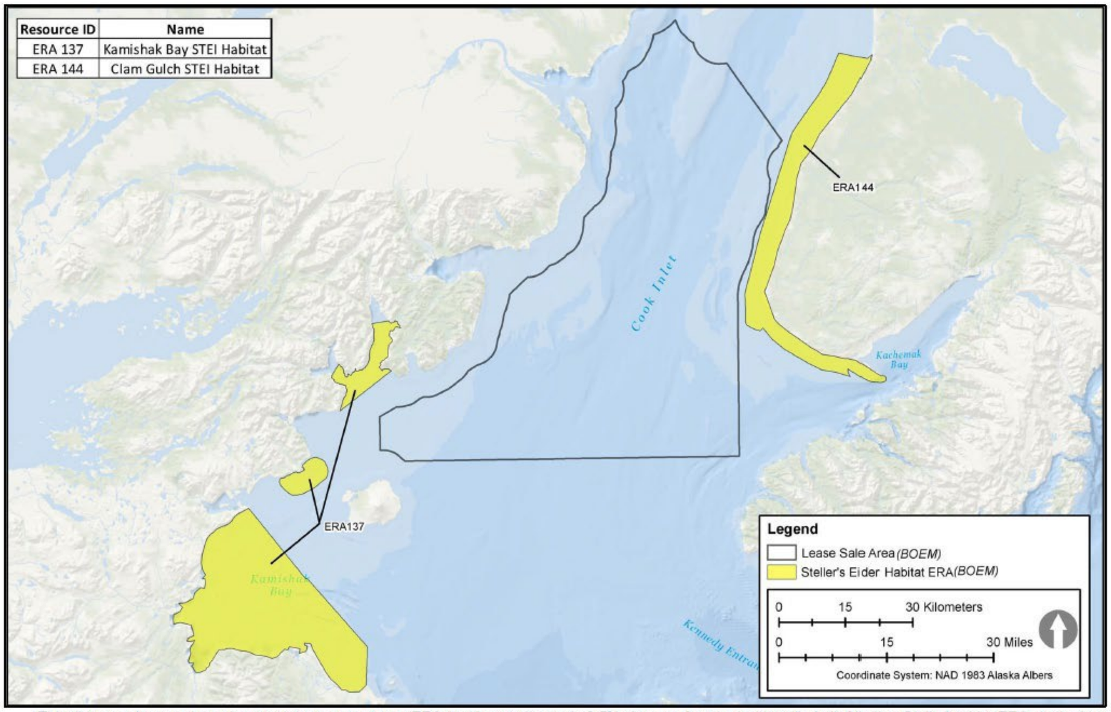
6.1.2.4.3 Large spills

The BOEM estimates there is a 19 percent chance of a large spill (greater than 1,000 bbl) occurring from platforms or pipelines during the future incremental steps. The potential effects of an oil spill would depend on factors such as the season of the spill, location of spill, proximity to bird habitat and bird congregations, oil type, and spill volume.

To analyze potential effects, BOEM assumes that one large spill may occur, with a spill size of 3,800 bbl. They then identified seven Environmental Resource Areas (ERAs) with known environmental resources for Steller's eiders and estimated the likelihood of these areas being contacted by a large spill. Of the seven, only two ERAs had a greater than one percent chance of being contacted by oil: Kamishak Bay (9 to 29 percent) and Clam Gulch (less than 0.5 to 23 percent; Figure 12).

The BOEM then analyzed the combined probability that a large oil spill would occur (19 percent), this spill would occur during the time of year eiders are present in the ERAs, and that no effective cleanup efforts would occur. Only two of the seven ERAs have combined probabilities of 1 percent or greater that oil spills and contacts a geographic area important to Steller's eiders. Assuming the life of the action is 40 years, the probability of one or more large spill of 3,800 bbls contacting Kamishak Bay within 30 days is 2 percent and Clam Gulch is 1 percent. For all other Steller's eiders ERAs, the combined probabilities are less than 0.5 percent.

The oil spill analysis by BOEM demonstrates the relatively low likelihood of a large oil spill occurring and affecting Steller's eiders or their habitat. However, while unlikely, it is still possible for a large spill to contact Steller's eiders habitat and injure or kill birds. As discussed for small oil spills in effects of the first incremental step, contact with oil may cause fouling of feathers, oil ingestion, skin irritation, respiratory effects from vapors, and other health concerns for birds. Oil may also cause trophic level effects because prey macroinvertebrates could uptake and accumulate hydrocarbons. Thus, in the event of an oil spill, eiders may ingest oil via prey resources or temporarily lose important prey resource areas.



NOTE: This diagram shows only environmental resource areas (ERAs) with an estimated ≥0.5% chance of contact with spilled oil. All other Steller's eider ERAs in the Lease Sale Area have conditional probabilities <0.5% for winter.

Note: BOEM 2022

Figure 12 Steller's Eider ERAs with a Greater than 0.5 Percent Chance of Contact with Spilled Oil

In addition, efforts to minimize the effects of large oil spills through cleanup operations could affect Steller's eiders through disturbance and displacement, which could in turn affect survival. Oil spill response may involve chemical dispersants which break oil into smaller particles in the water and make it less likely for birds to be coated in oil. Chemical dispersants may have some toxicity to birds (Jenssen 1994; Stephenson and Andrews 1997; Duerr et al. 2011).

A large oil spill in the action area would adversely affect Alaska-breeding Steller's eiders. The probability of a large oil spill is 19 percent and the probability of a large spill contacting important ERAs to eiders is 1 to 2 percent (combined probability). It is unlikely, yet possible, that the entire Cook Inlet overwintering eider population would be affected by a large oil spill. Therefore, while we expect some Steller's eider mortality in the case of a large oil spill, there is an overall low likelihood of oil spills affecting large quantities of eiders.

6.1.3 Summary of future incremental steps

Actions occurring during future incremental steps would adversely affect Steller's eiders but given the current status of the species and environmental baseline of the species (i.e., relatively few birds in the action area), there is a relatively low likelihood these adverse effects would cause population-level declines.

6.2 Effects of the Action on Southwest Alaska DPS of Northern Sea Otter

6.2.1 First Incremental Step

The first incremental step includes all activities associated with exploration and delineation of oil and gas resources on leases issued through LS 258, as described in the previous sections.

Disturbance to sea otters from support vessel and helicopter traffic from EDS activities and government-initiated oil spill response activities may occur during the First Incremental Step.

6.2.1.1 Disturbance

6.2.1.1.1 Vessel and Helicopter Traffic

Disturbance from vessel traffic associated with First Incremental Step activities is likely, particularly if EDS drill sites are located in OCS blocks overlapping with critical habitat within Cook Inlet (Figure 9). The potential for disturbance would be greatest during summer when sea otters are in open waters; during winter, protected bays and inshore waters are preferred and sea otters are less likely to be found in OCS waters. Because the likely shore bases are located on the eastern side of Cook Inlet, however, routine vessel traffic (e.g., resupply trips) would be unlikely to transit through the critical habitat that overlaps OCS blocks. Therefore, the potential for disturbance to the listed DPS of sea otters occurring in the eastern portion of sea otter habitat occupied by otters would likely affect few individuals. Helicopter traffic could also disturb listed sea otters, particularly if EDS drill sites are located in OCS blocks overlapping with otter critical habitat along the western side of Cook Inlet.

Disturbance would then likely be localized to jack-up drilling rigs. Disturbance from helicopters may be reduced through mitigation measures proposed by BOEM for maintaining operation at an altitude of 610 m or higher and to avoid extended flights over the coastline to minimize effects on marine mammals in nearshore waters or the coastline (BOEM 2022a). The potential for disturbance to sea otters from helicopter support vessels is unlikely, although a few individuals may be affected.

Collisions between sea otters and vessels (both slow and fast-moving vessels) do occur but are considered infrequent (Service 2012). Collisions between listed otters and vessels associated with the First Incremental Step are also considered unlikely because of the limited vessel traffic resulting from the Proposed Action in the range of the listed DPS on the western side of Cook Inlet. In addition, otters are primarily in the nearshore areas of the Action Area where vessels from this activity are less likely to transit.

We expect a low level of disturbance and a small number of collisions, at most, caused by vessel and helicopter traffic associated with the First Incremental Step, based on the low number of helicopter and vessel trips expected in the few OCS blocks overlapping with otter critical habitat and habitats occupied by sea otters.

6.2.1.1.2 Seismic Survey Noise

Seismic surveys are assumed to occur during the first incremental step. These include one 3D marine seismic survey and up to four geohazard and geotechnical surveys (Table 2). Individual surveys may last for days to weeks and are most likely to be conducted between April 2 to June 30 (or the start of gillnet season) and in October. Marine seismic surveys can cover broad areas, whereas geohazard (high-resolution) surveys typically focus on an individual block or small group of adjacent blocks.

Airguns are the typical acoustic sound source for 3D deep penetration seismic surveys. The sound source level (zero-to-peak) for airguns typically used in these marine seismic surveys ranges between 233 and 255 dB, with most of the energy emitted between 10 and 120 Hz. In a typical marine deep penetrating 3D seismic survey, the source vessel tows one to three source arrays of six to nine airguns each, depending on the survey design. Typical vessel speeds are 8.3 km per hour, and the source array is activated approximately every 10 to 15 seconds, depending on vessel speed. Airguns used during seismic surveys results in both vertical and horizontal sound propagation. Although there is variation in attenuation rates depending on bottom slope and composition, sound from airgun arrays can be detected using hydrophones at ranges of 50 to 75 km in water 25 to 50 m deep (Richardson et al. 1995).

Geohazard surveys use a suite of equipment including single beam and multibeam echosounders, side-scan sonar, subbottom profiler, bubble pulser, or boomer. Typical acoustic characteristics of these sources are summarized in Richardson et al. (1995) as follows:

- Echosounders: 180 to 200 dB between 12 and 60 kHz.
- Side scan sonar: 220 to 230 dB between 50 and 500 kHz.
- Subbottom profiler: 200 to 230 dB between 400 Hz and 30 kHz.
- Bubble pulser or boomer: 200 dB below 1 kHz.

The frequencies produced by airguns and other acoustic sources are within the hearing range of sea otters. Sea otters are similar to otariid pinnipeds with respect to amphibious hearing and also use sound in the same way (primarily for communication rather than feeding). Sea otters can detect air-born sounds in the range of 0.2 to 40 kHz and are most sensitive at 2 to 16 kHz (Ghoul and Reichmuth 2012, p. 2008). Their underwater hearing sensitivity is not as great as some pinnipeds, particularly below 1 kHz (Ghoul and Reichmuth 2013, p. 78) and sea otters are primarily adapted to hearing airborne sounds (Ghoul and Reichmuth 2014, p. 967). Ciminello et al. (2012) estimated the sea otter hearing range at approximately 20 Hz to 60 kHz. Southern sea otters displayed behavioral responses to underwater sounds between 10 and 40 kHz (Wendell et al. 1995). There is no indication that sea otters use underwater vocalization to communicate (Service 2020).

Potential auditory effects of underwater noise include temporary hearing loss (i.e., temporary threshold shift, TTS) and permanent hearing loss (i.e., permanent threshold shift, PTS). The level of loss is dependent on sound frequency, intensity, and duration. Hearing loss may lessen a marine mammal's ability to forage efficiently, maintain social cohesion, and avoid predators (Weilgart 2017). In evaluating acoustic impacts, the Service and NMFS categorize harassment from sound as Level A or Level B (Table 11). Under the MMPA, Level A harassment has the potential to injure a marine mammal or marine mammal stock in the wild, and Level B harassment has the potential to disrupt behavioral patterns including migration, breathing, nursing, breeding, feeding, or sheltering (16 USC § 1362(18). Level A harassment is conservatively based on NMFS (2018) estimates of PTS with a dual criteria threshold for peak and cumulative noise exposure levels for pinnipeds and cetaceans. The thresholds for otariid pinnipeds are considered the best proxy for sea otters. Level B harassment is defined for impulsive and non-impulsive noises with noise thresholds occurring at 160 and 120 dBs respectively (NMFS 2023). The 120 dB threshold may be slightly adjusted if background noise levels are at or above this level. These thresholds pertain to received levels (by the marine mammal), not source levels (NOAA 2014). For sea otters, the 160-db threshold has been adopted for both continuous and impulsive sound (84 FR 37716, August 1, 2019; 84 FR 44976, April 19, 2023).

Table 11 Summary of Thresholds for Predicting Level A and Level B Take of Northern Sea Otters from Underwater Sound Exposure*

Taxa	Injury (Level A) Threshold**		Disturbance (Level B) Threshold***
	Impulsive	Non-impulsive	All
Sea otters	2	219 dB SEL_{CUM}	160 dB rms

Notes: SEL_{CUM} = cumulative sound exposure level
* Thresholds pertain to received levels (by the marine mammal), not source levels and do not apply to tactical sonar and explosives.
** Derived from NMFS acoustic exposure criteria for take of otariid pinnipeds (NMFS, 2018, NOAA, 2014).
*** dB rms is re: 1 µPa and are based off SPL rms.

Sea otters may be less responsive to marine seismic pulses than some other marine mammals, such as mysticetes and odontocetes (baleen and toothed whales). Riedman (1983, 1984) monitored the behavior of sea otters along the California coast while they were exposed to a single 1,387-cm^3 air gun and a 1,098-liter air gun array. No disturbance reactions were evident when the air gun array was as close as 0.9 km. Sea otters also did not respond noticeably to the single air gun. Sea otters spend a great deal of time at the surface feeding and grooming (Riedman, 1983, 1984; Wolt et al., 2012). While at the surface, the potential noise exposure of sea otters would be much reduced compared to deeper water due to effects of turbulence (Greene and Richardson, 1988). The average dive time of a northern sea otter has been measured at only 85 seconds (Bodkin, Esslinger and Monson, 2004) to 149 seconds (Wolt et al., 2012), thereby limiting exposure during active seismic operations. Because seismic surveys are mobile, and airgun arrays usually fire only 8 to 15 seconds, there are limits to just how many pulses a sea otter could be exposed to before the vessels and airgun array have moved from the area.

Little is known about TTS impacts to sea otters. The average time sea otters spend beneath the water exposed to underwater sounds is brief. Wolt et al. (2012) found an average dive time of 149 seconds with 8.6 dives during a single feeding bout. Based on these values, BOEM estimates the total underwater dive time (about 21 minutes) equivalent to 12 or 18 percent of the time a typical 2- to 3-hour slack tide seismic survey shoot may occur. Because seismic surveys are mobile and airgun arrays usually fire only 8 to 15 seconds, the number of pulses a single sea otter may be exposed to before the vessels and airgun array have moved out of the area is limited.

