Alaska Outer Continental Shelf

Biological Assessment
Oil and Gas Activities Associated with Lease Sale 193

Spectacled Eider, Spectacled Eider Critical Habitat,
Alaska-breeding Steller's Eider, and Polar Bear

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ACRONYMS AND ABBREVIATIONS

2D ....Two-dimensional
3D ....Three-dimensional
A-C ....Alaska-Chukotka
ACIA ....Arctic Climate Impact Assessment
ACP ....Alaska Coastal Plain
ADEC ....Alaska Department of Environmental Conservation
ADFG ....Alaska Department of Fish and Game
ADOG ....Alaska Division of Oil and Gas
agl ....Above ground level
AKR ....Alaska Region
AMAP ....Arctic Monitoring and Assessment Programme
ANCSA ....Alaska Native Claims Settlement Act
ARBO ....Arctic Region Biological Opinion
ASAMM ....Aerial Surveys for Arctic Marine Mammals
ASAP ....Alaska Stand-alone Gas Pipeline
asl ....Above sea level
BA ....Biological Assessment
bbl ....Barrels of oil
Bbbl ....Billion barrels of oil
BE ....Biological Evaluation
BLM ....Bureau of Land Management
BMP ....Best Management Practice
BO ....Biological Opinion
BOEM ....Bureau of Ocean Energy Management
BOEMRE ....Bureau of Ocean Energy Management, Regulation, and Enforcement
BOP ....Blow-out Preventer
BS ....Boundary Segment
BSEE ....Bureau of Safety and Environmental Enforcement
CFR ....Code of Federal Regulations
CH ....Critical Habitat
CHIRP ....Compressed High Intensity Radar Pulse
CI ....Confidence Interval
CITES ....Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm ....Centimeter(s)
COMIDA ....Chukchi Sea Offshore Monitoring in Drilling Area
CPUE ....Catch Per Unit Effort
CS ....Chukchi Sea
CSESP ....Chukchi Sea Environmental Studies Program
cm^3 ....Cubic inch(es)
CV ....Coefficient of Variation
CWA ....Clean Water Act
dB ....Decibels
DDT ....Dichlorodiphenyltrichloroethane
DEW ....Distant Early Warning
DFO ....(Canadian) Department of Fisheries and Oceans
DNR ....Alaska Department of Natural Resources
DNV ....Det Norske Veritas
DP ....Dynamically positioned
DPP ....Development and Production Plan
DTAGS ....Deep-Towed Acoustics/Geophysics System
DWH ....Deepwater Horizon
EEZ ....Exclusive Economic Zone
EIS ....Environmental Impact Statement

EP .... Exploration Plan
EPA .... Environmental Protection Agency
ERA .... Environmental Resource Area
ERL .... Effects Range Low
ERM .... Effects Range Median
ERMA .... Environmental Response Management Application
ESA .... Endangered Species Act
EVOS............................ Exxon Valdez Oil Spill
EWC .... Eskimo Walrus Commission
FEIS.............................. Final Environmental Impact Statement
FLIR .... Forward-looking Infrared
FR .... Federal Register
ft.................................... Feet
FWS.............................. Fish and Wildlife Service
g .... Gram(s)
G&G .... Geophysical and Geotechnical
gal .... Gallon(s)
GHG .... Greenhouse Gas(es)
GLS .... Grouped Land Segment
GPS............................... Global Positioning System
Hz .... Hertz
I-I .... Inuvialuit-Inupiat
IAOGP.......................... International Association of Oil and Gas Producers
IHA............................... Incidental Harassment Authorization
IPCC .... International Panel on Climate Change
IPF .... Impact-producing factor
ITA .... Incidental Take Authorization
ITL................................ Information to Lessees (Clauses)
ITR................................ Incidental Take Regulation
IUCN .... International Union for Conservation of Nature
IWC .... International Whaling Commission
kg .... Kilogram
kHz .... Kilohertz
km................................. Kilometer(s)
kn .... Knots
L.................................... Liter(s)
LA................................. Launch Area
LACS............................ Low-level Acoustic Combustion Sources
LBCHA .... Ledyard Bay Critical Habitat Area
LNG.............................. Liquefied natural gas
LOA.............................. Letter of Authorization
LOWC .... Loss of Well Control
LS .... Land Segment
µg.................................. Microgram(s)
µPa................................ MicroPascal (s)
m .... Meter(s)
Mbbl .... Thousand barrels of oil
MBTA .... Migratory Bird Treaty Act
Mcf .... Thousand cubic feet
mi.................................. Mile(s)
min................................ Minute(s)
MLC .... Mudline Cellar
mm................................ Millimeter(s)
MMbbl.......................... Million barrels of oil
MMC .... Marine Mammal Commission
MMcf............................ Million cubic feet

MMO.............................Marine Mammal Observer
MMPA...........................Marine Mammal Protection Act
MMS..............................Minerals Management Service
MODU...........................Mobile Offshore Drilling Unit
ms.................................Millisecond(s)
MSY..............................Maximum Sustainable Yield
NEPA............................National Environmental Policy Act
NMFS............................National Marine Fisheries Service
nmi................................Nautical mile(s)
NOAA...........................National Oceanographic and Atmospheric Administration
NPDES..........................National Pollutant Discharge Elimination System
NPR-A...........................National Petroleum Reserve in Alaska
NRC..............................National Research Council
NSB...............................North Slope Borough
NSPDWM.....................North Slope Borough Department of Wildlife Management
NSE...............................North Slope Eider
NSIDC...........................National Snow and Ice Data Center
NTL...............................Notice to Lessees
OBC...............................Ocean-based Cable
OC.................................Organochoride
OCS...............................Outer Continental Shelf
OCSLA..........................Outer Continental Shelf Lands Act
OSRA............................Oil Spill Risk Analysis
OSRP.............................Oil Spill Response Plan
PAC...............................Poly-aromatic compound
PAH...............................Poly-aromatic hydrocarbon
PBTE.............................Polybrominated diphenyl ether
PCB...............................Polychlorinated biphenyl
PCE................................Primary Constituent Element
PL..................................Pipeline Segment
POP................................Persistent Organic Pollutants
ppb.................................Parts per billion
psi..................................Pounds per square inch
PSO................................Protected Species Observer
PTS................................Permanent Threshold Shift
ROD..............................Record of Decision
ROP...............................Required Operating Procedures
RS/FO............................Regional Supervisor, Field Operations
RSL................................Received Sound Level
SBS................................Southern Beaufort Sea
SD..................................Standard Deviation
SE..................................Standard Error
sec..................................Second(s)
SEIS...............................Supplemental Environmental Impact Statement
SEL................................Sound Exposure Level
SPL................................Sound Propagation Level(s)
SSV................................Sound Source Verification
t......................................Ton(s)
TA&R............................Technology Assessment & Research Program
TAPS.............................Trans-Alaska Pipeline System
Tcf.................................Trillion cubic feet
TTS................................Temporary Threshold Shift
UERR............................Undiscovered Economically Recoverable Resources
UME..............................Unusual Mortality Event
USACE..........................U.S. Army Corps of Engineers
USC...............................United States Code

USCG .... U.S. Coast Guard
USDOC .... U.S. Department of Commerce
USDOI.......................... U.S. Department of the Interior
USGS............................ U.S. Geological Survey
USSR............................ Union of Soviet Socialist Republics
VGP.............................. Vessel General Permit
VLOS............................ Very Large Oil Spill
VMS .... Vessel Monitoring System
VSM .... Vertical Support Member
VSP............................... Vertical Seismic Profiling
WCD............................. Worst Case Discharge
yd.................................. yard(s)
Y-K............................... Yukon-Kuskokwim

1.0 INTRODUCTION

This document transmits the Bureau of Ocean Energy Management's (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) biological assessment (BA) 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 effects of the Proposed Action on spectacled eiders (Somateria fischeri), spectacled eider critical habitat, Alaska-breeding Steller's eiders (Polysticta stelleri), and polar bears (Ursus maritimus).

The Outer Continental Shelf Lands Act, as amended (OCSLA; 43 U.S.C. 1331 et seq.), requires that the Secretary of the Department of the Interior (USDOI) ensures that the U.S. government receives fair market value for acreage made available for leasing and that OCS conventional (oil and gas) or renewable energy development activities conserve resources, operate safely, and take maximum steps to protect the environment. The Secretary delegated the responsibilities under OCSLA to BOEM and BSEE1.

Under these delegations, the Secretary divided duties generally between BOEM and BSEE as follows:

- BOEM: Leasing, exploration and development plan administration, environmental studies, resource evaluation, economic analysis, and the renewable energy program; and
- BSEE: Enforcing safety and environmental regulations, field operations including permitting of drilling operations and research, inspections, offshore regulatory programs, oil-spill response, training and environmental compliance functions.

As detailed later in this BA, the Proposed Action entails oil and gas exploration, development, production, and decommissioning in connection with 460 leased blocks from the Chukchi Sea Planning Area Oil and Gas Lease Sale 193 held by BOEM's predecessor, the Minerals Management Service on Feb. 6, 2008. At this time, industry holds those 460 leased blocks in the Chukchi Sea. Due to subsequent legal proceedings and new information, BOEM is supplementing its environmental analyses for Lease Sale 193 and the Secretary will determine whether or not to reaffirm the currently suspended leases issued as a result of the lease sale.

To supplement the environmental analyses, BOEM also updated its scenarios for reasonably foreseeable activities and effects that may result from Lease Sale 193. BOEM and BSEE reinitiated consultation with the U.S. Fish and Wildlife Service (USFWS) for activities that relate to the current leases from Lease Sale 193. The previous programmatic consultation had culminated in a Biological Opinion (BO) issued in 2012 and more broadly covered oil and gas activities in the Chukchi and Beaufort seas (USFWS, 2012a).

This updated scenario considers potential exploration, development, and other activities in connection with the 460 current leases. The area covered by these 460 leases is referred to in this BA as the "Leased Area." (See Figures 1–1 and 1–2). This reinitiated consultation applies only to oil and gas activities resulting from the Leased Area. Lease sales and oil and gas activities in the Chukchi and Beaufort seas that occur outside of the Leased Area continue to be subject to findings of the 2012 Biological Opinion (USFWS, 2012).

The USDOI, through BOEM and BSEE, conducts staged decision making under the OCSLA in a tiered approach for review under the National Environmental Protection Act (NEPA) and proposes to

[1] Collectively, BOEM and BSEE were historically part of a single agency, previously the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) and the Minerals Management Service (MMS). BOEMRE was reorganized, effective October 1, 2011, into the separate agencies of BOEM and BSEE.

use an incremental step consultation under the ESA as described in regulations at 50 CFR 402.14(k). The OCSLA review process gives the Secretary of the Interior a "continuing opportunity for making information adjustments" in developing OCS energy resources to ensure all activities are conducted in an environmentally sound manner. Section 7 consultation is not conducted at the first OCSLA stage – development of the Five-Year OCS Oil and Gas Leasing Program. The 2012 BO, accordingly, involved an incremental step consultation, and for the Chukchi lease sales included terms and conditions, reasonable and prudent measures, and an incidental take statement through the first increment of activities (namely, the exploration phase prior to production and development.) Regulations at 50 CFR 402.14(k) state:

> “When the Action is authorized by a statute that allows the agency to take incremental steps toward the completion of the action, the Service shall, 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:
>
> 1. The biological opinion does not conclude that the incremental step would violate Section 7(a)(2);
> 2. The Federal agency continues consultation with respect to the entire action and obtains biological opinions, as required, for each incremental step;
> 3. The Federal agency fulfills its continuing obligation to obtain sufficient data upon which to base the final biological opinion on the entire action;
> 4. The incremental step does not violate Section 7(d) of the ESA concerning irreversible or irretrievable commitment of resources; and,
> 5. There is a reasonable likelihood that the entire action will not violate Section 7(a) (2) of the ESA.”

As an incremental step consultation, this BA examines activities in the first step and future incremental steps that may result from the Proposed Action, with the primary focus of the BA being assessment of potential impacts from the first incremental step. The first incremental step includes all activities associated with the exploration and delineation of the anchor field (large, initial field that is effectively a prerequisite to any future development) up to submission of a Development and Production Plan (DPP). Future incremental steps include all steps that would occur after anchor field is explored and delineated. These steps include development and production of the anchor field; exploration, development and production of a satellite field (smaller, secondary field); and decommissioning of both fields. This BA also considers potential impacts through the endpoint of the actions as described in the hypothetical development and production scenario.

Note that the Proposed Action in this BA pertains to oil and gas activities associated with only with the Leased Area. It does not pertain to other oil and gas activities that may occur off the Leased Area (such as off-lease marine seismic surveys). we As specific projects (such as development projects) may be proposed in the future for authorizations by BOEM and/or BSEE, additional Section 7 consultations will be conducted as necessary to determine whether the proposed activities are likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat.

Figure 1-1. Program Area. The Chukchi Sea OCS Oil and Gas Lease Sale 193 Program area excluded OCS blocks within a 25-mile (40 km) coastal buffer (deferred in the 2007–2012 Five-Year Program). This also shows the Ledyard Bay Critical Habitat Unit for spectacled eider.

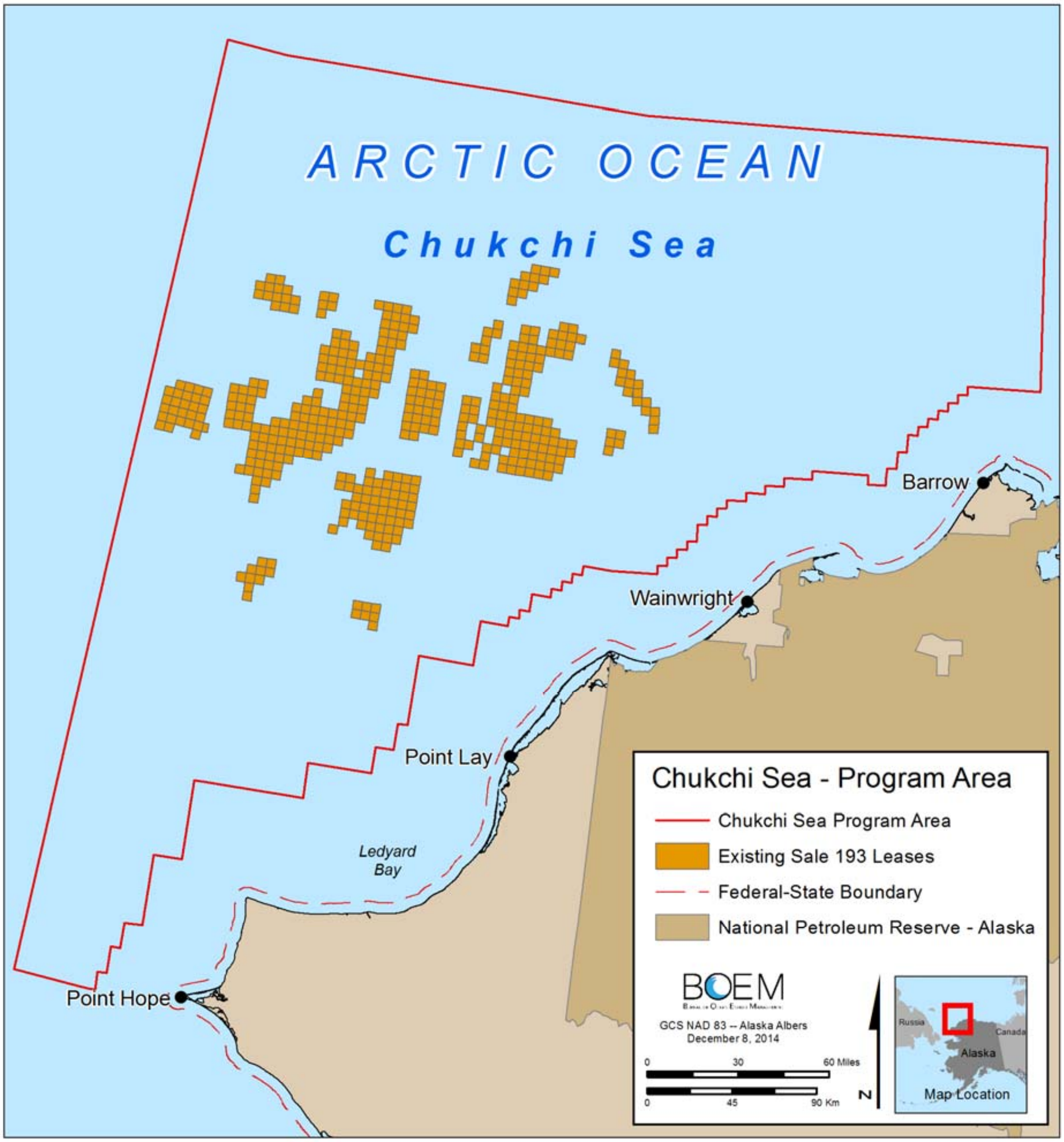

Figure 1-2. Sale 193 Leased Area. The Chukchi Sea Program Area is illustrated with a red border and excludes OCS blocks within a 25-mile (40 km) coastal buffer (deferred in the 2007–2012 Five-Year Program). This also illustrates the existing 460 leased blocks from Lease Sale 193.

2.0 PROPOSED ACTION DESCRIPTION

This section describes the Proposed Action and includes the Action Area, a description of the Proposed Action and associated assumptions, and mitigation measures typical of Arctic oil and gas activities.

2.1. Action Area

The Action Area is the geographic region in which direct and indirect effects of the Proposed Action may occur. Exploration and development is assumed to occur as a result of activities on the 460 leased blocks (the Leased Area) in the Chukchi Sea Program Area, a subset of the Chukchi Sea Planning Area. The Chukchi Sea Planning Area consists of approximately 40.2 million acres of the Chukchi Sea from the US-Russia Maritime border west of Point Hope to the edge of the Beaufort Sea Planning Area at Barrow. The Action Area is broader than the Leased Area, as structures resulting from the Proposed Action could be constructed in marine waters outside the Leased Area (e.g., platform-to-shore pipelines) and on land for shore facilities, pump stations, and a pipeline connecting to the Trans-Alaska Pipeline System (TAPS). The effects of the Proposed Action could affect areas outside the Chukchi Sea Planning Area. Because the specific location of future development is unknown, the Action Area (Figure 1–2) includes:

- The Chukchi Sea Planning Area;
- Marine waters between the southern boundary of the Chukchi Sea Planning Area and the Alaska coastline;
- Onshore areas for construction and operation of shore facilities, pump stations, ice roads/over-snow travel, and a pipeline connecting to TAPS; and
- Any other areas where impacts of the Proposed Action occur.

2.2. Proposed Action

The Proposed Action entails oil and gas exploration, development, production, and decommissioning in connection with the leases issue through Lease Sale 193. The activities comprising the Proposed Action are further described in the detailed hypothetical development scenario (Scenario) BOEM presented in USDOI, BOEM, 2014. The Scenario is not specific to any existing EP, but was created using the best available information from previously submitted EPs and previous development elsewhere on the U.S. OCS. This helped to identify reasonably foreseeable activities and locations.

Under the Proposed Action, a large prospect, the “anchor field,” and a smaller satellite field would be discovered, developed, and produced from the Leased Area. Their combined potential oil and condensate are 4.3 Bbbl, which is 37% of the estimated Undiscovered Economically Recoverable Resources (UERR) in the Chukchi Sea OCS, at $110/barrel of oil (USDOI, BOEMRE, 2011c). Producing this volume of oil and its associated natural gas (estimated at 2.2 Tcf) would require eight platforms of a new Arctic-class design and drilling 589 total wells (exploration, delineation, production, and service.) The Proposed Action assumes that an oil pipeline (either TAPS in its present form or a future redesigned pipeline) will continue to carry oil from fields in northern Alaska, including the OCS, and that infrastructure for a liquid natural gas (LNG) pipeline and gas processing would be available and accessible.