Masking occurs when louder noises interfere with marine mammal vocalizations or their ability to hear natural sounds in their environment (Richardson et al. 1995). These noise levels limit their ability to communicate and/or avoid predation or other natural hazards. However, sea otters do not vocally communicate underwater (Ghoul and Reichmuth 2012) and the importance of masking of underwater noise may be less important for sea otters than other marine mammals, as sea otters are primarily adapted to hearing airborne sounds (Ghoul and Reichmuth 2014).

Except for loud screams between pups and mothers (McShane et al. 1995), sea otters do not appear to communicate vocally, either at the surface or under water (Ghoul and Reichmuth, 2012) and they do not use sound to detect prey. Thus, any TTS due to seismic noise is unlikely to mask communication or reduce foraging efficiency. Sea otters are unlikely to rely on sound to detect and avoid predators. For example, sea otters at the surface are not likely to hear killer whale vocalizations because they are primarily adapted to hearing airborne sounds (Ghoul and Reichmuth 2012). A PTS occurs when continuous noise exposure causes hairs within the inner ear system to die. This can occur due to moderate durations of very loud noise levels, or long-term continuous exposure of moderate noise levels. A PTS is not likely to be an issue with sea otters and impulsive seismic noise. Sea otter exposure to underwater noises would be of very short duration because the average dive time of a northern sea otter is so short.

The BOEM and BSEE include mitigation for seismic surveys as described in Mitigation Measures within The Proposed Action section of this biological opinion. Typical mitigation measures include timing and location limitations; minimized energy levels; safety and disturbance zones; ramp up, and shutdown requirements; and detailed monitoring requirements for on-board Protected Species Observers (PSOs). Implementations of these mitigation measures is expected to be effective in preventing injury (Level A harassment) of sea otters by underwater noise from airguns and other active acoustic sources used in marine seismic surveys and geohazard surveys. Sea otters are likely to be detected by PSOs during seismic surveys because these animals often congregate in large groups of up to 20 individuals and spend a considerable amount of time floating at the water's surface. However, mitigation may not prevent all behavioral disturbance (Level B harassment) of sea otters. Sound produced by seismic source arrays may persist at noise levels greater than 160 dB (the noise level threshold above which Level B disturbance is assumed to occur) for up to several kilometers from the source – e.g., 6.83 km for a 28,941-cubic centimeter airgun array used in a recent seismic survey IHA in Cook Inlet (SAExploration, Inc. 2015). The PSOs would monitor this area, but it is too large to ensure all animals be detected, and shutdowns would only be required if a sea otter were detected within the much smaller exclusion zone based on the NMFS (2018) dual threshold criteria (assuming pinniped criteria are used for sea otters).

The potential for disturbance or other behavioral effects would vary depending on the survey location and timing. The potential for behavioral disturbance would be greatest for surveys in OCS blocks in proximity to areas frequently used by sea otters, and in other relatively shallow areas less than 40 m depth where sea otters are most likely to occur and forage. However, given sea otters' underwater hearing ability and limited time spent below the water's surface, seismic survey noises are expected to result in only localized and temporary disturbance effects to a few individual sea otters. While seismic airguns have the potential to alter the availability of invertebrate food sources, Vella et al. (2001) concluded there are generally few behavioral or physiological effects unless the organisms are very close (within several meters) to a powerful noise source. Consequently, noises from seismic airguns are not likely to decrease the availability of invertebrate crustaceans, bivalves, or mollusks.

6.2.1.1.3 Exploration and drilling

Exploratory drilling could disturb or displace listed sea otters from the immediate area of the exploration site. The EDS estimates up to eight exploration and delineation wells would be drilled in the proposed Lease Sale Area up to a 3-year period (Years 3 to 5; Table 2).

We assume exploration or delineation wells could be drilled in areas inhabited by sea otters. Exploratory drilling activities are limited to a relatively small spatial area and are stationary, allowing sea otters that are adjacent to exploratory drilling to depart the area or habituate to the disturbance. Additionally, in areas where sea otters may be present, BOEM and BSEE will impose mitigation measures on exploratory drilling operations.

The BOEM estimates drilling of an exploration or delineation well may take 30 to 60 days. Given the sea otter's tolerance for noise and ability to habituate, disturbances due to noise are expected to be only minor, localized, and short-term. If an exploration or delineation well site is located in sea otter habitat, the resulting noise and seafloor disturbance may result in localized and temporary affects to a few individual sea otters or rafts of otters (typically 10 to 20, but fewer than 100) when a drilling rig is present (30 to 60 days). Therefore, exploration and delineation drilling may result in disturbance to some individuals or groups of sea otters.

6.2.1.2 Pollution from Discharges into the Marine Environment

Authorized Discharges – Discharges of drilling muds (lubrication for drill bits) and cuttings (material removed from drill holes) during exploratory or delineation drilling would be small in scale and would likely dissipate quickly. Deposition of cuttings on the seafloor could alter benthic zone characteristics such as grain size, mineralogy, and micro-topography. It could also alter sea otter prey availability as discussed in section 6.3 *Effects of the Action on Northern Sea Otter Critical Habitat: Kodiak, Kamishak, Alaska Peninsula Management Unit* below. In Cook Inlet, it is expected that drilling mud and cuttings discharges would be quickly transported away by strong currents. Furthermore, the USEPA regulates discharge of drilling muds, cuttings, and other materials to the marine environment, and NDPES General Permit for Oil and Gas Exploration Facilities on the OCS in Cook Inlet would mandate specific discharge limits.

In addition to drilling mud and cuttings, discharges of grey or ballast water from vessel or platform operations could take place during the First Incremental Step. However, these discharges would also be authorized under a NDPES General Permit for Oil and Gas Exploration Facilities on the OCS in Cook Inlet and USEPA regulations (40 CFR 125.122) would require a determination that the permitted discharge would not cause unreasonable degradation to the marine environment. Because authorized discharges during the First Incremental Step would occur over relatively short periods of time (weeks or months at specific locations), impacts to water quality from authorized discharges is expected to be localized and short term.

Given: 1) the relatively small impact area associated with exploratory drilling in relation to the size of the lease area; 2) the low number of wells expected in the area (BOEM and BSEE estimate up to 8 exploration and delineation wells could be drilled during the First Incremental

Step); 3) BOEMs FEIS Preferred Alternative 4A, which prohibits drilling operations for 17 of the 193 OCS blocks located within (1,000 m) of northern sea otter critical habitat; and 4) limits on discharges imposed by the NPDES permit process, the Service anticipates only minor impacts to sea otters from discharges of drilling mud, cuttings, ballast and grey water during the First Incremental Step.

6.2.1.2.1 Small Spills

Based on information provided by BOEM and BSEE (BOEM 2022a), up to six small, refined oil spills (less than 1,000 bbl) would be reasonably foreseeable during the First Incremental Step.

Although low-volume spills could occur during exploration surveys, drilling operations, or refueling, due to safety measures in place (i.e., operation-specific spill prevention and oil spill response plans), these unauthorized discharges are expected to be uncommon. In the unlikely event a small spill reaches sea otter habitat, sea otters may be impacted. Impacts to otters from contact with oil may include fouling of fur, ingestion, skin irritation, corneal ulcers, respiratory effects, reproductive effects, and others (Geraci and Williams 1990; Ralls and Siniff 1990). The BOEM assumes that impacts to sea otters from contact with oil would be lethal (BOEM 2022a). We expect the likelihood of sea otters encountering oil from a small spill in the marine environment would be very low. Small offshore spills are expected to be contained or weather quickly (within a few hours to a few days). Although disturbance of sea otters could occur during cleanup efforts for small spills, this level of disturbance is expected to be minor and temporary.

Furthermore, disturbance from cleanup activities is likely to be extremely infrequent and limited to a small geographic area and would therefore impact very few individual sea otters.

Because: 1) small spills are expected to occur infrequently and be of low volume; 2) small spills are expected to be contained or weather quickly; and 3) sea otters would likely avoid disturbance associated with areas of active cleanup, sea otters are unlikely to encounter oil from a small spill during the First Incremental Step. Therefore, although the effects of small-volume spills on sea otters would depend on the location and timing of the spill and the speed and success of cleanup efforts, small spills resulting from the First Incremental Step would impact few individual sea otters.

6.2.1.2.2 Large and very large spills

No spills greater than 1,000 bbl are reasonably likely to occur during the First Incremental Step (BOEM 2022a) based on the historical frequency of such an event. The effects of a large or very large oil spill would likely result in injury or death of an unknown, and potentially large number of sea otters. However, such an event is not considered to be an effect of the First Incremental Step within the meaning of the ESA, because it is not reasonably likely to occur. The effects of a large oil spill to northern sea otter are discussed Future Incremental Steps, section *6.4.2 Pollution from Discharges into the Marine Environment*.

6.2.1.2.3 Spill response

Cleanup activities would likely take place if a large spill occurred, and such activities could displace or otherwise disturb sea otters present in or near habitats that have been affected by oil.

Activities could include vessel and aircraft operations, mechanical recovery (skimming and booming), use of dispersants, and in-situ burning (BOEM 2022a). The duration of cleanup activities for a large spill would depend on the timing and amount of oil spilled but would likely last months or years. Sea otter response to clean up operations will depend on intensity, scale, duration, location, and type of activity. The likelihood of large spill response actions, which may have impacts to large numbers of otters, is low. However, oil spill cleanup operations may result in disturbance to individual sea otters as a result of direct exposure to dispersed oil, physical manipulations of habitat associated with mechanical spill response actions, and/or chemical changes in habitat following use of dispersants or in situ burning, and vessel and aircraft traffic associated with these activities. The risk of effects from spill response activities is low (Service 2015a) but should such an event occur it could affect large numbers of sea otters.

6.2.1.3 Summary of First Incremental Step on Sea Otters

Sea otters could be impacted by disturbance from aircraft, vessel traffic, seismic surveys, and exploratory drilling, as well as authorized discharges and small oil spills. However, due to: 1) the low number of activities compared to the size of the action area; 2) the implementation of ship-based mitigation measures, including protected species monitoring, establishing and monitoring safety and disturbance zones, speed and course alterations, ramp-up (or soft start), power-down and shutdown procedures, and provisions for poor visibility conditions; 3) the limits on authorized discharges enforced through the NPEDES permit process; 4) the anticipated low frequency and low volumes of small oil spills; 5) the likelihood that spills would be recovered or dissipated quickly (due to spill prevention and response measures), we anticipate impacts from these factors would relatively few individuals or groups, resulting in only minor, temporary changes in behavior, and would unlikely result in injury or death.

6.3 Effects of the Action on Northern Sea Otter Critical Habitat: Kodiak, Kamishak, Alaska Peninsula Management Unit

6.3.1 First Incremental Step

The Kodiak, Kamishak, Alaska Peninsula Management Unit is an important area for northern sea otters. As described in section *4.2.2 Listing Status and Critical Habitat*, the PCEs for the designated critical habitat of the sea otter are:

- PCE 1 – Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 2 m depth;
- PCE 2 – Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m of the mean high tide line;
- PCE 3 – Kelp forests that provide protection from marine predators; forests occur in waters less than 20 m depth; and
- PCE 4 – Prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

The first two PCEs do not occur within the Lease Sale Area and are not likely to be affected by any first incremental step activities or events other than accidental small oil spills. Kelp forests

(PCE 3) and associated prey resources (PCE 4) occur within the seven OCS blocks that overlap with the proposed Lease Sale Area as well as in other areas along the shorelines of Cook Inlet. These PCEs may be affected through disturbance, authorized discharges, and small oil spills during the First Incremental Step.

6.3.1.1 Disturbance on PCE's

6.3.1.1.1 Vessel Traffic and Seafloor Disturbance

Support vessels could occasionally transit through KKAPMU during the First Incremental Step. Given the size of KKAPMU and the relatively small number of vessels that could operate within it at any one time, we do not anticipate vessel traffic during the First Incremental Step would appreciably affect the conservation value of the KKAPMU for northern sea otter. However, temporary effects to kelp forests (PCE 3) may could occur via propeller cuts to blades and stipes as vessels travel through kelp beds or during the process of 'backing down' when engines are run in reverse to dislodge propellers fouled by kelp fronds and stipes.

The E&D Scenario estimates up to eight exploration and delineation wells would be drilled in the Lease Sale Area during a 3-year period (Years 3 to 5; Table 2). No exploration or delineation wells will be drilled in the sea otter critical habitat, and lessees will be prohibited from conducting seafloor disturbing activities, including anchoring and placement of bottom-founded structures, within 1,000 m of northern sea otter critical habitat. Drilling adjacent to critical habitat may have adverse effects similar to those of authorized discharges, including localized sedimentation and increased turbidity.

6.3.1.2 Pollution from Discharges Authorized discharges on PCEs

Discharges of drilling fluids and cuttings will not be authorized in OCS blocks located within 1,000 m of sea otter critical habitat. Discharges from OCS facilities in the vicinity of critical habitat (i.e., greater than 1,000 m distance) may be authorized during the first incremental step and could include drilling mud and cuttings, deck drainage, sanitary and domestic waste, desalination unit brine, cooling water, bilge, ballast water, and other miscellaneous discharges.

As described in the Description of the Proposed Action for the Future Incremental Steps, water-based drilling fluids and cuttings from exploration operations in Cook Inlet may be discharged if authorized under an NPDES permit issued by USEPA. Deposition of cuttings on the seafloor could alter seafloor characteristics such as grain size, mineralogy, and microtopography. It could also alter prey availability (PCE 4) in the immediate vicinity of the discharges through burial of benthic organisms or changing bottom habitat characteristics, but such effects would be of limited size and duration. In Cook Inlet, it is expected that drilling mud and cuttings discharges would be quickly transported away by strong currents. Benthic impacts including burial and smothering are most likely to occur within a radius of approximately 500m around each wellsite, affecting an area of 0.78 km^2 per wellsite. Pollutants in drilling mud and cuttings discharges are regulated through an NPDES permit which will ensure adherence to the CWA standard of no unreasonable degradation of the marine environment (CWA section 403 and implementing regulations at 40 CFR Part 125). Impacts to sea otter critical habitat as a result of exposure to pollutants discharged in compliance with the permit requirements (i.e., USEPA2015a, b) associated with First Incremental Step activities are expected to be short-term, localized, and minimal. The prohibition from discharging drilling fluids and cuttings on lease blocks within 1,000 m of sea otter critical habitat will reduce possible contamination. Any discharges would not diminish the value of the constituent elements essential to the conservation of the listed stock of sea otters. That is, shallow depth, protection from predators, kelp, and prey resources are present in sufficient quantity and quality to support the energetic requirements of the species, and this availability will not be affected by authorized discharges associated with the first incremental step.