For the purposes of section 7 consultation, BOEM’s Proposed Action is divided into incremental steps. BOEM’s and BSEE’s request for incremental step consultation is appropriate because of the long-term, multistage nature of BOEM/BSEE decision making under the OCSLA. Incremental step consultation provides that BOEM/BSEE and the USFWS may conduct formal consultation increments in to maximize the opportunity for both agencies to more accurately evaluate potential effects of the Proposed Action on listed species and critical habitat by considering specific details of activities closer to the time that they become viable (such as through the submission of a DPP to BOEM).

The first incremental step for this consultation (the primary focus of this BA) includes all on-lease activities associated with the exploration and delineation of a hypothetical anchor field, up to and including a commercially viable oil and gas discovery. BOEM and BSEE considers all on-lease activities that would occur after the initial anchor field discovery to be components of future incremental steps. This is because the activities would occur after the submission of a DPP and would be the subject of consultation on the DPP.

2.2.1. First Incremental Step

The first incremental step includes all activities associated with exploration and delineation of the anchor field, including construction of supporting onshore facilities (also referred to as “shorebases”) (Table 2–1).

Deep penetration marine seismic surveys are conducted to define hydrocarbon deposits in the Leased Area. Companies would conduct three-dimensional (3D) or some two-dimensional (2D) marine seismic surveys to identify limits of the prospective hydrocarbon areas. Two-dimensional seismic surveying techniques are used to provide broad-scale information over a relatively large area, while 3D survey produce more detailed information on smaller, specific areas of interest (identified during 2D surveys). Because the focus is on-lease exploration and development in the Chukchi Sea Leased Area, BOEM expects that most of the additional geophysical seismic surveys described under the Proposed Acton would be 3D surveys focusing on specific leasing targets to identify possible drilling locations.

The Scenario assumes that the lessee company would proceed from seismic exploration of the prospect to exploratory and delineation drilling. At least one year prior to drilling exploratory wells, the company would conduct high-resolution geophysical surveys (also called “site clearance,” “shallow hazards surveys,” or “geohazard surveys”). These surveys would further evaluate near-surface geology, shallow hazards, depth to seafloor (bathymetry), potential shallow faults or gas zones, depth and distribution of ice gouges in the seabed, obtain engineering data for drilling or placement of structures (platforms and pipelines), and detect archaeological resources and certain types of benthic communities. The company would also conduct geotechnical surveys to increase the understanding of such site characteristics as sediment structures, ice gouges, and a variety of shallow hazard information.

Based on the evaluation of the marine seismic and ancillary activity data (both geohazard and geotechnical surveys), BOEM and BSEE expect that the company would propose to drill several test wells in the area of interest. This would involve two mobile offshore drilling units (MODUs) to drill exploration wells (with a maximum of four wells drilled per open-water season). Assuming a discovery happens during exploration well drilling, MODUs would drill delineation wells to determine the areal extent of economic production. A component of exploratory drilling involving vertical seismic profiling (VSP) surveys would be conducted in the wellbores.

In conjunction with the beginning of the first incremental step, onshore facilities would be constructed near Barrow or Wainwright. These shorebases would provide air support, search and rescue capabilities, and personnel housing/equipment storage.

Table 2–1. Activities Anticipated During the First Incremental Step of the Proposed Action.

Activity Type	Maximal Number during First Incremental Step	Activity Period
Open-water season 2D/3D marine seismic survey	1	July—November
In-ice 2D marine seismic survey	1	October–December
Geohazard survey	5	July–November
Geotechnical survey	5	July–November
Exploratory and delineation drilling	28 wells	June–November
Vertical seismic profile survey	28	June–November
Shorebase construction	Up to 3 bases, 2 years of construction	January–December

2.2.1.1. Activities Associated with the First Incremental Step

This section describes anticipated activities during the first incremental step of the Proposed Action.

2.2.1.1.1. Deep Penetration Marine Seismic Surveys

During the exploration phase, companies would conduct deep penetration marine seismic surveys to search for and define the prospective areas on lease that could contain hydrocarbon deposits. 2D deep penetration seismic surveying techniques provide broad-scale information over a relatively large area and are mostly for pre-lease exploration or to provide area-wide geologic information. 3D deep penetration seismic surveys are conducted on a closely spaced grid pattern that provides a more detailed image of the prospect that is used to select the proposed drilling locations.

Under the Proposed Action in the first incremental step, two marine seismic surveys would be conducted, with no more than one survey in any given year. One of these two surveys would be an in-ice survey; the other would be a typical 3D/2D marine seismic survey (Table 2–1).

The typical marine seismic survey would be conducted during the open-water season from July 1st into November. Even during the short open-water season, there are periodic incursions of sea ice, so there is no guarantee that any given location would be ice free throughout the survey. The in-ice survey would be conducted between October and late December. The exact timing of the in-ice survey would be dependent in part on ice conditions and the class of icebreaker available for escort.

2D/3D Marine Seismic Surveys

Airguns are the typical acoustic (sound) source for marine seismic surveys. To create outgoing sound signals a high-pressure air pulse from the airguns is released into the water that produces an air-filled cavity (a bubble) that expands and contracts. The size of individual airguns could range from tens to several hundred cubic inches (in3). A group of airguns is usually deployed in an array to produce a more downward-focused sound signal. Airgun array volumes for marine seismic surveys are expected to range from 1,800–4,500 in3, but may range up to 6,000 in3. Firing the airguns at short, regular intervals cause the arrays to emit pulsed rather than continuous sound. While most of the energy is focused downward and the short duration of each pulse limits the total energy into the water column, the sound can propagate horizontally for several kilometers (Greene and Richardson, 1988; Hall et al., 1994).

Marine 3D seismic surveys vary from typical 2D seismic surveys because the survey lines are more closely spaced and concentrated in a particular area. The specifications of a 3D survey depend on client needs, subsurface geology, water depth, and geological targets. A 3D and 2D source array typically consists of two to three subarrays of six to nine airguns each. Source-array size can be varied during the seismic survey to optimize the resolution of the geophysical data collected at any particular site. The energy output of the array is determined more by the number of guns than by the total array volume (Fontana, 2003, pers. communication, as cited in USDOI, MMS, 2007). Vessels usually tow up to three source arrays, depending on the survey-design specifications. Most operations use a single source vessel; however, in a few instances, more than one source vessel is used. The vessels conducting these seismic surveys generally are 70–90 m (230–295 ft) long.

The sound-source level (zero-to-peak) associated with typical 3D seismic surveys ranges between 233 and 240 dB re 1 μPa at 1 m (rms). Marine seismic surveys are acquired at typical vessel speeds of 4.5 knots (kn) (8.3 km/hr). A source array is activated approximately every 10–15 sec, depending on vessel speed. The timing between outgoing sound signals may 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 (82 or 123 ft).

The sound receivers for a 3D survey could include multiple (4–16) streamer-receiver cables towed behind the source array. Streamer cables contain numerous hydrophone elements at fixed distances within each cable. Each streamer could be 3–8 km (1.9–5 mi) long, with an overall array width of up to 1,500 m (4,921 ft) between outermost streamer cables. Biodegradable liquid paraffin is used to fill the streamer and provide buoyancy. Solid/gel streamer cables are also used.

The wide extent of this towed equipment affects both the turning speed and the area a vessel covers with a single pass over a geologic target. It is, therefore, common practice to acquire data using an offset racetrack pattern, whereby each acquisition line is several kilometers away from and traversed in the opposite direction of the track line just completed. Acquiring a single track line may take several hours, depending on the size of the survey area. The vessel then takes 2–3 hr to turn around at the end of the track line and starts acquiring data along the next track line. Adjacent transit lines for a modern 3D seismic survey generally are spaced several hundred meters apart and are parallel to each other across the survey area. Vessel transit speeds typically range from 8–12 kn (12.9–19.3 km/hr) depending on a number of factors including, but not limited to, the vessel itself, sea state, and ice conditions. Marine 3D surveys are acquired at vessel speeds of approximately 4.5 kn (8.3 km/hr). Seismic surveys are conducted day and night when ocean conditions are favorable, and one survey effort may continue for weeks or months, depending on the size of the survey. Data-acquisition is affected by number of streamer cables towed by the survey vessel and by weather/ice conditions. Typically, data are only collected between 25% and 30% of the time (or 6–8 hr a day) because of equipment or weather problems. In addition to downtime due to weather, sea conditions, turning between lines, and equipment maintenance, seismic surveys could be suspended for biological reasons (proximity to protected species). Individual seismic surveys could require 60–90 days to cover a 200 mi^2 (518 km^2) area.

Marine 2D seismic surveys use similar geophysical-survey techniques as 3D seismic surveys, but both the mode of operation and general vessel type used are different. The 2D seismic surveys provide a less-detailed subsurface image because the survey lines are spaced farther apart, for coverage of wider areas to image geologic structure on more of a regional basis. Large prospects are easily identified on 2D seismic data, but detailed images of the prospective areas within a prospect can only be seen using 3D data. The 2D seismic-survey vessels generally are smaller than modern 3D-seismic survey vessels, although larger 3D survey vessels are able to conduct 2D surveys. The 2D seismic-sound source array typically consists of three or more arrays of six to eight airguns each, equivalent to the arrays used for 3D surveys. The sound-source level (zero-to-peak) associated with 2D marine seismic surveys are the same as 3D marine seismic surveys (233–240 dB re 1 μPa at 1 m (rms)). Typically, a single hydrophone streamer cable approximately 8–12 km (5–7.5 mi) long is towed behind the survey vessel. The 2D seismic surveys acquire data along single track lines that are spread more widely apart (usually several miles) than are track lines for 3D seismic surveys (usually several hundred meters).

Marine seismic vessels are designed to operate for weeks without refueling or resupply. A support vessel is typically used for safety considerations, general support, maintenance, and resupply of the main vessel, but it would not be directly involved with the collection of seismic data.