Small spills on PCEs – In order for small spills to affect PCEs in the KKAPMU, they would need to occur within or adjacent to this critical habitat area. The BOEM estimates that approximately 0 to 6 refined (i.e., fuel) oil spills ranging in size from less than 1 bbl up to 50 bbl per spill could occur during the first incremental step (BOEM 2022b). Although the chances of a small spill in the first incremental step are high, depending on the spill location, a small, refined spill is likely to evaporate and disperse in offshore waters without ever reaching sea otter critical habitat. In the reduced probability of a small, refined spill reaching sea otter critical habitat, it is likely that any habitat impacts would be short-term and there would be no persistent contamination. In that event, it is also not likely that a small, refined spill would diminish the value of the physical or biological features essential to the conservation of the listed stock of sea otters. That is, small spills may affect critical habitat for sea otters but shallow depth, protection from predators, kelp, and prey resources are present in sufficient quantity and quality to support the energetic requirements of the species, and this availability will not be affected by small spills associated with the first incremental step.

Given the low number of activities expected within the KKAPMU during the First Incremental Step we expect major effects to critical habitat would be unlikely. We do not expect small spills to have long-term effects that would diminish the function or conservation value of the KKAPMU for northern sea otters occurring in the Lease Area, because: 1) although spills during the First Incremental Step would be highly probable, such spills are expected to be of relatively low volume; 2) the area affected by these spills would be small; 3) most of the oil would be quickly recovered, evaporated, or dispersed; and 4) the likelihood of spills occurring within or adjacent to the KKAPMU is low.

6.3.1.2.1 Large spills on PCEs

No spills greater than 1,000 bbl are reasonably likely to occur during the First Incremental Step (BOEM 2022a) based on the historical frequency of such an event.

Therefore, while the effects of a large or very large oil spill would likely result in adverse effects to PCEs 3 and 4, a large spill is not considered to be an effect of the First Incremental Step within the meaning of the ESA, because it is not reasonably likely to occur. The effects of a large and oil spill to sea otter critical habitat are discussed below in the Future Incremental Steps, section *6.3.3.2 Pollution from Discharges into the Marine Environment.*

6.3.1.3 Effects on Recovery

6.3.1.3.1 Recovery of the Southwest Alaska DPS of the northern Sea Otter

A review of the threats to sea otter recovery was completed in 2013 (Service 2013a). Most threats were assessed to be of low importance to recovery of the sea otter; threats judged to be most important are predation (moderate to high importance) and oil spills (low to moderate importance). Due to the large spatial extent of the DPS, even a large volume oil spill in lower Cook Inlet would be unlikely to affect a substantial proportion of the overall sea otter population given their wide distribution (Service 2013a). Southwest Alaska DPS of northern sea otter recovery criteria is discussed in detail in the Sea Otter Recovery Criteria of the Status of the Species.

The potential impacts of this development on recovery of the Southwest Alaska DPS should be negligible because sea otters occur primarily in the near shore zone and the lease sale area begins nearly 5 km offshore. Therefore, sea otter habitat does not significantly overlap with the lease sale area. However, large-volume oil spills, once they have occurred, are nearly impossible to completely contain or manage with current technology. When large numbers of otters become contaminated with spilled oil, it is not possible to capture and treat the great majority of the animals. Those that become extensively contaminated or ingest large quantities of oil are difficult, if not impossible, to rehabilitate (Estes 1991; Helm et al. 2015). Even with those constraints, however, it should be possible to protect small areas that provide important habitat in specific parts of the Southwest Alaska DPS from becoming oiled.

6.3.1.3.2 Function of Critical Habitat in Supporting Recovery of Northern Sea Otter

Threats and impacts of past and present impacts of Federal, State, or private actions and activities are described in Status of the Species and Critical Habitat. No trends in the condition of sea otter critical habitat are identified in the critical habitat designation, Recovery Plan, or 5-Year Review. However, the Recovery Plan rates habitat loss as a low threat to recovery of the population (Service 2013a). The physical habitat for sea otters is largely unspoiled throughout the majority of the range of the Southwest Alaska DPS.

Impacts to critical habitat within the KKAPMU from activities authorized in the First Incremental Step of the proposed Action are anticipated to have at most minor, short-term impacts to the PCEs, and are unlikely to diminish the function and conservation value to northern sea otters for which it was designated.

6.3.1.4 Summary of Effects on Sea Otter Critical Habitat for the First Incremental Step

Impacts to Critical Habitat for the Southwest Alaska DPS of northern sea otter within the KKAPMU from activities authorized during the First Incremental Step of the proposed Action are anticipated to have at most only minor, short-term impacts to the primary constituent elements and habitat qualities and are therefore not likely to diminish the function and conservation value of critical habitat.

Although small spills would be reasonably foreseeable during the First Incremental Step, they would be, by definition, so limited in size that oil or other spilled substances would likely evaporate, weather, or be mostly recovered. By virtue of their size, they would also likely cover a limited areal extent, and would be unlikely to persist long enough to reach critical habitat if spilled elsewhere. Moreover, given the limited volumes of small spills, effects on the biological and physical features of critical habitat would likely be short term and localized, and therefore would not diminish the function and conservation value of critical habitat within the KKAPMU for Alaska DPS of northern sea otter.

Spills of greater volume would not be likely to occur during the first increment. According to analysis by BOEM and BSEE, large and very large oil spills would be so unlikely during the First Incremental Step as to be considered not reasonably foreseeable. Therefore, they would not be considered a direct or indirect effect of the first increment within the meaning of the ESA.

In summary, although we identified potential impacts to critical habitat within the KKAPMU from disturbance and small spills, due to: 1) the implementation of minimization measures designed to reduce or avoid industry impacts within the Action Area; 2) the low likelihood and volume of spills during the First Incremental Step; and 3) the implementation of spill prevention and response measures, these effects would be expected to have at most only minor, short-term impacts to the primary constituent elements and habitat qualities, and are therefore not likely to diminish the function and conservation value of critical habitat for the southwest Alaska DPS of northern sea otter within the KKAPMU.

6.3.2 Future Incremental Steps: Southwest Alaska DPS of northern Sea Otter

Future Incremental Steps include all development, production, and decommissioning activities associated with Lease Sale 258, as described in section 2.4 and summarized in Table 2.

6.3.2.1 Disturbance Vessels and helicopters

Future Incremental Steps include support vessel and helicopter traffic from development, production and decommissioning activities, and government-initiated oil spill response exercises. Disturbance to sea otters could occur along the western side of Cook Inlet, particularly if a production platform is located in proximity of areas frequently used by sea otters (Figure 6).

Sea otters are slow swimmers relative to other marine mammals and spend much of their time at the surface resting, grooming, and nursing their young. They would appear to be highly vulnerable to disturbance by boats, however, sea otters generally show a high degree of tolerance and habituation to shoreline activities and vessel traffic (Service 2012) and disturbance of sea otters by boat traffic is identified as a threat of low importance to their recovery (Service 2013a). Populations of sea otters in Alaska have been shown to avoid areas with heavy boat traffic, but return during seasons with less traffic (Garshelis, Johnson, and Garshelis, 1984). Sea otters have shown signs of disturbance in response to survey vessels: e.g., sea otters swam away from approaching vessels; hauled-out otters entered the water; resting or feeding otters began to periscope or dive; and groups of otters scattered in different directions (Udevitz, Bodkin and Costa, 1995). However, sea otters off the California coast showed only mild interest in boats passing within hundreds of meters (Riedman, 1983), and Curland (1997) found that sea otters in California became habituated to boat traffic. Their behavior is suggestive of a dynamic response to disturbance, abandoning areas when disturbed persistently, and returning when the disturbance ceases. These responses may increase short-term energetic needs or reduce food intake rates for a sea otter, but these impacts are expected to last only as long as it takes for the vessel traffic to pass by or for the otter to reach an alternate, undisturbed habitat area. Sea otter collisions with vessels associated with the future incremental step are not likely because collisions between sea otters and vessels are infrequent.

Helicopter traffic to and from production platforms could disturb sea otters however, the disturbance would likely be localized to the vicinity of the platform (Figure 6). The BOEM anticipates helicopters will maintain a minimum altitude of 610 m which is usually sufficient to avoid disturbing marine mammals (BOEM 2016b). Although sea otters occurring in the action area may be susceptible to disturbance from helicopter and vessel traffic, we expect this effect to be localized and temporary. Because sea otters in Cook Inlet are known to spend time in high density rafts, small localized temporary disturbances have potential to affect a larger number of individuals than may normally occur to individual foraging or nursing sea otters. However, rafting otters occurring in the vicinity of platforms are likely habituated to the presence of the platform and platform activities.

6.3.2.1.1 Development and Production and Decommissioning

The E&D Scenario estimates up to six production platforms will be installed in the Lease Sale Area during Years 7 to 19. The BOEM's analysis assumed that one of the platforms will be in an area inhabited by sea otters. Platform construction activities would disturb the seafloor and create noise. Installation typically requires barges with cranes for platform stabilization/positioning and hoisting of modules topside of the platform. Tugboats could also be used for stabilization and positioning depending on structure type. It is assumed that each production platform will be a steel-caisson platform, designed to be resistant to tides and ice. Total area disturbed by use of a steel-caisson platform is approximately 0.4 hectare (ha) of seafloor (BOEM, 2022b).

A production platform would be in place for decades (Years 7 to 38 for oil or gas platforms). During this time, there would be airborne noise from engines, generators, pumps, and other machinery onboard the platform. Some of this noise is transmitted into the water (Spence et al., 2007). The E&D Scenario also assumes there will be two offshore pipelines to shore (one oil and one gas), with a landfall probably on the Kenai Peninsula between Homer and Nikiski. Because the likely landfalls are on the east side of Cook Inlet, a pipeline route is unlikely to pass through the sea otter critical habitat.

Offshore pipeline construction activities will generate noise and turbidity along the route. The noise would be from the engines of the vessels involved in pipe-laying and trenching. Trenching of the new oil pipelines (up to 129 km in length) and the new gas pipelines (up to 193 km in length) is estimated to disturb up to 295 ha of seafloor. As each pipeline is buried, turbidity could extend tens to hundreds of meters from the trenching location as the lay barge moves along the pipeline corridor. Within an individual OCS block, this disturbance would probably last for a few days.

Construction activities during decommissioning will be similar to those during development. Platform removal and pipeline cleaning and plugging will require vessel operations and may generate high levels of underwater noise. Some localized changes in water quality may affect benthic organisms eaten by sea otters.

Impacts of sedimentation on sessile benthic organisms are transmitted up through the food chain, affecting wildlife species that eat them, including sea otters. Otters are most likely to respond to changes in food availability by dispersing to unaffected areas. However, sea otter population declines are not likely attributed to food limitations (Service 2013a, 2013b). If a production platform or an offshore pipeline is located in sea otter habitat, the resulting seafloor disturbance and noise may cause sea otters to avoid the area. For the duration of the Action, sea otters may either become habituated to the platform's presence or permanently avoid the area. Therefore, if development and production activities are located in habitat of listed sea otters in the nearshore waters on the western side of Cook Inlet, the resulting noise and seafloor disturbance may result in short-term disturbance to or long-term habitat avoidance for hundreds of sea otters.

6.3.2.2 Pollution from Discharges into the Marine Environment Authorized Discharges

Discharges are regulated through the NPDES permit (USEPA2015) which will ensure adherence to the Clean Water Act (CWA) standard of no unreasonable degradation of the marine environment (CWA section 403 and implementing regulations at 40 CFR Part 125.122). In addition, any discharges from production platforms are expected to be diluted rapidly in receiving waters. Therefore, the Service expects any discharges during Future Incremental steps to likely have no significant impacts to sea otters.

6.3.2.2.1 Small Spills

The BOEM estimates that approximately 405 small spills of refined oil and crude or condensate oil are reasonably foreseeable during the future incremental steps. Of the total, 389 spills are estimated to be less than 1 bbl, 14 spills are estimated to be between 1 and 50 bbl, and 2 spills are estimated to be between 50 and 500 bbl. The trajectory of a small spill was not modeled in BEOM 2022b because they would not be expected to persist on the water long enough for the OSRA model to follow their path in a trajectory analysis.

Most small, refined spills are estimated to evaporate and disperse in offshore waters without reaching relatively shallow areas where sea otters typically forage (less than 40 m). It is not entirely discountable, however, that a small spill would reach habitat of the listed otter DPS. In the event of a small spill reaching sea otter habitat, it is likely some otters, which typically forage individually, could be impacted. Impacts may be sub-lethal, depending on factors such as amount of contact, but for purposes of conservative analysis, BOEM assumes impacts would be lethal.

Furthermore, because otters can raft up into groups, it is not entirely discountable that up to larger groups of otters may be impacted if a small spill should reach their habitat when a raft is present. If they occur, small spills may affect and are likely to adversely affect the southwest Alaska stock of northern sea otters due to pelage contamination and the resulting ingestion and inhalation of petroleum.

6.3.2.2.2 Large Oil Spills

Sea otters occur in the Cook Inlet area year-round and could be affected by oil spills during any season. The potential impacts would be greatest near the coastlines of lower Cook Inlet where sea otters aggregate, particularly in critical habitat. A large spill is not an expected outcome of the Proposed Action. However, to ensure effects are not underestimated, BOEM modelled the effects of one 3,800 bbl spill. The probability of the oil spill making contact with an ERA is given as the conditional probability (the probability under the condition that the spill has occurred) and the combined probability (the chance of one or more large spill first occurring, and then contacting, an ERA). Model results show the chances of the spill contacting geographic areas used by sea otters. The likelihood of contact is given as either conditional or combined probability and is presented below for areas that overlap or are in close proximity to the Lease Sale Area. Summary information about oil spill modelling was presented in section 2.4.4.

6.3.2.2.3 Conditional Probabilities

The detailed methodology for oil spill trajectory modeling is discussed in Appendix A of the FEIS (BOEM 2022b); full results are presented in Ji and Smith (2020). Geographic areas used by otters include ERAs, LSs, and GLSs. Locations of several representative areas are shown in Figure 13. The following areas are within, overlap with, or are adjacent to the Action Area and contain sea otters and otter habitat (BOEM 2022b, Appendix A, Figure A8):

ERA 16 – Inner Kachemak Bay	ERA 66 – Afognak-east
ERA 45 – Clam Gulch	ERA 67 – Shuyak
ERA 46 – Outer Kachemak Bay	ERA 68 – Kenai Fjords-west
ERA 47 – SW Cook Inlet	ERA 145 – Outer Kachemak Bay/IBA
ERA 48 – Kamishak Bay	LS 35 – Tuxedni Bay
ERA 49 – Katmai NP	LS 84 – Raspberry Strait
ERA 50 – Becharof NWR	LS 86 – Uginak Bay/Passage
ERA 57 – Trinity Islands	LS 87 – Uyak Bay
ERA 59 – Kodiak NWR-south	GLS 124 – Kukak Bay
ERA 60 – Kodiak NWR-west	GLS 141 – Seldovia side Kachemak Bay
ERA 64 – Afognak-west	GLS 152 – Barren Islands
ERA 65 – Afognak-north	GLS 159 – Kupreanof Strait

The OSRA model estimates winter, summer, and annual conditional probabilities of contact assuming a large spill has occurred. Table 12 summarizes the percent chance that a large spill starting in the Lease Sale Area would contact each of the ERAs, LSs or GLSs representing northern sea otter resource areas. Ranges of values represent results from different launch areas (LAs) and pipelines (PLs). Sea otters and critical habitat in these areas have the potential to be affected by a large spill in the Lease Sale Area. Generally, ERAs that overlap or are in close proximity to the Lease Sale Area or are on the western side of Cook Inlet and upper Shelikof Strait, have higher chances of contact than other areas.

6.3.2.2.4 Combined Probabilities

The combined probabilities are projected over the assumed 40-year time period of the Proposed Action. Combined probabilities incorporate both the likelihood of a 3,800 bbl oil spill both occurring and contacting a certain ERA, LS, or GLS that supports sea otters. Probabilities were predicted for summer and winter and for various time periods from 1 to 30 days after the spill. The resulting combined probabilities are less than 0.5 percent chance of a spill occurring and contacting 33 out of 43 total sea otter resource areas. Eight areas have a probability of less than 6 percent and two areas have a probability of 6 percent or greater (Ji and Smith 2021, Table A-2.61). The estimated percent chance of occurrence and contact within 30 days to sea otter resource areas was greatest for Southwest Cook Inlet (ERA 47) (6 percent) and Outer Kachemak Bay (ERA 46) (10 percent). These areas are adjacent to the Lease Sale Area. ERA 153, Polly Creek Beach, is not generally recognized as a sea otter resource area, but it had the highest combined probability of an ERA (11 percent) and is included here for comparison (Figure 13).

Sea otters are vulnerable to the impacts of oil in their habitat (Geraci and Williams 1990; Ralls and Siniff 1990). Sea otters in the Action Area could be killed if contacted or otherwise contaminated by oil from a large spill. Estimates of total expected mortality could vary widely, depending on exactly which areas were contacted and where sea otters were at the time oil arrived. A large spill could affect local distribution and abundance and potentially have chronic impacts in affected areas.

Table 12 Thirty-day Conditional Probabilities of a Large Spill Contacting Northern Sea Otter Resources

OSRA Feature Type	Highest Chance of Contact[1]	Summer: 30 days	Winter: 30 days
ERA[2]	≥0.5–<6	50, 51, 59, 60, 65, 66	16, 50, 57, 59, 60, 65
ERA	≥6–<25	16, 49, 64, 67, 68	49, 64, 67, 68
ERA	≥25–<50	45	45, 46
ERA	≥50	46, 47, 48, 145	47, 48, 145
LS[3]	≥0.5–<6	84, 86, 87	84, 86, 87
LS	≥6–<25	35	35
GLS[4]	≥0.5–<6	124, 152, 159	124, 152, 159
GLS	≥6–<25	141	141

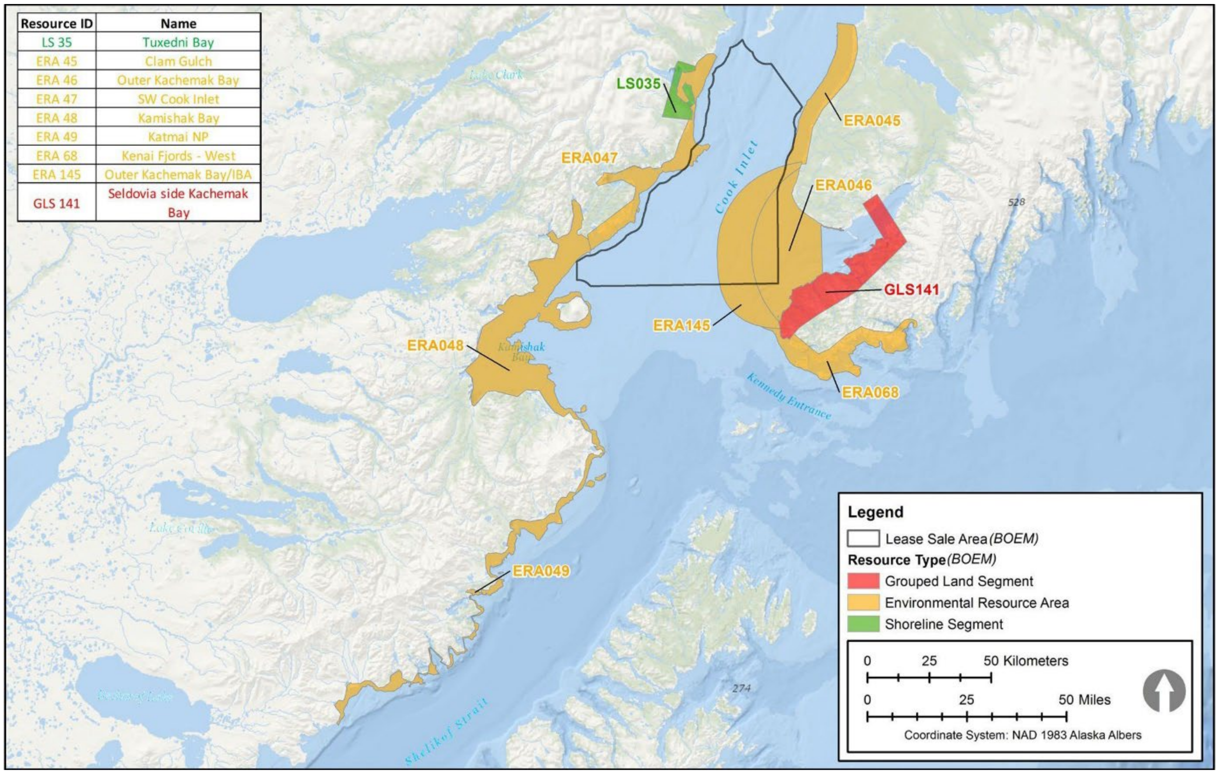
Notes: Source Ji and Smith (2021)

1 Highest percent chance from any LA or PL during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.

2 Names of ERAs Contacted: 45 Clam Gulch; 46 Outer Kachemak Bay; 47 SW Cook Inlet; 48 Kamishak Bay; 49 Katmai NP; 64 Afognak-west; 67 Shuyak; 68 Kenai Fjords-west; 145 Outer Kachemak Bay/IBA

3 Names of LSs Contacted: 35 Chisik Island; Tuxedni Bay; 84 Malina Bay; Raspberry Island; Raspberry Strait; 86 Uganik Bay Uganik Strait; Cape Ugat; 87 Cape Kuliuk; Spiridon Bay; Uyak Bay

4 Names of GLSs Contacted: 124 Kukak Bay; 141 Seldovia side Kachemak Bay; 152 Barren Islands; 159 Kupreanof Strait



Notes: Excerpted from BOEM 2022b. Not all areas are shown. For full results see Ji and Smith (2021; Table A.2-61 and Table A.2-62). Source BOEM (2022a).

Figure 13 Representative Northern Sea Otter ERAs, LSs and GLSs Potentially Contacted by a Large Spill

High levels of mortality and demonstrated population-level impacts of oil on sea otters were documented after the *Exxon Valdez* oil spill (Ballachey et al. 2014; DeGange et al. 1994; Garrott et al. 1993). Oiled sea otters captured soon after the spill had medical problems including anemia, dehydration, elevated liver enzymes, low plasma glucose levels, disorientation, gastrointestinal distress, seizures, hypothermia, hypoglycemia, stillbirths, diarrhea, hemorrhagic enteritis, subcutaneous and bulus emphysema, hemorrhagic necrotizing sinusitis, corneal ulcers, and corneal scarring (Wilson et al. 1990). A high rate of pup mortality, miscarriages, and stillbirths were observed in female otters inhabiting areas affected by the *Exxon Valdez* oil spill. Pups were unable to nurse and became hypothermic due to their mothers' inability to keep their fur properly groomed (Wilson et al. 1990).

In addition to the direct toxic effects of oil exposure, oil can compromise the buoyancy and thermal efficiency of sea otter pelage and lead to hypothermia (Ralls and Siniff 1990). Sea otters respond to fouling by grooming, resulting in oil ingestion. They prey on macroinvertebrates, some of which uptake and accumulate hydrocarbon contaminants from water and sediments.

They also have a high risk of oil exposure because they often congregate in large groups and spend a considerable amount of time floating at the water's surface (Ralls and Siniff 1990).

6.3.2.3 Oil Spill Prevention and Response Operations

Oil spill prevention (spill drills) and response (clean up) operations could also displace or otherwise disturb sea otters present in or near habitats that have been affected by oil. The response of sea otters to spill drills and cleanup operations would depend on intensity, scale, duration, location, and type of activity. Typical prevention and response actions would be relatively small in scale. These events would have only localized impacts to a limited number of animals. Otters could respond to disturbances with changes in behaviors. Operations would usually have little or no effect on habitat. The likelihood of large spill response actions, which may have impacts to large numbers of otters, is extremely low. Spill prevention and response actions are likely to have a greater net benefit for sea otters than if none occurred (Service 2015). However, oil spill cleanup operations may result in adverse effects to individual sea otters as a result of direct exposure to dispersed oil, physical manipulations of habitat associated with mechanical spill response actions, and/or chemical changes in habitat following use of dispersants or in situ burning, and vessel and aircraft traffic associated with these activities. The risk of effects from spill response activities is low (Service2015) but not discountable.

6.3.2.4 Conclusion

Based on the conditional probabilities (Table 12), several areas of sea otter habitat along the eastern and western sides of Cook Inlet are likely to be affected (greater than 50 percent probability of contact) if a large spill occurred in the Action Area. The combined probability of a spill both occurring and contacting sea otter areas ranges from less than 0.5 percent to 10 percent, with the combined probability for contact of Kamishak Bay being 10 percent within 30 days.

If a large spill reached the largest rafts of sea otters in Kamishak Bay, where the population is estimated to contain more than 10,000 animals, it could impact hundreds or less likely, even thousands of otters. A large spill could measurably depress and affect local populations of sea otter prey for about a year, and small amounts of oil could persist in shoreline sediments for a decade or more, possibly affecting sea otters for multiple generations. For this level of impact, all of the following would have to occur: 1) one large oil spill occurs (the estimated likelihood of a large spill occurring is 19 percent over the life of the proposed action); 2) the oil would have to contact and compromise areas where sea otters and/or associated prey species inhabit (nearshore), and 3) no effective clean-up efforts would occur (the OSRA trajectory model is based on the movement of un-weathered oil with no mitigation from oil spill response activities). While any of these events is possible, BOEM concluded that it is not reasonably certain that all of these events would occur, based on the best information currently available. Consequently, while a large spill could have long-lasting effects on sea otters, such effects are not likely to occur. However, if a large spill were to occur during future incremental steps, based on previous documented effects of oil on sea otters including in Prince William Sound, it would be likely to cause deleterious health effects or death to a large number of sea otters. Although a proportion of the total population of southwest Alaska DPS of northern sea otter may experience internal or external oil contamination which can cause hypothermia, stress, and toxicity or death, we do not anticipate population-level declines to occur for the southwest Alaska DPS of the northern sea otter, given the scenario analyzed.

6.3.3 Future Incremental Steps: Southwest Alaska DPS of Northern Sea Otter Critical Habitat for KKAPMU

6.3.3.1 Disturbance within the KKAPMU

6.3.3.1.1 Platform and Offshore Pipeline Installation

The E&D Scenario assumes that up to six production platforms would be installed in Cook Inlet. No leases will be offered in sea otter critical habitat, but for this analysis, it is assumed that one of the platforms could be adjacent to northern sea otter critical habitat. It is assumed that each production platform would be a steel-caisson platform, designed to be resistant to tides and ice.

The E&D Scenario also assumes there would be two offshore pipelines from the initial platform to shore (one oil and one gas), with a landfall probably on the Kenai Peninsula between Homer and Nikiski. Pipeline routes would depend on where a commercial discovery is made but are expected to be within the Action Area. Because the likely landfalls would be on the east side of Cook Inlet, the pipeline route and transportation corridor are unlikely to pass through sea otter critical habitat.

Construction activities during development and decommissioning of a production platform or offshore pipeline would cause short-term habitat impacts. Installation of a steel-caisson platform would disturb less than 0.4 ha of seafloor, depending on platform design (BOEM, 2022b).

However, once installed, a production platform would be in place for decades (Years 7 to 38 for oil and gas platforms), and associated seafloor disturbance may occur in proximity to sea otter critical habitat which could alter foraging habitat for marine mammals Installation of offshore pipelines is estimated to disturb 59 to 295 ha of seafloor in the Lease Sale Area. As each pipeline is buried, turbidity could extend tens to hundreds of meters from the trenching location as the lay barge moves along the pipeline corridor. Within a particular OCS block, this turbidity would probably last for a few days. Once a pipeline is in place (and especially if it is buried), there would likely be little or no residual effect on adjacent areas of critical habitat. During decommissioning, cleaning and plugging a pipeline could cause localized increases in turbidity which could affect prey distribution for sea otters in areas frequented by sea otters.

Although platform and offshore pipeline installation would not occur in sea otter critical habitat, work in adjacent areas may cause seafloor disturbance and effects to water quality. These effects would be temporary and would cease when construction was complete. Increased turbidity and sediment deposition would not diminish the value of the physical and biological features of critical habitat that are essential to the conservation of the listed stock of sea otters: shallow depth, protection from predators, kelp, and prey resources, that are present in sufficient quantity and quality to support the energetic requirements of the species. Therefore, activities associated with development and production may affect critical habitat for sea otters.

Although platform and offshore pipeline installation may cause seafloor disturbance in the unlikely event they would occur in sea otter critical habitat, they would not diminish the value of the primary constituent elements (i.e., shallow depth, protection from predators, kelp, and prey resources that are present in sufficient quantity and quality to support the energetic requirements of the species) essential to the conservation of the listed stock of sea otters.