Marine seismic surveys require a largely ice-free environment to allow effective operation and maneuvering of the airgun arrays and long streamers. One exception to the need for a largely ice-free environment is the in-ice seismic survey. These seismic surveys use a specialized survey vessel with a special fitting that allows the streamer to be towed below the ice. These surveys require an icebreaker to clear a path through the ice for the survey vessel to follow. In-ice surveys could occur as late as late December, when the thickness of the ice becomes an issue. In the Arctic, the timing and areas of seismic surveys are often dictated by ice conditions.

In-Ice Towed-Streamer 2D Surveys

A change in technology has allowed geophysical (seismic reflection and refraction) surveys to be conducted in thicker sea ice concentrations. Sea ice concentration is defined in terms of percent coverage in tenths. An area with 1/10 coverage of ice means the area contains sporadic ice floes that provides for easy vessel navigation; whereas, 10/10 coverage of ice means there is no open water in the area. This new technology uses a 2D seismic source vessel and an icebreaker. The icebreaker generally operates ~0.5–1 km (~0.3–0.62 mi) ahead of the seismic acquisition vessel, which follows at speeds ranging from 4 to 5 kn (7.4 to 9.3 km/hr). Like open-water 2D surveys, in-ice surveys operate 24 hr a day or as conditions permit.

The seismic airgun arrays and streamers used in-ice are similar to those used in open water marine surveys. A single hydrophone streamer, which uses a solid fill material to produce constant and consistent streamer buoyancy, is towed behind the vessel. The streamer receives the reflected signals from the subsurface and transfers the data to an on-board processing system. The survey vessel has limited maneuverability while towing the streamer and thus requires a 10 km (6.2 mi) run-in for the start of a seismic line, and a 4–5 km (2.5–3.1 mi) run-out at the end of the line.

2.2.1.1.2. Geohazard Surveys

Prior to submitting an exploration or development plan, oil and gas industry operators are required to evaluate any potential geological hazards and document any potential cultural resources or benthic communities pursuant to 30 CFR 550. The BOEM, Alaska OCS Region, has provided guidelines (Notices to Lessees 05–A01, 05–A02, and 05–A03) that require high-resolution shallow hazards surveys to ensure safe conduct and operations in the OCS at drill sites and along pipeline corridors, unless the operator can demonstrate there is enough previously collected data of good quality to evaluate the site. These data are vital not only when planning for the design and construction of a facility, but also to ensure that all associated activities are completed safely.

Ancillary geohazard surveys:

- Locate shallow hazards (<2,000 m water depth);
- Obtain engineering data for placement of structures (e.g., proposed platform locations and pipeline routes); and
- Detect geohazards, archaeological resources, and certain types of benthic communities.

Under the Proposed Action, up to five ancillary geohazard surveys would be conducted during the first incremental step, with no more than one survey in any given year (Table 2–1). All Geohazard surveys would occur on-lease, and would utilize airgun arrays or other sound generating equipment smaller in size and lower in sound level output than those described above for 2D and 3D seismic surveys. All geohazard surveys would be conducted during the open-water season (July–November).

Geohazard surveys use various geophysical methods (e.g., seafloor imaging, water-depth measurements, and high-resolution seismic reflection profiling) designed to identify and map hazards such as shallow faults and ice gouges, and may also collect oceanographic data. Most basic components of a geophysical system include a sound source to emit acoustic impulses or pressure waves, a hydrophone or receiver that receives and interprets the acoustic signal, and a recorder/processor that documents the data.

The suite of equipment used during a typical shallow hazards survey consists of:

- Seismic systems (e.g., airguns, sub-bottom profilers, sparkers, etc.) which produce sound waves that penetrate the seafloor
- Single beam and multibeam echosounders which provide water depths and seafloor morphology (including ice gouges); and
- Side scan sonar that provides acoustic images of the seafloor.

The waves will reflect at the boundary between two layers with different acoustic impedances, producing a cross sectional image. These data are interpreted to infer geologic history of the area. Seismic energy can be produced by different types of sources, discussed briefly below: a sub-bottom profiler that provides 20–200 m sub-seafloor penetration at a 6 to 20 cm resolution; a bubble pulser or boomer with 40–600 m sub-seafloor penetration; and a multichannel seismic system with 1,000–2000 m sub-seafloor penetration. Magnetometers that detect ferrous items have not been required in the Alaska OCS to date.

A typical operation consists of a vessel towing an acoustic source (airgun) about 25 m (82 ft) behind the ship and a 600 m (1969 ft) streamer cable with a tail buoy. The source array usually is a single array composed of one or more airguns. A 2D ancillary geohazard survey usually has a single airgun, while a 3D ancillary geohazard survey usually tows an array of airguns that are typically smaller in volume than the arrays used in marine seismic exploration activities. The ships travel at 3–3.5 kn (5.6–6.5 km/hr), and the source is activated every 7–8 sec (or about every 12.5 m (41 ft)). All vessel operations are designed to be ultra-quiet, as the higher frequencies used in ancillary geohazard work are easily masked by the vessel noise.

Typical seismic surveys cover one proposed drilling location at a time. Federal regulations require information be gathered on a 300 by 900 m (984 x 2953 ft) grid, which amounts to about 129 line-kilometers (80 mi) of data per lease block (NTL No. 05-A01). If there is a high probability of archeological resources, the north-south lines are 50 m (164 ft) apart and the 900 m (2953 ft) remains the same. Including line turns, the time to survey a lease block is approximately 36 hrs. Airgun volumes for ancillary geohazard surveys typically are 40–450 in^3 (1.5–2.5 L), and the output of a 90-in^3 (1.5 L) airgun ranges from 229–233 dB high-resolution re 1μPa at 1 m (rms). Airgun pressures typically are 2,000 pounds per square inch (psi), although they can be used at 3,000 psi for higher signal strength to collect data from deep in the subsurface.

Seismic Systems. Seismic systems produce sound waves which penetrate the seafloor. The waves will reflect at the boundary between two layers with different acoustic impedances, producing a cross sectional image. These data are interpreted to infer geologic history of the area. Seismic energy can be produced by several different types of sources; they will be discussed briefly below.

- *Single channel high-resolution seismic reflection profilers*. High-resolution seismic reflection profilers, including sub-bottom profilers, boomers, and bubble pulsers, consist of an electromechanical transducer that sends a sound pulse down to the seafloor. Sparkers discharge an electrical pulse in seawater to generate an acoustic pulse. The energy reflects back from the shallow geological layers to a receiver on the sub-bottom profiler or a small single channel streamer. Sub-bottom profilers are usually hull mounted or pole-mounted; the other systems are towed behind the survey vessel. These systems range in frequency from 0.2 to 200 kHz, Laban et al., 2009; Greene and Moore, 1995).

- *Multichannel high-resolution seismic reflection systems*. The multichannel seismic system consists of an acoustic source which may be a single small gun (air, water, Generator-Injector, etc.) 10 to 65 in^3 or an array of small guns, usually two or four 10 in^3 guns. The source array is towed about 3 meters behind the vessel with a firing interval of approximately 12.5 m (7–8 sec). A single 300–600 m, 12–48 channel streamer with a 12.5 m hydrophone spacing and tail buoy is the passive receiver for the reflected seismic waves. A 40 in^3 airgun array is commonly used in the Arctic as the source for these multichannel seismic surveys. This array will typically have frequency between 0 and 200 Hz and a source level between 196 and 217 dB re 1 µPa at 1 m (rms) (NMFS, 2008a, 2009a, 2010a; Greene and Moore, 1995).

Survey ships are designed to reduce vessel noise because the higher frequencies used in higher resolution work are easily masked by the vessel noise if special attention is not paid to keeping the ships quiet. Surveys are site specific and can cover less than one lease block, but the survey extent is determined by the number of potential drill sites in an area. The typical survey vessel travels at 3–4.5 kn (5.6–8.3 km/hr). A single vertical well site survey will collect about 70 line-miles of data per site and take approximately 24 hrs. BOEM regulations require data to be gathered on a 150– by 300–m grid within 600 m of the drill site, a 300 by 600 m grid out to 1,200 m from the drill site, and a 1,200 by 1,200 m grid out to 2,400 m from the well site. If there is a high probability of encountering archeological resources, the 150– by 300–m grid must extend to 1,200 m from the drill site.

- **Echosounder.** Echosounders measure the time it takes for sound to travel from a transducer, to the seafloor, and back to a receiver. The travel time is converted to a depth value by multiplying it by the sound velocity of the water column. Single beam echosounders measure the distance of a vertical beam below the transducer. The frequency of individual single beam echosounders can range from 3.5 to 1000 kHz with source levels between 192 to 205 dB re 1 µPa at 1 m (rms) (Koomans, 2009).

  Multibeam echosounders emit a swath of sound to both sides of the transducer with frequencies between 180 and 500 kHz and source levels between 216 and 242 dB re 1 µPa at 1 m (rms) (Hammerstad, 2005; HydroSurveys, 2010).

- **Side scan sonar.** Side scan sonar is a sideward-looking, narrow-beam instrument that emits a sound pulse and “listens” for its return. The side scan sonar can be a two or multichannel system with single frequency monotonic or multiple frequency Compressed High Intensity Radar Pulse (CHIRP) sonar acoustic signals. The frequency of individual side scan sonars can range from 100 to 1600 kHz with source levels between 194 and 249 dB re 1 µPa at 1 m (rms). Pulse lengths will vary with according to the specific system, monotonic systems range between 0.125 and 200 milliseconds (ms) and CHIRP systems range between 400 and 20,000 ms. (HydroSurveys, 2008a, b; Dorst, 2010)

2.2.1.2. Geotechnical Surveys

In addition geohazard surveys, there are other ancillary activities that can provide more detailed information about a prospective site. These are important for understanding such site characteristics as sediment structures, strudel scouring, ice gouges, and a variety of shallow hazard information.