6.3.3.2 Pollution from Discharges into the Marine Environment

6.3.3.2.1 Small Oil Spills

The BOEM estimates that approximately 405 small spills of refined, crude or condensate oil could occur during future incremental steps. Of the total, 389 spills are estimated to be less than 1 bbl, 14 spills are estimated to be between 1 and 50 bbl, and two spills are estimated to be between 50 and 500 bbl. The trajectory of small spills was not modelled in the BOEM analysis because they would not be expected to persist on the water long enough for the OSRA model to follow their path in a trajectory analysis.

Depending on the spill location, a small, refined spill could evaporate and disperse in 24 to 48 hours (BOEM, 2022b, Appendix A, Table A1) in offshore waters without reaching the sea otter critical habitat. In the event of a small spill reaching sea otter habitat, it is likely that any habitat impacts would be short-term and there would be no persistent contamination.

Small spills could temporarily contaminate a very small area within the KKAPMU containing flora and fauna in the water column; although some oil from small spills could also contaminate the underlying benthic community, this is less likely than contamination within the water column. For these effects to occur, spills would have to occur directly adjacent to or within the KKAPMU, and few activities are likely to occur in this area. Additionally, effects of such contamination would be minimized through oil evaporation, weathering, and recovery efforts. If small spills do occur, the area affected would be small, and most of the spilled oil would evaporate, weather, or would be recovered; therefore, we do not expect small spills would have long-term effects that would diminish the function and conservation value of the KKAPMU for sea otters.

6.3.3.2.2 Large Oil Spills

BOEM estimates that a large spill is unlikely to occur. However, to ensure effects are not underestimated, this analysis models one large 3,800-bbl spill and provides both the chances of a large spill contacting habitat areas, assuming one occurs (conditional probability), and the chances of a large spill occurring and contacting habitat areas (combined probability). The combined probabilities factor in the chance of a large spill occurring.

6.3.3.2.3 Conditional Probabilities

The OSRA model estimates winter, summer, and annual conditional probabilities. The percent chance that a large spill in the Lease Sale Area would contact each of the ERAs representing northern sea otter critical habitat during summer or winter within 30 days is summarized in Table 6-2. The range of values represents the results from different LAs and PLs. A dash indicates that all values were less than 0.5 percent.

Three of the ERAs have conditional probabilities of 10 percent or greater during one or both seasons:

- ERA 47 – SW Cook Inlet: 13 to 61 percent summer and 13 to 70 percent winter
- ERA 48 – Kamishak Bay: 19 to 55 percent summer and 20 to 64 percent winter

- ERA 49 – Katmai NP: 6 to 13 percent summer and 4 to 10 percent winter

These are areas along the southwest shoreline of Cook Inlet, Kamishak Bay, and western upper Shelikof Strait, and are the sea otter critical habitat areas most likely to be affected in the event of a large spill in the Lease Sale Area.

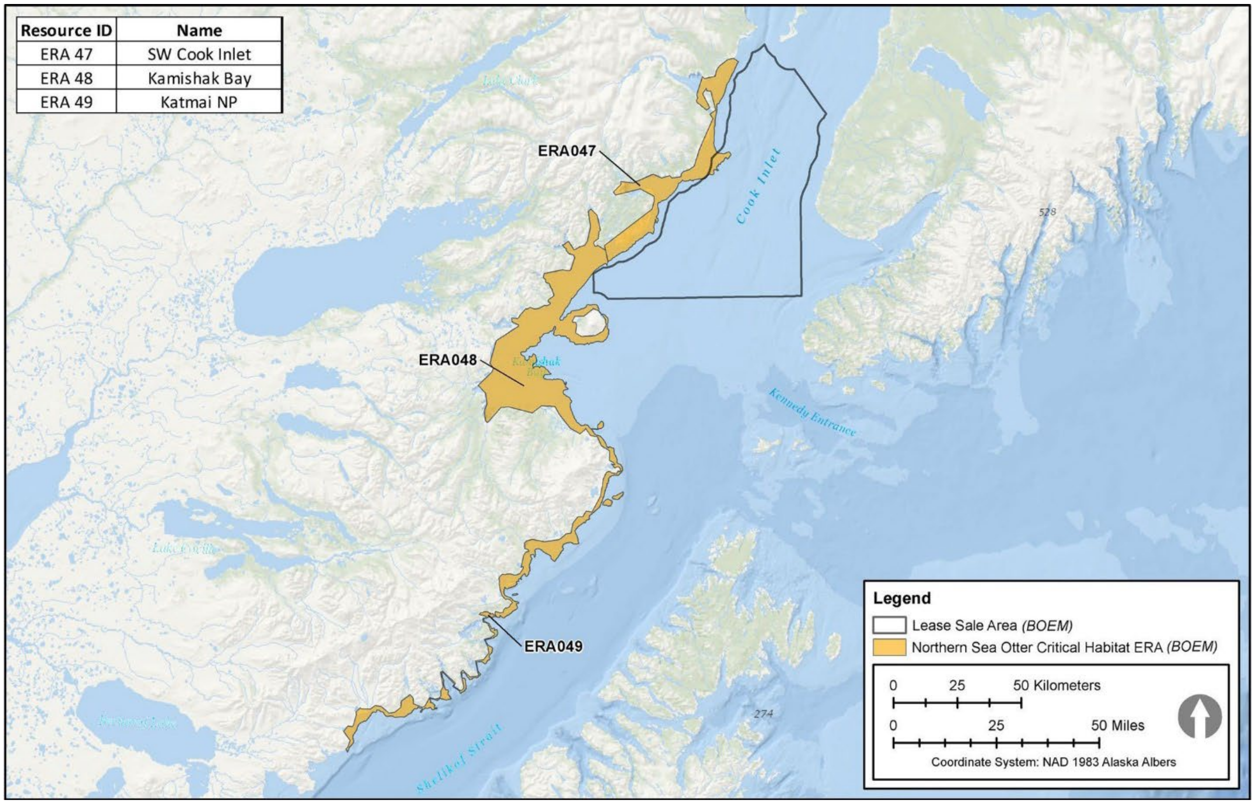
6.3.3.2.4 Combined Probabilities

The combined probabilities (expressed as percent chance) represent the probability of a large spill occurring and contacting ERAs or GLSs over the assumed 40-year life of the Proposed Action. The combined probability of a large spill occurring and contacting an ERA was highest (6 percent) for ERA 47 (SW Cook Inlet). Five ERAs containing sea otter critical habitat had combined probability values of 1 percent. For all other ERAs and GLSs containing sea otter critical habitat, the combined probabilities are 0.5 percent or less within 30 days. The locations are shown in Figure 14.

Table 13 Northern Sea Otter Critical Habitat Conditional Probability of Large Spill Contact

ID	Name	Summer (Percent)	Winter (Percent)
ERA			
47	SW Cook Inlet	13-61	13-70
48	Kamishak Bay	19-55	20-64
49	Katmai NP	6-13	4-10
50	Becharof NWR	1-1	<0.05-1
57	Trinity Islands	--	<0.05-1
59	Kodiak NWR-south	1-1	1-2
60	Kodiak NWR-west	1-3	2-5
64	Afognak-west	2-6	3-8
65	Afognak-north	<0.05-1	<0.05-1
66	Afognak-east	<0.05-1	--
67	Shuyak	3-7	2-6
LS			
84	Raspberry Strait	1-2	1-2
86	Uginak Bay/Passage	<0.5-1	1-2
87	Uyak Bay	<0.5-1	<0.5-1
GLS			
124	Kukak Bay	1-4	1-3
152	Barren Islands	2-4	1-4
159	Kupreanof Strait	<0.5-1	1-1

Note: -- = <0.5 percent, NP = National Park; NWR = National Wildlife Refuge. Source (BOEM 2022a)



Notes: BOEM 2022a
Only the ERAs with a conditional probability of 10 percent or greater (during summer, winter, or both seasons within 30 days) are shown.

Figure 14 Northern Sea Otter Critical Habitat ERAs Subject to Contact by a Large Spill

6.3.3.2.5 Oil Spill Cleanup Operations

Oil spill cleanup operations could impact some areas of sea otter critical habitat as a result of direct exposure to dispersed oil, physical manipulations of habitat associated with mechanical spill response actions, and/or chemical changes in habitat following use of dispersants or in situ burning. (Service 2015). For example, the application of oil dispersants, or the intentional ignition of floating oil at the sea surface could generate residues that may float or sink and may affect water quality or important sea otter habitat or habitat important to prey resources for sea otters, such as kelp beds. Impacts to critical habitat from cleanup operations will depend on intensity, scale, duration, location, and type of activity. Typical spill response actions will be relatively small in scale. These events will have only localized impacts to the important physical and biological features of habitat (including food resources, shallow nearshore areas, and kelp beds). The likelihood of large spill response actions, which may have extensive impacts to areas of critical habitat, is extremely low. Critical habitat for the sea otter is not within the preauthorization zone for use of dispersants, therefore the Service will provide additional review and recommendations prior to use of dispersants which may affect otter critical habitat, thereby reducing risks to this species (Service 2015).

6.3.3.3 Conclusion

Based on the conditional probabilities two ERAs (47 and 48) along the southwest shoreline of Cook Inlet are the critical habitat areas most likely to be affected if a large spill occurred in the Lease Sale Area. The conditional probabilities (expressed as percent chance) for ERA 47 range from 13 to 61 percent in summer and 13 to 70 percent in winter from all LAs or PLs (Table 14). The conditional probabilities (expressed as percent chance) for ERA 48 range from 19 to 55 percent in summer and 20 to 64 percent in winter (expressed as percent chance). Although the combined probability of a large spill occurring and contacting these areas is 6 percent for ERA 47, a large spill during future incremental steps could cause physical effects to each of the four PCEs, which could likely alter the quality of these essential features of sea otter critical habitat.

Shallow rocky areas where marine predators are less likely to forage in waters less than 2 m deep, nearshore marine waters within 100 m of the mean high tide line, and kelp forests occurring within 10 m depth (PCE 1 to 3), could be impacted by small amounts of oil which could persist in shoreline sediments for a decade or more, possibly affecting sea otter critical habitat for decades. A large spill could measurably depress and affect local populations of shellfish (PCE 4 prey resources) for about a year, such that these resources are not present in sufficient quantity or quality to support energetic requirements of sea otters in the area or render it temporarily unsuitable.

For this level of impact to occur, all of the following would have to occur: 1) one large oil spill occurs (the estimated likelihood of a large spill occurring is 19 percent and the chance of no spills occurring is 81 percent over the life of the Proposed Action); 2) the oil would have to contact and compromise a large portion of sea otter critical habitat and/or associated prey species, and 3) no effective clean-up efforts would occur (the OSRA trajectory model is based on the movement of un-weathered oil with no mitigation from oil spill response activities). While any of these events is possible, BOEM concluded that it is not reasonably certain that all of these events would occur, based on the best information currently available. Consequently, while a large spill could have effects on sea otter critical habitat through long-lasting adverse impacts to prey species, such effects are not likely to occur. Affected PCEs would eventually recover and be capable of supporting sea otters, and therefore severe population-level impacts are not reasonably likely to occur.

7 CUMULATIVE EFFECTS

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 CFR 402.02). Within the Action Area, oil and gas development, scientific research, and community growth will likely occur. However, these activities would require Federal permits (e.g., from the Bureau of Land Management [BLM] and USACE) and separate consultation and therefore are not considered cumulative impacts under the ESA. Therefore, in this section we analyze other non-Federal activities reasonably likely to occur in the Action Area during the same period as the Proposed Action.

7.1 Summary

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the ESA. We are unaware of any non-Federal actions that are reasonably certain to occur in the action area that would adversely affect the listed population of Steller's eiders and northern sea otters in the Action Area.

8 CONCLUSION

Section 7(a)(2) of the ESA requires that each "Federal agency will, in consultation with...the Secretary, ensure that any action authorized, funded, or carried out by such 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 designated critical habitat. This biological opinion evaluates the potential impacts of the proposed Action on listed species and designated critical habitat and was conducted as an incremental step consultation. As an incremental step consultation, this biological opinion must address whether:

Activities within the First Incremental Step violate section 7(a)(2) of the ESA; and there is a reasonable likelihood the entire Action (i.e., including Future Incremental Steps) will violate section 7(a)(2) of the ESA.

To reach conclusions, impacts of the incremental steps of the proposed Action are not considered in isolation, but are placed in the context of the current status of the species and critical habitat, the environmental baseline, and cumulative effects (as defined by the ESA).

8.1 Alaska-breeding Steller's Eiders

The regulatory definition of "to jeopardize the continued existence of the species" focuses on assessing the effects of the proposed action on the reproduction, numbers, and distribution, and their effect on the survival and recovery of the species being considered in the biological opinion. For that reason, we have used those aspects of the Steller's eider's status as the basis to assess the overall effect of the proposed action on the species.

8.1.1 Conclusion for First Incremental Steps

8.1.1.1 Reproduction

Steller's eiders do not breed within the action area. We do not expect impacts to breeding habitat. Loss of a few Steller's eiders individuals from the breeding population is not expected to have an appreciable effect on annual eider reproduction.

8.1.1.1.1 Numbers

The Alaska-breeding population of Steller's eiders is just a few hundred individuals yet the majority of Steller's eiders in the project area are from the Russian-Pacific population (Service 2019). Habitat loss, disturbance, collisions, and pollution during the first incremental step may injure or kill a small number of individual Steller's eiders and the likelihood of individuals lost being from the Alaska-breeding population is low.

8.1.1.1.2 Distribution

Cook Inlet is located in the easternmost part of the range of pacific-wintering Steller's eiders. The proposed activities in the first incremental step are not likely to cause significant reduction of habitat quantity or quality in a way that would measurably affect the species' distribution. We expect most of the disturbance to be short-term and temporary.

8.1.1.1.3 Recovery

The Steller's Eider Recovery Plan (Service 2002) presents research and management priorities aimed at improving the population status of the species to a point when protection under the ESA is no longer required. Recovery goals are based around lowering the likelihood of species extinction. We do not expect BOEM LS 258 to appreciably alter Steller's eiders populations in a way that would negatively impact species recovery goals.

8.1.1.1.4 Summary

In evaluating impacts of the First Incremental Step to Steller's eiders, the Service identified potential adverse effects from habitat loss, disturbance, collisions, and pollution from discharges into the marine environment. The Service anticipates few if any listed Alaska-breeding Steller's eiders will be taken during 5 years of exploration and delineation activities.