- **Geological/geochemical surveys** involve collecting bottom samples to obtain physical and chemical data on surface sediments. Sediment samples typically are collected using a gravity/piston corer, grab sampler, or dredge sampler. Shallow coring, using conventional rotary drilling from a boat or drilling barge, is another method used to collect physical and chemical data on near-surface sediments.

Under the Proposed Action, five ancillary geotechnical surveys would be conducted during the first incremental step, with no more than one survey in any given year (Table 2–1). All geotechnical surveys would be conducted between July and November.

2.2.1.3. Exploratory and Delineation Drilling

Under the Proposed Action, exploration drilling operations during the first incremental step will employ two MODUs with icebreakers and other support vessels (detailed in Section 2.2.1.1.6). Examples of MODUs include drillships, semisubmersibles, and jackup rigs.

Drillships

A drillship is a maritime vessel that has been equipped with a drilling apparatus. Most are built to the design specification of the company, but some are modified tanker hulls that have been equipped with a dynamic positioning system. One example of a drillship that has been used in drilling on the Alaska OCS is the *M/V Discoverer* (also known as the *Noble Discoverer*). Shell Oil has proposed, in prior applications, to use the *Discoverer* for drilling in both the Chukchi and Beaufort seas and used the vessel in their 2012 exploratory drilling in the Leased Area (Shell Offshore Inc., 2010; Bisson et al., 2013). The *Discoverer* is a drillship, built in 1976, that has been retrofitted for operating in Arctic waters. It is a 156 m (512 ft) conventionally-moored drillship with drilling equipment on a turret. It mobilizes under its own power, so it can be moved off the drill site with help of its anchor handler. Depending on the circumstances of the situation, the procedure and time needed to move off a drill site can change. In extreme emergencies, this process can be completed in less than one hour. In the event that operations must be temporarily curtailed due to the advance detection of a hazard, the process could take from 4 to 12 hrs. Typical transit speed of the *M/V Discoverer* is 8 kn (14.8 km/hr). Measurements of sounds produced by the Discoverer in the Chukchi Sea were performed in 2012. The broadband source level of the Discoverer while drilling was 182 dB re 1 μPa (rms) (Bisson et al., 2013).

Support vessels are used to assist the drillship with icebreaking and ice management, anchor handling, oil spill response, refueling, resupply, and servicing. There is also the potential for re-supply to occur via a support helicopter from the shore to the drill site. The total number of support vessels and aircraft depends on the local conditions and the design of the exploration program. Section 2.2.1.1.6 provides further detail on the number and type of vessels and aircraft anticipated to support exploratory drilling operations.

Jackup Rigs

A jackup rig is an offshore structure composed of a hull, support legs, and a lifting system that allows it to be towed to a site, lower its legs into the seabed and elevate its hull to provide a stable work deck. Because jackup rigs are supported by the seabed, they are preloaded when they first arrive at a site to simulate the maximum expected support leg load to ensure that, after they are jacked to full airgap (the maximum height above the water) and experience operating loads, the supporting soil will provide a reliable foundation. The actual dimensions of a jackup rig would depend on the environment in which the unit would be operating and the maximum operating water depth. A typical jack up rig with a maximum operating depth of 50 m (164 ft) is approximately 50 m (164 ft) in length, 44 m (144 ft) beam, and 7 m (23 ft) deep.

Noise levels from jackup rigs have not been measured in the Arctic or any other environment (Wyatt 2008), but are expected to be similar to or less than noise levels produced by the drillship discussed above, as jackup rigs use the same general drilling machinery that is the source of underwater noise for drillships. Sound levels transmitted into the water from bottom-founded structures are typically less than sound levels from a drillship because the vibrating machinery is not in direct contact with the water because the platform is above water. Because the jackup rig has fewer structures in direct contact with the water, noise levels are expected to be less.

As with drillships, support vessels are used to assist with ice breaking and ice management, oil spill response, refueling, resupply, and servicing. There is also the potential for re-supply to occur via a support helicopter from the shore to the drill site. The total number of support vessels depends on local conditions and the design of the exploration plan. Section 2.2.1.1.6 provides further detail on the number and types of vessels anticipated to support exploratory drilling operations.

Semisubmersibles

A semisubmersible is a MODU designed with a platform-type deck that contains drilling equipment and other machinery supported by pontoon-type columns that are submerged into the water. Semisubmersibles may either have their own propulsion or be towed into place. Once in place, they are partially submerged in the water using a pontoon system. This makes them less subject to rolling and pitching than other types of MODU. Semisubmersibles maintain their position either by mooring or dynamic positioning, whereby the vessel uses its propulsion system to maintain position.

Semisubmersibles are generally smaller vessels than drillships. Their noise levels would be comparable, but somewhat less because they have smaller engines than drillships. The only subsea footprint would be caused by mooring if the vessel were not dynamically positioned. Support vessels needed for semisubmersibles would be the same as those needed for drillships.

To date semisubmersibles have not been used in the U.S. Arctic. However, at least one company has proposed to use a semisubmersible drilling unit in future exploratory drilling in the Leased Area.

2.2.1.3.1. Exploratory Drilling Operations

Drilling operations are expected to range between 30 and 90 days at different well sites, depending on the depth of the well, delays during drilling, and time needed for well logging and testing operations. Considering the relatively short open-water season in the Chukchi Sea OCS (June–November), BOEM estimates that two wells per drilling rig could be drilled, tested, and abandoned during a single open-water season, assuming both MODUs were operating simultaneously. If a discovery is made during exploration well drilling, MODUs would drill delineation wells to determine the areal extent of economic production. Operators need to verify that sufficient volumes are present to justify the expense of installing a platform and pipelines.

During the first incremental step, a maximum of 28 exploratory and delineation wells would be drilled, including dry wells. No more than four wells would be drilled annually (Table 2–1). All wells, including successful exploration and delineation wells would likely be plugged and abandoned rather than converted to production wells because it would require several years before platforms and pipelines could be installed and oil produced.

Exploratory drilling will disturb an area of the seafloor. The area of disturbance would vary based on the type of drill rig used, ocean currents, and other environmental factors, but in general includes disturbance from the mud cellar, the anchoring system for the MODU (e.g., legs of the jack up rig or footprint of the drillship anchors), displacement of sediments, and discharges from the drill hole. For example, a previous drilling operation on the Burger prospect (in the Leased Area) is estimated to have disturbed 1,018 ft^2 of seafloor per well and each well cellar excavated 619 yd^3 of sediment (USDOI, BOEM, 2014). Cuttings from the well cellar excavation were deposited on the seafloor below the temperature and salinity stratification layer. It is estimated that the maximum thickness of the sediment deposition onto the seafloor would be 10.4 ft (3.2 m) and the deposition would continue out to a horizontal distance of 449 ft (137 m) from the excavation site, where it would be 0.4 in (1 cm) thick. Displaced sediments could cover an additional 1,600 ft^2 (or 148.6 m^2). The anchoring system of a drill ship with 12 anchors (usually drill ships use 8–12 anchors) would disturb an estimated 78,000 ft^2 (7,500 m^2) of the sea floor.

Vertical Seismic Profiling

Vertical seismic profiling (VSP) is conducted as part of a drilling program in the wellbore. These programs use hydrophones suspended in the well at intervals which receive signals from external sound sources; usually an airgun(s) is suspended from the drill rig or a nearby supply vessel. Data are used to aid in determining the structure of a particular petroleum-bearing zone. Purely defined, VSP refers to measurements made in a vertical wellbore using geophones inside the wellbore and a source at the surface near the well. In the more general context, VSPs vary in the well configuration, the number and location of sources and geophones, and how they are deployed. Most VSPs use a surface seismic source, which is commonly a vibrator on land and an airgun in offshore or marine environments. VSPs include the zero offset VSP, offset VSP, walk away VSP, walk-above VSP, salt-proximity VSP, shear-wave VSP, and drill-noise or seismic-while-drilling VSP. A VSP is a much more detailed survey than a check-shot survey because the geophones are more closely spaced, typically on the order of 25 m (82 ft), whereas a check-shot survey might include measurements at intervals hundreds of meters apart. Also, a VSP uses the reflected energy contained in the recorded trace at each receiver position, as well as the first direct path from source to receiver. The check-shot survey uses only the direct path travel time. In addition to tying well data to seismic data, the vertical seismic profile also allows for converting seismic data to zerophase data and distinguishing primary reflections from multiples. Airgun volumes for VSPs typically are 450–750 in^3 (7.4 –12.3 L). For example, a 500 in^3 airgun array was used offshore Greenland for a VSP survey. The acoustic properties were modeled for an environmental impact assessment (Kyhn et al., 2011) to predict the possible exposure levels to marine mammals. The output of 500–in^3 airgun array was 222 dB re 1μPa at 1 m (rms).

It is unlikely that VSPs would be conducted at every exploratory and delineation well; however, for the purposes of this BA, BOEM conservatively assumes that VSP would be conducted in association with each wellbore, resulting in a maximum of 28 VSP occurring during the first incremental step (Table 2–1).

Authorized Discharges

The Scenario assumes that the synthetic drilling mud would be reconditioned and reused with an efficiency of 80%. All of the rock cuttings would be discharged at the exploration site. Discharges from exploration operations in the Chukchi Sea are permitted under a National Pollutant Discharge Elimination System (NPDES) General Permit that is issued by EPA and has a term of five years. Discharges under a General Permit for exploration typically include sanitary waste, domestic waste, drilling fluids, drilling cuttings, and deck drainage. Detailed information on the various types and properties of discharges from routine oil and gas activities is contained in the 2007 FEIS (USDOI, MMS, 2007). The estimated drill cuttings from one exploration well would be 5,800 bbl, while the estimated 3,200 bbl of drilling fluids would be associated with one exploration well.

The current NPDES General Permit for exploration discharges in the Chukchi Sea is the 2012–2017 NPDES General Permit for Oil and Gas Exploration Facilities on the Outer Continental Shelf in the Chukchi Sea (AK 28-8100) (EPA, 2012). For background, the terms of this permit are indicative of the expected terms of future General Permits. The types of discharges in the current 2012–2017 General Permit are presented in Table 4–6 of the second SEIS (USDOI, BOEM, 2014).

Unauthorized Discharges

Small Spills

A few small refined oil spills (<1,000 bbl) are considered reasonably foreseeable during the first incremental step. Spills during the first incremental step are expected to be small and consist of refined oils because crude and condensate oils would not be produced during exploration. Refined oil is used in exploratory drilling activity for equipment and refueling. Small refined oil spills during seismic and geophysical and geotechnical (G&G) surveys and exploratory drilling activities would occur during July through early November.

The estimated total and annual numbers and volumes of small refined oil spills during first incremental step activities is presented in Table 2–2. BOEM and BSEE estimate that approximately 20 spills ranging in size from <1 bbl up to 55 bbl per spill could occur during the first incremental step (spill ranges sourced from USDOI, BOEM, 2014). BOEM and BSEE anticipate that most spills from the Proposed Action's seismic and G&G survey activities would be <1 bbl, one would be up to13 bbl (spill ranges sourced from USDOI, BOEM, 2014). BOEM and BSEE anticipate that most spills originating from the Proposed Action's exploration and delineation drilling activities would be up to 5 bbl; some would be up to 55 bbl. For the purpose of analysis, BOEM and BSEE assume that the13 bbl spill and one 55 bbl spill would occur during the first incremental step.

Table 2–2. Annual and Total Potential Small Spills from First Incremental Step Activities.

Activity Phase	Estimated Total Number of Small Spills	Estimated Total Volume of Small Spills (bbl)
	Small Refined Oil Spills	
Exploration Geological and Geophysical Activities	0 – 6	0 – < 18
Exploration and Delineation Drilling	0 – 14	0 – < 115

Large Spills

BOEM and BSEE estimate that no large spills >1,000–150,000 bbl would occur during the first incremental step of the Proposed Action. This estimate is based on a robust set of historical data about oil spills. Of over 15,000 exploration wells drilled on the OCS from 1971–2010, no crude oil spills ≥1,000 bbl have occurred during exploration, other than the Deepwater Horizon (DWH) incident. The DWH falls within the category of VLOS, which is defined as spills greater than 150,000 bbl, and is considered a low-probability, high-impact event. In other words, a spill of this volume is highly unlikely to occur during any activity phase, but if one did occur, the impacts would be substantial (USDOI, BOEM, 2014). VLOS are analyzed separately from large oil spills as they are not reasonably certain to occur.

In addition to the above assumption, no large spills are assumed to occur because only a very small fraction of spills are estimated during the relatively short first incremental step, as compared to the total spill frequency for future incremental steps (which include development and production activities). Despite this assumption, the exploration drilling program in the Proposed Action would include oil spill response and cleanup vessels and equipment, which may be staged near the drilling area or in more protected nearshore areas, such as Goodhope Bay in Kotzebue Sound.

Very Large Oil Spill. It is highly unlikely but cannot be wholly discounted that a VLOS could occur from a well control incident followed by a long duration flow during exploratory drilling in the first incremental step, and drilling for production in a future incremental step. A VLOS is extremely unlikely to occur because the frequency of such a spill from a loss of well control incident is extremely low. Thus, while the potential effects of a VLOS would be substantial if one were to occur, and such effects were analyzed in the Second SEIS for the purpose of evaluating a low-probability, high impact event, the effects of a VLOS cannot be said to be reasonably certain to occur. Therefore, they are not considered a direct or indirect effect of Proposed Action under the ESA and are beyond the scope of the analysis here.

Details of the assumptions of the VLOS scenario and analytical methods used are presented in depth in Section 4.4.2 and Appendix A of the draft second SEIS (USDOI, BOEM, 2014). The OSRA does not account for response, cleanup, or containment and therefore may overestimate the chance of a large spill contacting a given geographical area.

2.2.1.4. Onshore Facilities Construction

Under the Proposed Action, up to three exploration-support facilities would be constructed onshore during the first incremental step to provide housing and equipment storage, air support, and search and rescue. These coastal facilities could be situated near Wainwright or Barrow, with efforts made to use existing infrastructure and to co-locate the bases, although uncertainty remains regarding the specific location of these exploration-support facilities. For the purposes of this impact assessment, the second SEIS and this BA assume that all gravel fill and ground disturbance would be to sedge/grass/moss wetland and sedge/moss/dwarf shrub wetland habitat.

- Up to approximately 15 acres of tundra would likely be filled for an exploration camp. The exploration camp would include stationary equipment consisting of generators, pumps, compressors, and jackhammers. The camp would include housing facilities, mess hall(s), and recreation as well as vehicle parking.
- If the air support base is located near Wainwright, up to approximately 5 acres of tundra could be filled to expand the existing Wainwright airport in order to support cargo (C-130 Hercules) and commercial airlines (Boeing 737).
- Up to approximately 7 acres of tundra could be filled to construct a search and rescue (SAR) base with a helipad and a road connection to the village of Wainwright or Barrow. At least one mile of road may be built.

Construction for these shore-based exploration facilities would require gravel. Gravel would be obtained from an approximately 240 acres material site. It is anticipated that the material site would be located near Wainwright or Barrow. Approximately 70 acres of tundra at the edge of the gravel fill could be exposed to gravel/dust spray and dust shadow as a result of onshore facilities construction during the first incremental step. (BOEM and BSEE assume dust and gravel spray would occur within 30–35 ft (approximately 10 m) of adjacent fill material and that the dust shadow would extend beyond 30–35 ft by less than 165 ft (approximately 50 m) from adjacent fill material.). These impacts would persist throughout they life of the Proposed Action as vehicle use continues and maintenance is accomplished on the fill.

Overall, approximately 337 acres of tundra is anticipated to be impacted by onshore facilities construction associated with the first incremental step. Before any onshore construction activities were to occur, plans and detailed information, including location(s) and size(s) of facilities and borrow sources, will be subject to a multi-tiered decision making and review process. First, OCSLA staged decision making will provide for review of the Exploration Plan(s). Compliance with the conditions of the Biological Opinion that results from the current ESA consultation will be required. Other mitigation may be required as well, including but not limited to site characterization or alternative siting. The lessee would also be obligated to coordinate with the land owner(s) in order to obtain necessary authorizations and permits for all onshore activities, including construction and gravel mining. Construction activities that impact wetlands will also be reviewed by the Corps of Engineers, and permit(s) required under the CWA 404 process which will include measures to avoid, minimize, and otherwise mitigate habitat losses. This coordination could require additional ESA consultation(s) to ensure listed species are protected and additional mitigation measures to reduce construction and operation activity impacts to natural resources. Typical mitigation measures for onshore activities are presented in section 2.3.

Transportation

Operations at remote locations in the Leased Area would require transportation of supplies and personnel by different means, depending on seasonal constraints and phase of the operations. Under the Proposed Action, marine vessels would be the primary form of transportation during the first incremental step. Aircraft would be used to conduct any search and rescue efforts and would support exploratory drilling activities as well as onshore construction. Onshore vehicle presence would be restricted to activities associated with shore base construction.

During exploration seismic surveys, the vessels would be largely self-contained. Therefore, helicopters would not be used for routine support of operations. Under the Proposed Action, during the open-water season smaller support vessels would make occasional trips (one to three round-trips per survey, depending upon the duration of the survey), probably operating out of Barrow and/or Wainwright. Additionally, if directed by NMFS or USFWS during consultation, a mitigation vessel might accompany the seismic survey vessel. No support vessels would be associated with the in-ice seismic survey; however, an icebreaker would be present during the survey for ice management (Table 2–3).

During exploration drilling, operations would be supported by both helicopters and supply vessels (Table 2–3). An anchor handler would move MODUs to the various drill sites. Helicopters would fly from Barrow and/or Wainwright at a frequency of one to six flights per day. Support-vessel traffic would be one to three round-trips per week, also out of Barrow and/or Wainwright. After completion of the shore-bases, air and vessel traffic might alternatively originate from the onshore air support facility.

During the first incremental step, a tug and a refueling barge may be moored in Kotzebue Sound for oil spill recovery. It is anticipated that these vessels would be moored in the Goodhope Bay area of Kotzebue Sound. These vessels would be used for nearshore oil spill recovery. An additional tanker would serve as spill storage.

Ice-breaking and ice-management would likely occur during some of the activities described in the previous subsections. BOEM and BSEE define ice breaking and ice management as separate activities. Ice-breaking is defined as opening a pathway or lead through pack ice, ice floes or landfast ice for the purpose of moving vessels through sea ice. Ice-breaking occurs in waters with ice. BOEM defines ice management as using an ice-hardened vessel or icebreaker to move floes away from a stationary vessel, such as a drill rig, by pushing, towing or passing back and forth upstream of the stationary vessel or drill rig. Ice management activities take place in an environment that is primarily open water.

During shorebase construction heavy equipment and materials would be moved to the coastal site using barges, aircraft, and perhaps winter ice roads. Under the Proposed Action, one to two barge trips (possibly from either West Dock or Nome) would occur in each of two consecutive open-water seasons. There could be as many as five transport aircraft (C-130 Hercules or larger) trips per day during peak periods of base construction (Table 2–3).

Utilization of winter ice roads would depend on the location of the shore-bases in proximity to Wainwright or Barrow, the presence of any existing ice roads, and the EP submitted to BOEM and BSEE by the lessee. Submission of an EP would require project-specific NEPA analysis and additional ESA consultation that would assess impacts of any proposed ice-roads or additional infrastructure associated with the shore-bases on threatened or endangered species and critical habitat. The overall frequency of transportation in and out of the shore-base would decrease substantially after construction is completed. In construction of the shorebase it is anticipated that mobile ground equipment such as dozers, graders, crew vehicles would be used (Table 2–3).

Table 2–3. Transportation Associated with First Incremental Step Activities[1].