8.1.2 Conclusion for Future Incremental Steps

The future incidental steps mirror the first incidental steps in their risk to eiders: habitat loss, disturbance, collisions, and pollution. The future incidental steps have the additional collision risk of oil platforms with gas flaring, which is a known attractant to Steller's eiders, causing disorientation and collisions. Future incidental steps are also much longer in time scale (40 years), so we expect an increase in adverse effects to Steller's eiders compared to the first incremental step. However, the action area is on the easternmost range of Steller's eiders where the maximum estimated populations of pacific-wintering eiders is 5,783 individuals and of these, 0.5 percent (approximately 29 birds) are likely from the listed Alaska-breeding population. Activities from future incremental steps are unlikely to impact large quantities of birds. We do not expect the activities in the future incremental step to affect the reproduction, numbers, distribution, or recovery of the species in a significant way. Over the lifetime of the project, we expect the amount of Steller's eider take through disturbance, injury, and mortality to be low.

8.2 Southwest Alaska DPS of Northern Sea Otter

The regulatory definition of "to jeopardize the continued existence of the species" focuses on assessing the effects of the proposed action on the reproduction, numbers, and distribution, and their effect on the survival and recovery of the species being considered in the biological opinion. For that reason, we have used those aspects of the Southwest Alaska DPS of northern sea otter's status as the basis to assess the overall effect of the proposed action on the species.

8.2.1 Conclusion for First Incremental Steps

Disturbance from vessel or helicopter traffic, including underwater noise from geophysical and geotechnical surveys, associated with First Incremental Step activities is likely, particularly if EDS drill sites are located in close proximity with critical habitat. The potential for disturbance is greatest during summer when sea otters are in open water. Helicopter traffic may also disturb listed sea otters, likely localized to jack-up rigs that may occur in close proximity to critical habitat. Disturbance from helicopters may be reduced through mitigation measures proposed by BOEM for maintaining operation at an altitude of (610 m) or higher and to avoid extended flights over the coastline (BOEM 2022a). The potential for disturbance by vessel or helicopter support vessels to sea otters is unlikely but could rarely impact a few individuals.

We anticipate that most disturbances would result in only minor, temporary changes in behavior that would not rise to the level of adverse effects to the individual sea otters involved. Collisions between sea otters and vessels (both slow and fast- moving vessels) do occur but are considered infrequent (Service 2012). Collisions between listed otters and vessels associated with the First Incremental Step are considered unlikely because of limited vessel traffic in the range of the listed DPS on the western side of Cook Inlet and mitigation measures proposed by BOEM.

Although small spills would be reasonably likely in the First Incremental Step, it is unlikely that sea otters will be significantly affected because small spills are by definition of such low volume that oil or other spilled substances would likely evaporate, weather, or be mostly recovered. We expect the likelihood of sea otters encountering oil from a small spill in the marine environment would be very low. Small offshore spills would be expected to be contained or weather quickly (within a few hours to a few days). Although disturbance of sea otters could occur during cleanup efforts for small spills, this level of disturbance is expected to be minor and temporary. Furthermore, disturbance from cleanup activities is likely to be infrequent and limited to a small geographic area and would therefore impact very few individual sea otters.

8.2.1.1 Summary

Activities from the First Incremental Step that could affect sea otters include disturbance (i.e., vessels and surveys, helicopter support, and collisions) and exposure to oil spills. We expect caused by the First Incremental Step to be generally limited to the individual level and not the population level. We have reached this conclusion based on the following: 1) disturbance from vessels and helicopters would be unlikely to result in the death of a sea otter; 2) collisions would be unlikely because of limited vessel activity in areas frequently used by sea otters; 3) implementation of ship-based mitigation measures, including protected species monitoring, establishing and monitoring safety and disturbance zones, speed and course alterations, ramp-up (or soft start), power-down and shutdown procedures, and provisions for poor visibility conditions, would avoid or minimize vessel-caused impacts; 4) small spills would be expected to affect few, if any, individuals due to small volumes, weathering, and spill prevention and response measures; and 5) large or very large oil spills would be unlikely to occur. After reviewing the current status of the Southwest Alaska DPS of northern sea otter, the environmental baseline for the Action Area, the effects of the proposed oil and gas activities associated with Lease Sale 258 and cumulative effects, it is the Service's biological opinion that the oil and gas activities associated with Lease Sale 244, as proposed, is not likely to jeopardize the continued existence of the Southwest Alaska DPS of the northern sea otter by reducing appreciably their likelihood of survival and recovery in the wild by reducing their reproduction, numbers, and distribution.

8.2.2 Conclusion for Future Incremental Steps

We conclude that vessel collisions, disturbance, and small oil spills may adversely affect sea otters at the individual level. In all cases, however, we also conclude that these potential effects would be very unlikely to cause population-level impacts based on the best information available at this time.

The impact of potential disturbance/displacement to sea otters will be proportional to the spatial overlap between significant oil and gas infrastructure and sea otter concentration and critical habitat areas. To have population-level impacts, there would need to be substantial development or repeated disturbance in areas where sea otters concentrate.

We expect that repetitive disturbance of sea otters is unlikely in the Action Area because construction and survey work are temporary and other disturbance can be avoided by routing vessels and aircraft around identified concentrations of sea otters. Vessel transit may cause short-term minor disturbance, but the effects are likely to be limited to the brief duration of the vessel's transit and by the small number of vessels expected to transit the area (Tables 2 and 4). Pipelines connecting offshore platforms with the shoreline are likely but considering pipeline landfall is expected to occur along the eastern Cook Inlet shoreline (likely between Nikiski and Homer) where no sea otter critical habitat occurs, the proportion of the benthos area subject to habitat alteration or construction-related disturbance would likely be limited. The occurrence of sea otters along the eastern shoreline in areas where pipeline landfalls are anticipated (likely between Nikiski and Homer) are not areas typically associated with high sea otter densities. Further, the benthic community and its use by sea otters would be expected to recover quickly.

For the purposes of analysis under the EDS, BOEM and BSEE estimate that approximately 411 small spills (less than 1,000 bbl) would occur over the life of the scenario (6 during the First Incremental Step and 405 during future incremental steps). Of the 405 crude, condensate, or refined small oil spills that could occur during development, production, and decommissioning, about 389 would be less than 1 bbl, 14 would be between 1 and 50 bbl, and 2 would be between from 50 bbl and 500 bbl.

We expect small spills would be contained or evaporate and dissipate quickly, and travel limited distances, reducing the likelihood of contacting northern sea otters. We conclude that small spills would be reasonably likely events but based on their limited size and other ameliorating factors, would have minimal effects to listed sea otters.

In addition to small spills, development activities carry the additional risk of large (greater than 1,000 bbl) spills and very large (greater than 150,000 bbl) spills. The DEIS (BOEM 2022bb) and BA (BOEM 2022a) provide detailed descriptions and Effects of the Action section above provides a summary of larger or very large oil spill effects.

The Recovery Plan for the Alaska DPS of northern sea otter concludes that due to the large spatial extent of the DPS, even a large spill from a crude oil tanker would be unlikely to affect a substantial proportion of the overall sea otter population (Service 2013a). Using this same rationale, we expect that impacts from oil spills caused by the Proposed Action are unlikely to result in population-level effects.

Therefore, the Service concludes the effects of all incremental steps, considered in the context of the status of the species, environmental baseline, and cumulative effects, are not reasonably likely to jeopardize the continued existence of Alaska DPS of northern sea otter by reducing appreciably the likelihood of survival and recovery of these species in the wild by reducing their reproduction, numbers, and distribution.

8.3 Sea Otter Critical Habitat

8.3.1 First Incremental Step

Impacts to the KKAPMU from activities authorized in the First Incremental Step of the proposed Action are anticipated to have at most only minor, short-term impacts to the PCEs, and therefore are not likely to diminish the function and conservation value of the critical habitat unit for northern sea otters. In addition, due to minimization measure designed to avoid disturbance within the critical habitat (e.g., prohibiting lessees from conducting seafloor disturbance within 1,000 m of areas designated as critical habitat), human presence and disturbance is not expected to prevent northern sea otters from accessing or utilizing critical habitat or associated PCEs.

Although small spills would be reasonably likely in the First Incremental Step, they are by definition so limited in size that oil or other spilled substances would likely evaporate, weather, or be mostly recovered. By virtue of their size, they are also likely to cover a limited areal extent and are unlikely to persist long enough to reach the KKAPMU if spilled elsewhere. Moreover, given the limited volumes of small spills, effects on the biological and physical features of the critical habitat would be short term and localized, and therefore would not diminish the function and conservation value of the KKAPMU for northern sea otters.

Spills of greater volume would not be likely to occur during the first increment. According to analysis by BOEM and BSEE, large and very large oil spills would be so unlikely during the First Incremental Step as to be considered not reasonably foreseeable. Thus, they are not considered to be direct or indirect effects of the first increment within the meaning of the ESA.

Activities that may result from the First Incremental Step that could affect critical habitat of southwest Alaska DPS northern sea otter include disturbance and exposure to oil spills. These effects would be expected to have at most only minor, short-term impacts to the PCEs and disturbance is not expected to prevent northern sea otters from accessing or utilizing the KKAPMU or associated PCEs. We have reached this conclusion based on the following: 1) BOEM modeling predicts low numbers and low volumes of small oil spills; 2) BOEM will prohibit lessees from discharging drilling fluids and cuttings and conducting seafloor disturbance including anchoring and placement of bottom founded structures, within 1,000 m of areas designated as critical habitat; 3) BOEM will require lessees to implement spill prevention and response measures, which will ensure spill out would be expected to be completely recovered or dissipated quickly; and 4) BOEM modeling predicts a large oil spill is unlikely to occur during the First Incremental Step.

8.3.1.1 Summary

After reviewing the current status of the critical habitat of Southwest Alaska DPS northern sea otter, the environmental baseline of critical habitat for the action area, the effects of the proposed oil and gas activities associated with Lease Sale 258 on critical habitat, and the cumulative effects, it is the Service's biological opinion that oil and gas activities associated with the first incremental step of Lease Sale 258, as proposed, is not likely to result in the destruction or adverse modification of critical habitat of the northern sea otter habitat such that it fails to retain the intended function and conservation role for which it was designated.

8.3.2 Conclusion for Future Incremental Steps

The direct loss of habitat caused by placing infrastructure in areas of sea otter critical habitat would be limited to a very small portion of the designated critical habitat. Burying one or more pipelines through critical habitat would disturb the benthos and the PCE of the marine benthic community but would affect only a very small proportion of critical habitat, and would likely pose a short-term effect, as the benthos would likely recolonize the area. Drilling muds and cuttings from exploration or production facilities on leases outside of critical habitat would leave footprints around well sites and would impact the surrounding benthos. These discharges could result in drifting sediments that affect the flora and fauna in the water column and underlying benthic community through toxicity or organic enrichment. While development, production, and other activities may adversely affect critical habitat, effects on the PCEs would be localized and would not diminish the function and conservation value of the critical habitat for the Alaska DPS of northern sea otter.

Small spills are, by definition, of low volume and would be largely recoverable; such spills would therefore have a limited dispersal distance. Small spills would also have to occur directly adjacent to or within critical habitat for effects to occur and expect few activities would be likely to occur there. Additionally, effects of such contamination would be minimized through oil evaporation, weathering, and recovery efforts. While it is possible that small spills may occur in areas adjacent to designated sea otter critical habitat, their effects on the PCEs would be short-term and localized and would not diminish the function and conservation value of the critical habitat for sea otters.

Large oil spills during future incremental steps could originate from platforms (and wells) and pipelines or from a loss of control incident followed by a long-duration flow. According to the OSRA model used by BOEM and BSEE, depending on the geographic origin of the spill, the chance of a large oil spill contacting sea otter critical habitat within 110 days, ranges from less than 0.5 percent to 64 percent. Thus, assuming a spill occurs, there would be an appreciable chance that oil would reach sea otter critical habitat. Combining the probability of one or more large spills occurring over the assumed life of the Leased Area, with that of oil from a large spill reaching sea otter critical habitat within 30 days, BOEM and BSEE estimate a range of less than 0.5 percent to 10 percent chance that one or more large spills will occur and contact sea otter critical habitat. The BOEM and BSEE conclude that a large spill could cause physical effects, which could likely alter the quality of the essential features of sea otter critical habitat PCEs or render the function of the critical habitat temporarily unsuitable.

Although the effects of a large spill could reduce the conservation value of the critical habitat unit for an unknown length of time, we expect the likelihood of this occurring to be low. For this level of impact to occur, all of the following would have to take place: 1) one or more large oil spill occurs; 2) the oil would have to contact and compromise a large portion of sea otter critical habitat and/or associated prey species, and; 3) no clean-up efforts would occur (the OSRA trajectory model is based on the movement of un-weathered oil with no mitigation from oil spill response activities. Further, should these events occur, the actual effects to sea otter critical habitat and its ability to support sea otters would depend on a variety of factors, including the amount of oil to reach sea otter critical habitat and efficacy of clean-up efforts. Based on this low likelihood of these factors all occurring, we do not expect the Proposed Action to result in a significant reduction in function of critical habitat for the norther sea otter.

The Service concludes the effects of all incremental steps, considered together with uncertainty regarding the scale of potential development and oil spills, and in the context of the status of the critical habitat, environmental baseline, and cumulative effects, are not reasonably likely to destroy or adversely modify sea otter critical habitat, and the critical habitat would retain the intended function and conservation role for which it was designated.

8.4 Conclusion for the Entire Proposed Action

After reviewing the current status of Steller's eider, the environmental baseline for the action area, the effects of the proposed Cook Inlet Oil and Gas Lease Sale 258 and the cumulative effects, it is the Service's biological opinion that the lease sale, as proposed, is not likely to jeopardize the continued existence of the Steller's eider or the Southwest Alaska DPS of northern sea otter by reducing appreciably their likelihood of survival and recovery in the wild by reducing their reproduction, numbers, and distribution. The Service concludes the effects of all incremental steps, considered together with uncertainty regarding the scale of potential development and oil spills, and in the context of the status of the critical habitat, environmental baseline, and cumulative effects, are not reasonably likely to destroy or adversely modify sea otter critical habitat, and the critical habitat would retain the intended function and conservation role for which it was designated.

The Service concludes that the effects of the proposed lease sale are:

- Not likely to jeopardize the continued existence of the federally threatened Alaska breeding Steller's eider or the federally threatened Southwest Alaska DPS of northern sea otter, and

- Not reasonably likely to destroy or adversely modify critical habitat for the Southwest Alaska DPS of northern sea otter.

8.5 Future Consultation

Consultation prior to future incremental steps in this phased oil and gas process is required to fully evaluate actions beyond exploration and delineation of the oil field. As stated previously, considerable uncertainty regarding specific future activities exists. Therefore, when future incremental steps are proposed with specific information about the nature and extent of proposed activities, including the scale and location of activities and description of specific technology to be employed to reduce oil spill risk, more precise estimation of the actual risk of impacts to listed species and critical habitat will be possible. A s a result, formal section 7 consultation to evaluate specific proposals in future incremental steps will be crucial.