Activity Type	Activity Period	Transportation Type		
		Marine Vessel	Aircraft	Terrestrial Vehicle
Open-water season 2D/3D marine seismic survey	July–November	1 source/receiver vessel, 1 support vessel *(1–3 trips to shore per survey)*, +/- 1 mitigation vessel	None	None
In-ice 2D marine seismic survey	October–December	1 seismic survey vessel, 1 icebreaker	None	None
Geohazard survey	July–November	1 vessel[2]	None	None
Geotechnical survey	July–November	1 vessel[2]	None	None
Exploratory drilling	June–November	Drilling Support: 2 MODUs, 2 ice breakers, 3 anchor handlers, 2 supply tug-and-barges, 3 offshore supply vessels, 2 support tugs, 2 science vessels, 2 shallow water vessels, +/- 1 MLC ROV system vessel Oil Spill Response: 1 oil spill response vessel, 1 oil spill response tug and barge, 2 oil spill tankers, 1 oil spill containment system tug and barge, 1 oil spill response tug and barge for nearshore response	1+ helicopter *(1–6 flights per day)*	None
Shorebase construction	Year-round	1–2 barge trips during first two open-water seasons of shorebase construction	1+ C-130 Hercules or similar, 1+ Boeing 737 or similar (*Up to 5 flights per day)*	Crew vehicles, Dozers, Graders, Dump trucks, Other mobile construction equipment as determined by the lessee's EP

[1] The quantitative information contained in Table 2–3 is BOEM and BSEE's best estimates for transportation activities Previous and present-day EPs as well as government NEPA documents specific to the Alaska OCS were consulted in the development of these estimates.

[2] In lieu of additional support vessels, companies that conduct geohazard and geotechnical surveys in the Arctic typically coordinate to ensure that two survey vessels are present in the vicinity of one another to provide support in case of emergency.

2.2.2. Future Incremental Steps

As described previously, future incremental steps include all activities that would occur after anchor field exploration and delineation, and the approval of a DPP. These activities include the development and production of the anchor field, the exploration, development, and production of the satellite field, and decommissioning of both fields. Table 2–4 details the activities anticipated during future incremental steps. Under the Proposed Action oil would be produced first, as it can be shipped to market via TAPS, while the gas would initially be re-injected to aid oil recovery. Gas production would likely occur much later in time after a gas transportation system (anticipated to be via pipelines) has been constructed. The Proposed Action assumes that that infrastructure to transport gas across state will be available in the later years of the prospects' production.

Under the Proposed Action, development of the anchor field would begin in approximately the 5th year and BOEM and BSEE assume that majority of development activities associated with the anchor field and the satellite field would occur over the next approximately 20 years (installation of supplemental offshore gas pipeline could continue into the later years of the Proposed Action). BOEM and BSEE anticipate that production activities would begin in approximately the 10th year and continue for roughly 50 years. Decommissioning would commence after oil and gas reserves at a given platform are depleted and income from production no longer pays operating expenses. To comply with BSEE regulations (30 CFR 250.1710—wellheads/casings and 30 CFR 250.1725—platforms and other facilities), lessees are required to remove all seafloor obstructions from their leases within one year of lease termination or relinquishment. Under the Proposed Action decommissioning is anticipated to begin after approximately 30 years of production.

It is important to note that the schedule of activities presented in the Proposed Action is a compressed and ambitious one resulting in a robust level of activities upon which to base the impacts analyses in this consultation. The Proposed Action assumes there would be no construction delays for platforms, regulatory delays, or other delays of any kind. 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 Leased Area would be determined by the lessee and could be affected by any of the variables mentioned above.

Table 2–4. Activities Anticipated During Future Incremental Steps of the Proposed Action[1].

Activity	Activity Period	Estimated Operations	Associated Transportation
Exploration (Satellite Field)			
Marine seismic surveys (including potential in-ice surveys)	July–November (October–December for in-ice)	6 surveys over ~20 years; no more than one survey per year	1 source/receiver vessel, 1 support vessel (1–3 trips to shore per survey), +/- 1 mitigation vessel +/- 1 icebreaker (in-ice surveys only)
Geohazard survey	July–November	8 surveys over ~20 years; no more than two surveys per year, generally a maximum of 1 survey per year	1 vessel[1]

Activity	Activity Period	Estimated Operations	Associated Transportation
Geotechnical survey	July–November	8 surveys over ~20 years; no more than two surveys per year	1 vessel per survey[1]
Exploratory and delineation drilling	June–November	12 wells drilled in satellite field; maximum of 4 wells drilled per open-water season; maximum of 4 MODUs per open-water season (includes MODUs for production drilling)	Drilling Support: 2–4 MODUs, 2–4 ice breakers, 3–6 anchor handlers, 2–4 supply tug-and-barges, 3–6 offshore supply vessels, 2–4 support tugs, 2–4 science vessels, 2–4 shallow water vessels, +/- 1 MLC ROV system vessel Oil Spill Response: 1 oil spill response vessel, 1 oil spill response tug and barge, 2 oil spill tankers, 1 oil spill containment system tug and barge, 1 oil spill response tug and barge for nearshore response
Development			
Offshore			
Subsea oil pipeline installation	July–November	160 mi of buried oil pipe from hub platform to shore; installed at the onset of development over the course of several open-water seasons	1 lay vessel, 1 trenching vessel, +/- 1 mitigation vessel
Subsea gas pipeline installation	July–November	160 mi of buried oil pipe from hub platform to shore; installed in towards the end of development over the course of several open-water seasons	1 lay vessel, 1 trenching vessel, +/- 1 mitigation vessel
Platform Installation	July–November	8 platforms installed over ~20 years (5 in anchor field, 3 in satellite field)	multiple tugs, barges
Flowline Installation	July–November	30 mi of flowline connecting subsea templates to host platforms (2 mi per template)	1 reel vessel, 1 trenching vessel, +/- 1 mitigation vessel
Template Installation	July–November	15 subsea templates	1+ installation vessel, 1 ROV, +/- 1 mitigation vessel
On-platform drilling	Year-Round	16 wells per platform per year (including both production and service wells)	None
Subsea well drilling	July–November	90 production wells (6 per template); maximum of 4 MODUs during open-water season (includes MODUs for exploratory drilling); BOEM assumes that a single MODU could drill up to 3 subsea wells in a single season	Drilling Support: 2–4 MODUs (includes MODUs associated with exploratory drilling that could occur simultaneous to subsea well drilling), 2–4 ice breakers, 3–6 anchor handlers, 2–4 supply tug-and-barges, 3–6 offshore supply vessels, 2–4 support tugs, 2–4 science vessels, 2–4 shallow water vessels,

Activity	Activity Period	Estimated Operations	Associated Transportation
			+/- 1 MLC ROV system vessel Oil Spill Response: 1 oil spill response vessel, 1 oil spill response tug and barge, 2 oil spill tankers, 1 oil spill containment system tug and barge, 1 oil spill response tug and barge for nearshore response
Personnel and supply transport	Year-Round	Includes crew changes, supply delivery, and waste transport	1–3 vessel trips per platform per week, 1–3 helicopter trips per platform per day, 1–2 barge trips per open-water season (for waste disposal)
Spill response	July–November	Vessels will likely be stationed at Wainwright or Barrow	1 barge (for spill response), 1 tug (for spill response), 1 tank vessel (for spill storage)
Onshore			
Production base construction	Year-Round	Construction to occur over 2 years. Would include landfall valve pad, protective ice berm, valve enclosure control building, pipeline riser well, onshore pipeline trench and backfill, a pump station, pipeline pigging facilities, and a land-farm for barged drilling waste treatment	Dump trucks, graders, crew transport vehicles Flights Barges
Boat terminal construction	Year-Round	Construction to occur over 2 years. Boat terminal would include a barge dock with lay-down area and material storage, fuel tank farm, and vehicle parking	Dredge, dozers, dump trucks, graders, crew transport vehicles Flights Barges
Oil pipeline installation	Year-round	300–320 mi of oil pipeline tying into TAPS; installed at the onset of development over the course of several winters. Includes VSMs and pump station installation.	Crew transport vehicles, helicopters, graders, backhoes, dump trucks, other large construction vehicles as needed
Gas pipeline installation	Year-round	300–320 mi of gas pipeline tying into future existing gas transport system; installed towards the end of development over several winters	Crew transport vehicles, helicopters, graders, backhoes, dump trucks, other large construction vehicles as needed
Personnel and supply transport	Year-Round	Includes crew changes and supply delivery	1–2 barge trips each summer for two summers during production base construction, Up to 5 C-130 or larger aircraft flights per day, road traffic
Production			

Activity	Activity Period	Estimated Operations	Associated Transportation
Offshore maintenance and support	Year-Round	Pigging, pipeline repairs, equipment and facilities maintenance and upgrades, well servicing, crew changes	1 support vessel trip per platform every 1–2 weeks, 1–3 flights per platform per day
Onshore maintenance and support	Year-Round	Pigging, pipeline repairs, equipment and facilities maintenance and upgrades, crew changes	2 flights per day, road traffic
Decommission			
Offshore decommission	Year-Round	Drilling and plugging wells, plugging pipelines and flowlines, removal of templates, manifolds, platforms	2–3 MODUs
Onshore decommission	Year-Round	Transfer of existing facilities and pipelines to other entities (e.g., industry, village associations)	Crew transport vehicles

[1] The quantitative information contained in this table is BOEM and BSEE's best estimates for transportation activities Previous and present-day EPs as well as government NEPA documents specific to the Alaska OCS were consulted in the development of these estimates.

2.2.2.1. Infrastructure Development

Offshore and onshore development would commence simultaneously. Development would begin with the installation of oil pipelines (on- and off-shore) over the course of several years and the installation of processing and waste management facilities and a supply boat terminal at the exploration base, which would become production base and first pump station. The lessee would coordinate with landowner(s) and relevant government agencies to obtain all necessary permits and authorizations for onshore activities, which may include separate ESA consultation processes.