8.6 Avoiding Jeopardy and Destruction/Adverse Modification in Future Incremental Steps

Under the incremental step consultation approach, BOEM and BSEE have continuing obligations to:

- Avoid irreversible or irretrievable commitment of resources that would prevent implementation of reasonable and prudent alternatives to the Action at a later date; and
- Obtain sufficient data upon which to base the final BO(s) for future incremental steps.

It is incumbent upon BOEM and BSEE and lessees proposing to develop oil and gas resources associated with Lease Sale 258 to design future proposed production projects that are not likely to result in jeopardy or destruction or adverse modification of critical habitat. Therefore, BOEM and BSEE and the oil and gas industry must remain fully aware of the need to consult on other future increments, and the requirement for additional jeopardy or destruction and adverse modification analysis by the Service for all future incremental steps. Further, BOEM and BSEE and the oil and gas industry should recognize their obligations to incorporate effective avoidance, minimization, and mitigation measures into their future proposed actions to reduce take and avoid jeopardy or destruction or adverse modification of critical habitat from development and production and the impacts of potential oil spills.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

In June 2015, the Service finalized new regulations implementing the incidental take provisions of section 7(a)(2) of the ESA. The new regulations also clarify the standard regarding when the Service formulates an Incidental Take Statement [50 CFR 402.14(g)(7)], from "…if such take may occur" to "…if such take is reasonably certain to occur." This is not a new standard, but merely a clarification and codification of the applicable standard that the Service has been using and is consistent with case law. The standard does not require a guarantee that take will result; only that the Service establishes a rational basis for a finding of take. The Service continues to rely on the best available scientific and commercial data, as well as professional judgment, in reaching these determinations and resolving uncertainties or information gaps.

This Incidental Take Statement is limited to take caused by the First Incremental Step for Steller's eiders and the Southwest Alaska DPS of northern sea otter. Take caused by Future Incremental Steps will be analyzed and included in an Incidental Take Statement in a future formal consultation. This Incidental Take Statement is further limited to otherwise lawful activities; therefore, take caused by oil spills, which are not lawful activities, are not included here and are not exempted from section 9 of the ESA.

9.1 Steller's Eiders

We anticipate that some Steller's eiders could be taken as a result of the proposed action. We expect the incidental take to be in the form of disturbance, injury, or mortality. This Incidental Take Statement provides exemption for incidental take only for activities in the first incremental step of the action. The BOEM must continue consultation for future incremental steps and should reinitiate consultation if the take threshold is exceeded. As described in the *Effects of the Action*, activities during the First Incremental Step may adversely affect Alaska-breeding Steller's eiders through habitat loss, disturbance, collisions, and pollution through discharges into the marine environment. Of these, collisions are the most likely cause of mortality to eiders.

We cannot quantify the precise number of Steller's eiders that may be taken as a result of the actions that the BOEM has proposed because Steller's eiders occur in different areas depending on the season. Risks to these species not only depend on the season but also on potential intersection of vessel routes with migration routes, and risk of strikes increase with rough weather, darkness, fog, and vessel lights. There is additional uncertainty in the precise locations of exploration and delineation drilling that will occur during the first incremental step of the lease sale. While protective measures may minimize the risk of mortality or injury to individuals, some mortality or injury may go undetected if it's dark, if birds fall into the water, or behind a vessel in motion.

Consequently, we are unable to reasonably anticipate the actual number of Steller's eiders that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to Steller's eiders would likely be low given the nature of the proposed activities, and we, therefore, anticipate that take of Steller's eiders would also be low. We also recognize that for every Steller's eider found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level, we are anticipating that the actual take would be higher, and we set the number below that level. Similarly, for estimating the number of Steller's eiders that would be taken by habitat loss, disturbance, and pollution, we cannot predict how many may be encountered.

As collisions are the most likely cause of eider mortality, we estimate and provide lethal incident take exemption from collisions during exploration and delineation of the oil field in the first incremental step. We expect in a typical year one eider may be subject to take as a result of collisions. However, we do not expect this to be an annual occurrence. Therefore, we estimate and provide lethal incidental take exemption for up to, but no more than, one Steller's eider per year and a cumulative total of three Steller's eiders from collisions with human-made structures over the course of the first incremental step (See Appendix A for methods). This take estimate is lower than BOEM LS 244 because the amount of vessel traffic expected during the First Incremental Step for LS 258 is reduced compared to LS 244. The lower number of vessels expected per year resulted in less anticipated take due to vessel collisions.

It will be impossible to determine if a dead or injured Steller's eider belongs to the listed breeding population. Therefore, we conservatively use this number as the anticipated effect of the action for the purposes of the reinitiation threshold. If more than one (1) Steller's eider are found dead or injured during any single year or if cumulatively more than three (3) Steller's eiders are found dead or injured during the entire period of the First Incremental Step, BOEM and BSEE must contact our office immediately to reinitiate formal consultation. Contact information is provided in Chapter 12, Reporting Requirements. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

9.2 Southwest Alaska DPS Northern Sea Otter

We anticipate that some sea otters could be taken as a result of the proposed action. We expect the incidental take to be in the form of disturbance, injury, or mortality. We cannot quantify the precise number of sea otter that may be taken as a result of the actions that BOEM has proposed because sea otters move over time and their site selection can vary considerably over the course of a year; for example, during summer sea otters are more likely to be found in open waters whereas during winter, sea otters prefer protected bays and inshore waters. Concentrations of sea otters within these areas may make a greater number susceptible to effects of the Action. While in open water, sea otters may occur as individuals, as mother and a pup, or are also known to spend time in high density rafts or groups of typically up to 20, and rarely up to 300 to 500, animals in the Cook Inlet area (Doroff and Badajos, 2010). The protective measures proposed by BOEM and BSEE are likely to prevent mortality or injury of most individuals.

Consequently, we are unable to reasonably anticipate the actual number of Southwest Alaska DPS northern sea otter that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to Southwest Alaska DPS northern sea otter would likely be low given the nature of the proposed activities, and we, therefore, anticipate that take of Southwest Alaska DPS northern sea otter would also be low. We also recognize that for every Southwest Alaska DPS northern sea otter found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level, we are anticipating that the actual take would be higher, and we set the number below that level.

Based on the expected annual effects of vessel and air traffic, seismic survey noise, and seafloor or other disturbance from exploration and delineation drilling, we anticipate that in most years (3 out of 5) up to one raft of sea otters may be affected by project activities during the First Incremental Step (Years 1 to 5), though these may not necessarily be representative of estimated effects annually. Effects may vary by project activity and expected take in each year may be related to the proportion of each project component occurring in each year. In addition, many project activities are progressive (e.g., they depend on results or completion of the previous activities), resulting in uncertainty in the timing, duration, and completion of each year's scope of work. Because activities will occur during a limited amount of time and in a localized region, disturbance from these activities is also expected to be temporary and localized, with disturbance effects to a few sea otters or up to tens of listed sea otters. Sea otters exposed to sound produced by the project are likely to respond with temporary behavioral modification or displacement.

Project activities could temporarily interrupt feeding, resting, and movement of sea otters and anticipated effects are short-term behavior reactions and displacement of otters (Service 2019). Animals that encounter the specified activities may exert more energy than they would otherwise due to temporary cessation of feeding, increased vigilance, and retreat from the project area. We expect that affected sea otters would tolerate this exertion without measurable effects on health or reproduction. Most of the anticipated incidental take would be due to short-term harassment in the form of TTS, startling reactions, or temporary displacement.

Because sea otter distribution can vary significantly from year to year, levels of impacts will also vary from year to year, and therefore we also anticipate the number of sea otter rafts affected could vary between one to three rafts. We anticipate that all individuals occurring in a raft would be subject to take in the form of disturbance or harassment. The typical sea otter raft size is 20 animals; therefore, we expect that up to 60 animals would be non-lethally harassed (disturbed) annually although we do not expect this to be an annual occurrence. Of these 60 individuals, we expect that a small percentage might suffer injury or death. Although we cannot predict a precise proportion of individuals that might suffer injury or death, we expect one to two sea otters may be the subject of take in a given year. However, we do not expect this to be an annual occurrence; we anticipate this could occur in approximately half the years. Therefore, we estimate and provide lethal incidental take exemption for up to two sea otters per year, and a cumulative total of six sea otters over the course of the first incremental step. Therefore, if more than two (2) adult, subadult, or juvenile Southwest Alaska DPS northern sea otter are found dead or injured during any single year or if cumulatively more than six (6) adult, subadult, or juvenile Southwest Alaska DPS northern sea otter are found dead or injured during the entire period of the First Incremental Step, BOEM and BSEE must contact our office immediately to reinitiate formal consultation if more than two (2) adult, subadult, or juvenile Southwest Alaska DPS northern sea otter are found dead or injured during any single year or if cumulatively more than six (6) adult, subadult, or juvenile Southwest Alaska DPS northern sea otter are found dead or injured during the entire period of the First Incremental Step. Contact information is provided in Chapter 12, Reporting Requirements. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

This biological opinion and associated Incidental Take Statement are only valid when paired with an accompanying Letter of Authorization to allow harassment of northern sea otters pursuant to the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq).

10 REASONABLE AND PRUDENT MEASURES

The measures described below are non-discretionary and must be undertaken by BOEM and BSEE or made binding conditions of any grant or permit issued to the (applicant), as appropriate, for the exemption in section 7(o)(2) to apply. The BOEM and BSEE have a continuing duty to regulate the activity covered by this incidental take statement. If BOEM and BSEE: (1) fail to assume and implement the terms and conditions or (2) fail to require the lessee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, BOEM or BSEE must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

These Reasonable and Prudent Measures (RPMs) and their implementing Terms and Conditions (T&Cs) aim to minimize the incidental take anticipated for the First Incremental Step (marine deep-penetration surveys, high-resolution activities, and exploratory and delineation drilling) of the proposed Action. Additional RPMs will be developed and implemented during consultation on future incremental steps in this project.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of Alaska-breeding Steller's eiders and Alaska DPS of northern sea otter:

- RPM 1 – The BOEM and BSEE must ensure that the amount and form of incidental take of Steller's eiders is commensurate with the analysis contained within this biological opinion by coordinating with the Service to develop and implement strategies to avoid and minimize bird collisions.
- RPM 2 – The BOEM and BSEE must monitor and report oil spills to the Service to improve understanding of risk and impacts.
- RPM 3 – The BOEM and BSEE must ensure that the amount and form of incidental take of the Southwest Alaska DPS of northern sea otters is commensurate with the analysis contained within this biological opinion by coordinating with the Service to develop and implement strategies to avoid and minimize harassment and disturbance to sea otters.

11 TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, BOEM and BSEE must comply with the following terms and conditions (T&C), which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

T&C 1 – The following T&Cs implement RPM 1:

1) The BOEM and BSEE shall work with the Service to develop a lighting plan, as suggested in the EIS (BOEM 2022b). The BOEM and BSEE must require lessees and their contractors to implement lighting protocols on MODUs and vessels aimed at minimizing outward radiation of light. Measures to implement lighting protocols which minimize outward light radiation would reduce the risk of collision to Steller's eiders. The objective is to minimize the radiation of light outward from exploration vessels and structures while operating on a lease or if staged within or moving through nearshore Federal waters. The BOEM shall require lessees to provide a written statement of measures that will be or have been taken to meet the lighting plan's objectives. This information must be submitted to BOEM and BSEE with an exploration plan when it is submitted for regulatory review and approval pursuant to 30 CFR 550.203 or at least 30 days prior to vessel activities that do not require an exploration plan.
2) The BOEM and BSEE must require their lessees, permittees, and agents of their lessees and permittees to minimize the use of high-intensity work lights, especially inside the 20 m bathymetric contour. Measures to implement lighting protocols which minimize outward light radiation on vessels and MODUs would reduce the risk of collision to Steller's eiders. Exterior lights will only be used as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather; otherwise, they will be turned off. Interior and navigation lights should remain on as needed for safety or per U.S. Coast Guard requirements. The BOEM and BSEE shall work with the Service to develop a lighting plan, as suggested in the EIS (BOEM 2022b).
3) The BOEM and BSEE must require their lessees, permittees, and agents of their lessees and permittees, to report Steller's eider mortalities or collisions with vessels or drilling structures within 3 days to BSEE and BOEM, who will then provide these avian collisions and mortality reports to the Ecological Services Branch Chief, Southern Alaska Fish and Wildlife Field Office (SAFWFO) within 7 days. Minimum information for encounter reporting will include species, date and time, location, weather, identification of the vessel or drilling structure involved and its operational status when the encounter occurred, and one or more photographs (or a statement explaining why obtaining a photograph of a bird was not possible). The SAFWFO shall be contacted regarding the recovery or transport of dead birds. See Disposition of Dead or Injured Specimens in Chapter 12.

T&C 2 – The following T&Cs implement RPM 2:

1) The BSEE must report oil spills greater than 1 bbl, as defined by 30 CFR 254.46, if the spill contacted water or ice, to the Ecological Services Branch Chief, SAFWFO, within 7 days. A follow-up report by BSEE is required within 30 days after the first report if the oil contacted any Steller's eiders in the area, including information on number birds contacted, their behavioral response and fate, and other circumstances relevant to the impact of contact.
2) The BOEM and BSEE must require their lessees to develop an oil and gas spill response plan and have it approved by BOEM, BSEE, and the Service. Spill response plans should be submitted to the Service for review and approval at least 30 days prior to the start of work.

T&C 3 – The following T&Cs implement RPM 3:

1) The BOEM and BSEE must require their lessees, permittees, and agents of their lessees and permittees, to report sea otter collisions with vessels within 3 days to BSEE who will then provide these sea otter encounter reports to the Ecological Services Branch Chief, SAFWFO, within 7 days. Minimum information for sea otter encounter reporting will include species, date and time, location, weather, identification of the vessel or drilling structure involved and its operational status when the encounter occurred, and one or more photographs (or a statement explaining why obtaining a photograph of any particular sea otter was not possible). The SAFWFO shall be contacted regarding the recovery or transport of dead northern sea otters.
2) The BOEM and BSEE must require their lessees, permittees, and agents of their lessees and permittees to apply the appropriate disturbance radii specified in Table 9 (section 2.1.13; copied below) in order to establish those noise thresholds that prevent exposure to noise exceeding harassment and injury to prevent take (NMFS 2018a, 2018b, 2018c, 2019, 2020, 2021, 2023; Ruppel et al. 2022).

Table 14 Exclusion and Safety Zones for Activities Monitored by Protected Species Observers

Activity	Exclusion Zone (m)	Safety Zone (m)
2D/3D Deep Penetrating Seismic	500	1,500[7]
Chirp sub-bottom profiler, boomer, sparker	100	1,500[7]
Vertical Seismic Profiling (VSP)	500	1,500[7]
Other High Resolution Geophysical equipment[1]	N/A	500
Drilling and Well construction activities[2,8]	N/A	500
Tug towing rig[3,8]	N/A	1,500[7]
Dynamic Positioning (DP) thrusters[4,8]	N/A	1,500[7]
Aircraft in route[5]	N/A	500
Aircraft Take off or Landing from Rig[6,8]	N/A	500

Note: If the activity has an EZ, the operator will shut down the activity if one or more sea otters is expected to enter or is observed within the associated EZ zone.

1 The small-radius shutdown zones produced by these sources are impractical to implement and monitor because most of

the ensonified area is occupied by the vessel. However, the PSO will monitor a radius of 500 m prior to deployment and ensure no sea otters are within this area.

2 A PSO will monitor waters within 500 m of drilling and well construction sites 30 minutes prior to startup of any activities that produce in- water sound to ensure sea otters are not within the zone and exposed to an abrupt increase in sound level.

3 Tug operations cannot discontinue controlling rig transport without causing risk to life, property, or the environment, but PSOs will continue to monitor for, and report on, the presence of sea otters within 1,500 m of a tug.

4 If the use of dynamic positioning (DP) thrusters is anticipated, a PSO will monitor the zone for 30 minutes prior to the vessel engaging the DP thrusters to ensure no sea otters are within or are likely to enter the zone. Prior to the arrival of a vessel that is likely to engage its DP thrusters, the PSO will monitor waters within 1,500 m of the vessel for 30 minutes and will ensure that the vessel arrival at the modular offshore drilling unit (MODU) occurs when this zone is devoid of sea otters (or at a portion of the tide cycle that will not require the use of DP thrusters).

5 All aircraft (excluding aircraft participating in pre-seismic aerial surveys) will maintain an altitude of 457 m or higher, to the extent practical, while maintaining Federal Aviation Administration flight rules (e.g., avoidance of cloud ceiling, etc.), excluding take-offs and landings.

6 A PSO on the MODU will monitor a 500-m zone around the MODU prior to landings and take-offs and will contact the helicopter pilot calling for a delay in approach and landing or take-off if any sea otters are within or are likely to enter the 500-m radius zone during aircraft operations.

7 The Level B zone is larger than the SZ.

8 Either a PSO, diver, or crewmember can monitor the SZ.

12 REPORTING REQUIREMENTS

Pursuant to 50 CFR 402.14(i)(3), BOEM and BSEE must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement. The BOEM and BSEE must ensure submittal of the following reports:

12.1 Notable Events Reporting

The BOEM and BSEE must submit an informal written report within 24 hours, such as electronic mail, for any notable event including injury or mortality of a listed species, biologically important observations associated with a listed species, implementation of any of the Conservation Recommendations listed below, etc. Electronic mail reports can be submitted to Libby Benolkin at elizabeth_benolkin@fws.gov and to the SAFWFO general delivery mailbox at ak_fisheries@fws.gov. Please include the consultation number (2023-0025961) in the subject line of the correspondence. Notable Events include such events including, but not limited to:

- Any injury or mortality to a listed species
- Observation of large rafts (40) of Steller's eiders or northern sea otters in close proximity (as per T&C 3.2) to EDS activities.
- Occurrence of any spill of a size greater than 50 barrels

12.2 Annual Reporting

The BOEM, Alaska OCS Region, must submit an Annual Monitoring Report for each year, by March 1st of the following year, to the Ecological Services Branch Chief, SAFWFO, and the Regional Supervisor, Environment, BSEE, Alaska OCS Region. The purpose of this report is to monitor the effectiveness of RPMs and T&Cs and effects of the First Incremental Step on listed species and critical habitat. The Annual Monitoring Report will include the following information on incidents observed:

- A summary of injuries, mortalities, or collisions involving Steller's eiders or sea otters reported during the previous calendar year.
- A summary of all reported discharges, leaks and spills greater than or equal to 1 barrel for the preceding calendar year.
- A summary of support vessels and aircraft entries into the Action Area.
- A summary of any incidences of non-compliance issued to the lessees and permittees of BOEM or BSEE and the agents of their lessees and permittees for activities conducted in the preceding year. If new incidents of non-compliance from previous years emerge, report these incidents in the next annual report; and
- A summary of efforts by BOEM and BSEE to implement Conservation Recommendations (see below).

The annual report should also include summaries of operational activities, as proposed and specified by BOEM and BSEE (BOEM 2016b):

- Summaries of monitoring effort (e.g., total hours, total distances, and sea otter distribution through study period versus operational state, sea state, and other factors affecting visibility and detectability of sea otters).
- Summaries of the occurrence of shutdowns, ramp-ups, and ramp-up delays.
- Analyses of the effects of various factors, influencing detectability of sea otters (e.g., sea state, number of observers, and fog or glare).
- Species composition, occurrence, location, and distribution of sea otters, including date, water depth, mammal numbers, age/size/gender categories (if determinable), group sizes, and ice cover.
- Sighting rates of sea otters versus operational state (and other variables that could affect detectability), including:
  - Initial sighting distances versus operational state.
  - Closest point of approach versus operational state.
  - Observed behaviors and types of movements versus operational state.
  - Numbers of sightings/individuals seen versus operational state; and
  - Distribution around the acoustic source vessel versus operational state.
- Estimates of take by harassment. To ensure a conservative approach to estimation of take, reports will include possible Level B take by harassment.
  - Number of takes estimated using the following methods to provide both minimal and maximal estimates:
    - The minimum estimate based on the numbers of sea otters directly seen within the safety zone and the Level B zone by observers on the source vessel during activities.

        - The maximal estimate calculated using densities of sea otters from data collected during (a) vessel-based surveys in non-operational areas, or (b) observations from the source vessel or supply boats during non-operational periods. The estimated densities in the observable monitoring zone in areas without data acquisition activity are applied to the amount of area exposed to the relevant levels of sound to calculate the maximum number of animals potentially exposed.
    - The total count of all behavioral responses which may indicate harassment by disruption of behavioral patterns:
        - For Steller's eiders these behaviors have not been specifically identified but may include flying away from preferred foraging and resting sites, disrupting foraging, or disturbance during resting periods.
        - For sea otters (84 FR 37725, August 1, 2019):
            - Responses which may indicate the potential for disturbance by disruption of behavioral patterns (Level B)
                - ✓ Swimming away at a fast pace on belly (*i.e.,* porpoising)
                - ✓ Spyhopping repeatedly in an agitated manner while swimming away (or in the case of a pup, spyhopping repeatedly while hiding behind and holding onto its mother's head)
                - ✓ Abandoning prey or feeding area
                - ✓ Ceasing to nurse and/or rest (applies to dependent pups)
                - ✓ Ceasing to rest (applies to independent animals)
                - ✓ Ceasing to use movement corridors along the shoreline
                - ✓ Ceasing mating behaviors
                - ✓ Shifting/jostling/agitation in a raft so that the raft disperses or sudden diving of an entire raft
                - ✓ One-time flushing off a haulout
                - ✓ Brief separation of mother and pup
            - Responses by sea otters which may indicate the potential for injury (Level A)
                - ✓ Prolonged or permanent separation of mother and pup (*i.e.,* mother and pup vocalizing repeatedly)
                - ✓ Repeated flushing off a haulout or repeated dispersal/diving of raft
                - ✓ Prolonged fleeing from pursuit

12.3 Disposition Of Dead or Injured Specimens

Pursuant to 50 CFR 402.14(i)(1)(v), upon locating a dead or injured Steller's eider or sea otter, initial notification within 3 working days of its finding must be made by telephone and in writing to the SAFWFO (907-271-2888 and ak_fisheries@fws.gov). The report must include the date, time, location of the carcass, a photograph, cause of death or injury, if known, and any other pertinent information. If the carcass is reasonably fresh (not in an advanced state of decay) a reasonable effort should be made to recover it and keep in cold storage (refrigerated or frozen) until SAFWFO can be contacted.

The BOEM and BSEE, or the lessee must take care in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. The BOEM and BSEE, or the lessee must transport injured animals to a qualified veterinarian. Should any treated Steller's eider or sea otter survive, BOEM and BSEE or the lessee must contact the Service regarding the final disposition of the animal(s).

13 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1) The BOEM should work with the oil and gas industry to develop and improve technologies for reducing migratory bird collisions with offshore and onshore oil and gas development infrastructure, particularly for Steller's eiders;
2) The BOEM should work with the oil and gas industry to improve technologies to reduce the risk of and effects from oil spills in Cook Inlet;
3) The BOEM should work with the Service and the oil and gas industry to improve technologies and strategies to prevent spilled oil from contacting listed species in the event of a large marine spill in Cook Inlet;
4) The BOEM should work with the Service to characterize the distribution and use of marine habitats and over-wintering areas of Steller's eiders in Cook Inlet;
5) The BOEM should work with the Service to conduct monitoring of abundance, trends, habitat use, and productivity of listed species to assist with understanding potential effects of human activities on populations in Cook Inlet.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

14 REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the BA of Oil and Gas Activities associated with Lease Sale 258 (BOEM 2022a). As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9.

Consequently, we recommend that any operations causing such take cease pending reinitiation.

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16 APPENDICES

16.1 Appendix A. Steller's Eider Incidental Take Statement Methods

Comparing collision data of eiders to population estimates provides a method to determine strike rates (the percentage of the population killed per year by collision). The collision rate can be used as a surrogate to assess potential impacts to Steller's eiders by converting it to a percentage and applying it to the estimated population size of listed eiders that may migrate past a structure. This same methodology was applied to estimating collision risk for listed eiders as part of the Service's Biological Opinion (BO) for oil and gas activities associated with lease sale 193 (Service 2015b) and lease sale 244 (Service 2016).

Although limited, the best available data for estimating collision risk to Steller's eiders for Lease Sale 258 is bird encounter data recorded during Shell's 2012 exploratory drilling season in the Chukchi Sea. Ten vessels operating in the Chukchi Sea for 108 days recorded 131 total bird-vessel encounters, 17 of which were fatal collisions between eiders (13 king and 4 common eiders) and vessels. Of these 17 collisions, 2 involved mobile offshore drilling units, while the other 15 involved support vessels, which are reasonably similar to other vessels transiting for proposed research, fishing, freight haul, etc. Considering that 10 vessels were involved in 15 fatal eider collisions, we estimate average collision rate per vessel to be 1.5 (i.e., 15 ÷ 10 = 1.5 collisions/vessel) over a 108-day season. Two modules were involved in two collisions, so we estimate the average collision rate per MODU to be 1 (i.e., 2 ÷ 2 = 1 collision/MODU) over a 108-day season.

Assuming that Steller's eiders are equally vulnerable to collisions as king eiders and common eiders, and because there is no basis to assume otherwise, we would expect collisions to occur in proportion to species abundance. Based on a total of 673,486 eiders (499,423 king and 174,063 common eiders) recorded during migration counts near Barrow in late summer and fall 2002 (best available data; Quakenbush et al. 2009), we very roughly estimate the risk of collision to be:

- 1 collision/MODU ÷ 673,486 eiders = 0.0000015 collisions per MODU
- 1.5 collisions/vessel ÷ 673,486 eiders = 0.0000022 collisions per vessel

We can then approximate the number of potential collisions for Steller's eiders by applying these rates for king and common eiders to estimates of Steller's eiders in Cook Inlet (Larned 2006).

Peak abundance estimates of Steller's eiders in Cook Inlet vary by year and time of year. The survey maximum and minimum estimates for Steller's eiders in Cook Inlet are 5,783 and 739 (Larned 2006). To not underestimate take, we use the maximum Steller's eider abundance estimate to derive Steller's eider collision rate with MODUs and vessels.

- 5,783 Steller's eiders x 0.0000015 collisions/MODU = 0.0087 Steller's eider collisions/MODU per season
- 5,783 Steller's eiders x 0.0000022 collisions per vessel = 0.013 Steller's eider collisions per vessel per season

To adjust this number to reach a daily collision rate, we divide by the length of the season for which we have data (108 days).

- 0.0087 Steller's eider collisions per MODU per season ÷ 108 days = 0.000081 MODU collisions per day
- 0.013 Steller's eiders collisions per vessel per season ÷ 108 days = 0.00012 vessel collisions per day

We can then approximate the number of collisions expected by applying collision rates to the number of vessels anticipated during the first incremental step. The BOEM estimates exploration drilling operation will employ one MODU for the 3 years of exploratory drilling operations (years 3-5).

- 0.000081 MODU x 300 days x 1 MODU = 0.024 Steller's eiders collisions with MODUs

The number of vessels during the first incremental steps vary by year. A maximum of 17 vessels for deep penetrating survey (assuming one for marine mammal monitoring; year 1), 2 for geohazard and geotechnical survey (assuming one for marine mammal monitoring; year 2-5), 2 resupply vessels (years 3-5), 6 vessels for oil spill response exercises (years 3-5). We calculate a collision estimate according to Table A-1.

Table A-1 Calculations for Collisions Estimates with Vessels

Year	Vessels	Collision Rate (per vessel per day)	Season Length (days)[1]	Steller's Eider Collisions Estimate[2]
1	17	0.00012	300	0.61
2	2	0.00012	300	0.072
3	10	0.00012	300	0.36
4	10	0.00012	300	0.36
5	10	0.00012	300	0.36
			Total Collisions	1.762

Notes: [1] The season length is based on the approximate length of time Cook Inlet would be ice free (generally March through December).
[2] Calculated by multiplying: vessels x collision rate x season length.

To determine the total number of individual eiders expected to collide with vessels, we round the Steller's eider collision estimate for MODUs and vessels to the nearest whole number individuals (because you cannot have a fraction of a bird). Therefore, we estimate approximately one Steller's eider collisions with MODUs and two Steller's eiders collisions with vessels for a total of three Steller's eider collisions during the first incremental step.

The reliability of these estimates may be limited by several factors. For example, 1) collisions are often episodic, and those resulting from light attraction in inclement weather may be particularly so, such that observations collected on a few structures/vessels in a single year may not be representative of collision rates in general, 2) monitoring for collisions is difficult and an unknown number of collisions may go undetected, even by trained bird observers, and 3) low visibility often coincides with increased collisions (Ronconi et al. 2015), which may increase the number of undetected collisions. However, these estimates are based on the best information available.