On shore, a main production shorebase would be developed. This may occur at a new location, or, alternatively, the existing exploration camp would likely be expanded and converted in to the production shorebase. The shorebase would support offshore operations, including oil and gas processing, and would serve as the first pump station. The location of this shorebase is unknown, but, for purposes of this assessment, BOEM and BSEE consider a location near Wainwright or Barrow, or otherwise on the coast between Icy Cape and Point Belcher. The production base would be expected to be composed of the landfall valve pad with, protective ice berm, valve enclosure control building, pipeline riser well, onshore pipeline trench and backfill, a pump station, pipeline pigging facilities, a land-farm for barged drilling waste treatment. Table 2–5 presents the maximum estimated footprint of onshore development by step and development component. See Section 2.2.1.1.5 for discussion of the processes and permits necessary before final site selection is achieved, in order to ensure avoidance and minimization of impacts to listed species and designated critical habitat.

In association with the production shorebase, a supply boat terminal would be constructed. The boat terminal would include the barge dock with lay-down area and material storage, fuel tank farm, and vehicle parking. BOEM estimates that approximately 10 acres of uplands habitat would undergo disturbance from construction of the terminal (Table 2–5).

From the production base, vertical support members (VSMs) would suspend communication cables and oil pipelines approximately 300–320 mi east to connect to existing North Slope oilfield infrastructure. Onshore pipeline placement would occur during winter months and would include gravel mining from one or more new or existing sources, and supply and personnel transport along a seasonal ice road. The pipeline corridor is anticipated to be approximately 300 ft (91 m) wide with a 100–ft (30.5 m) right-of-way. The total estimated pipeline corridor footprint would include an estimated 10 river crossings, a gravel pad for storage of spills prevention equipment, three pump stations (excluding Pump Station 1, which would be located at the production shorebase), and 20 valve pads and numerous VSMs (Table 2–5). Pump stations would be installed along the pipeline corridor at necessary intervals and likely would be collocated with existing oil fields along the corridor (e.g., Alpine). Two gravel material sites (in addition to the site developed for construction during the first incremental step) would likely be located at the mid-point and eastern end of the onshore pipeline corridor.

BOEM and BSEE assume that a large scale onshore gas transport system (similar to TAPS) will be developed in the future. On that assumption, the Scenario anticipates that a chilled high-pressure gas pipeline would be buried in the same corridor, within the 100–ft right-of-way, approximately 20 years after the oil pipeline is installed.

Table 2–5. Maximum Disturbance Area from Onshore Activities Associated with the Proposed Action.[1]

Step	Construction Component	Short-term Maximum Impact Area (acres)[2]	Long-term Maximum Impact Area (acres)
First Incremental Step	Exploration Camp	0	15
	Search and Rescue Base[3]	0	7
	Air Support Base[4]	0	5
	Dust/Gravel Spray and Shadow[5]	0	70
	Gravel Material Site[6]	0	240
Future Incremental Steps	Production Base – Total Area	0	142
	Primary Production Pad	*0*	*25*
	Pump Station 1	*0*	*27*
	Supply Boat Terminal and Barge Dock	*0*	*10*
	Landfall Control Pad	*0*	*10*
	Dust/Gravel Spray and Shadow[5]	*0*	*70*
	Pipeline Corridor – Total Area	3,600	339
	Ice Road	*3,600*[7]	*0*
	Pump Stations	*0*	*150*[8]
	VSMs	*0*	*9*[9]
	Valve Pads	*0*	*4*[10]
	River Crossings	*0*	25[11]
	Dust/Gravel Spray and Shadow[5]	*0*	*151*
	Gas Pipeline Corridor – Total Area	436	13,202
	All Season Road	*0*	*1,275*[12]
	Gas Pipeline Trench	*436*[13]	*0*
	Dust/Gravel Spray and Shadow[5]	*0*	*11,927*
	Gravel Material Sites[6]	0	480[14]
	Total Area (acres)	**4,036**	**14,500**

[1]All estimates assume a 300-mi long oil pipeline connecting the processing facility with TAPS.
[2]Assumes that restoration would occur at all sites after use is complete.
[3]Assumes ~1 mile of 50-ft wide road extension from Wainwright
[4]Assumes a 2,000-ft long, 150-ft wide extension to the Wainwright Airstrip.
[5]Assumes dust and gravel spray within 30–35 ft (approximately 10 m) of adjacent fill material and that dust shadow extends beyond 30–35 ft by less than 165 ft (approximately 50 m) from adjacent fill material.

[6]For the purposes of this BA, habitat alteration/loss from gravel material sites are assumed to be a long-term impact because USFWS has found that rehabilitation of mine sites to habitat comparable in quality to that which was present prior to mine construction has been largely unsuccessful to date (Louise Smith, USFWS, per. commun., 2014).
[7]Assumes a 25–35 ft wide ice road.
[8]Assumes three pump stations (excluding the production shorebase, which would serve as the first pump station), each with 50-acre footprints.
[9]Assumes 0.3 acres required per VSM per mile.
[10]Assumes 20 valve pads at 0.2 acres each.
[11]Assumes ten river crossings required 2.5 acres each.
[12]Assumes a 35-ft wide all-season road.
[13]Assumes a 12-ft wide trench for a pipe 38–50 in diameter.
[14]Two gravel material sites at 240 acres each.

Offshore pipeline installation would occur during the open-water season. All pipelines would be trenched in the seafloor as a protective measure against damage by floating ice masses. BOEM and BSEE anticipate that the depth and width of subsea pipeline trenches would be similar to those dug for Northstar (7–11 ft deep and 8–52 ft wide), with pipelines at greater depths requiring deeper and wider trenches. Approximately 6–9 ft of backfill would cover trenched pipelines.

An estimated 160 mi of trunk oil pipelines would connect the anchor field hub platform (1st installed platform) to the onshore processing facility (discussed below). An additional estimated 20 mi of oil pipeline would connect the satellite field hub platform to the anchor field hub. Subsea gas pipelines would be installed approximately 20 years after the oil pipelines and along the same routes.

After pipeline installation, offshore production platforms would be installed over the course of several open-water seasons. BOEM and BSEE anticipate that large, bottom-founded platforms which would be pinned to the seafloor and stabilized by its wide base, anchoring system, and ballast be used. Platforms would likely be constructed in large sections which would be transported to the site by boat during the open-water season, before they are mated together. Five platforms would be located in the anchor field. Additional exploratory surveys and drilling (as described in Section 2.2.1.1) conducted during development of the anchor field would reveal a smaller discovery in the satellite field approximately 20 mi from the anchor field hub platform. An additional three platforms would be installed at the satellite field.

Each platform would have two drilling rigs capable of drilling year-round. Each platform would also house processing equipment, fuel and production storage capacity, and quarters for personnel. It is assumed that oil would be piped to the shore as soon as it is processed. There would be some storage capacity on the platforms to accommodate periods of processing equipment downtimes. The first platform would serve as the hub. Additional anchor field platforms would be located approximately 5 mi from the hub platform, with buried subseaflowlines (placed during pipeline installation) connecting each platform to the hub. One of the three satellite field platforms would act as a secondary hub, delivering oil and gas to the anchor field hub via 20 mi of subsea flowline. The two remaining satellite field platforms would connect to the secondary hub via 5 mi of subsea flowline.

A total of 15 subsea templates would be installed during open-water seasons. Templates would be located within 2 mi of the host platform and connected via subsea flowline.

2.2.2.2. Production Drilling

Production well and service well drilling would be conducted both from production platforms and from drillships. An estimated annual maximum of eight wells could be drilled by each production platform rig (e.g., 16 wells total per platform per year). A total of 459 production and service wells would be drilled from production platforms over the life of the Proposed Action. Subsea wells would be drilled by drillships. With efficiencies gained by repeated operations, BOEM and BSEE assume that a single drillship could drill up to three subsea wells in a single season. The Proposed Action estimates that 6 to 9 subsea wells would be drilled per open-water season, requiring two to three drillships each summer over approximately 12 years. A total of 90 subsea production wells would be drilled over the life of the Proposed Action. Treated well cuttings and mud wastes for platform and subsea wells could be reinjected in disposal wells or barged to an onshore treatment and disposal facility located at the shorebase. The impact producing factors (IPF) associated with production well drilling (i.e., noise generation, rock cuttings, drilling mud) would be similar in type as those described for exploratory drilling but, as previously stated, production well drilling produces less drilling mud and fewer cuttings than does exploration and delineation well drilling.

2.2.2.3. Production

Production operations would largely involve resupply of materials and personnel, inspection of various systems, and maintenance and repair. Maintenance and repair work would be required on the platforms, and processing equipment would be upgraded to remove bottlenecks in production systems. Well repair work would be required to keep both production and service wells operational. Well workovers would likely be made at 5–10 year intervals to restore production flow rates. Pipelines will be inspected and cleaned regularly using internal devices (“pigs”). Crews would be rotated at regular intervals.

2.2.2.4. Discharges

2.2.2.4.1. Authorized Discharges

Discharges from development and production operations in the Chukchi Sea are permitted under a National Pollutant Discharge Elimination System (NPDES) General Permit that is issued by EPA and have a term of five years. Discharges under a General Permit for exploration typically include sanitary waste, domestic waste, drilling fluids, drilling cuttings, and deck drainage. The production fluids (oil, gas, and water) would be gathered on the platforms where gas and produced water would be separated and gas and water reinjected into the reservoir using service wells. During the later gas sales phase, water would continue to be reinjected. Disposal wells would handle wastewater from the crew quarters on the platforms.

2.2.2.5. Unauthorized Discharges

BOEM and BSEE’s estimate of the likelihood of one or more large spills occurring assumes that there is a 100% chance that development(s) will occur and 4.3 Bbbl of crude oil and natural gas liquid condensate will be produced. For the purposes of analysis under the Scenario, BOEM and BSEE estimate that approximately 777 small spills (<1,000 bbl) could occur over the life of the Scenario (20 during the first incremental step and 757 during future incremental steps).

Small Spills. Small spills (<1,000 bbl) of both refined oils and crude and condensate oils could occur both onshore and offshore during future incremental steps. The estimated total and annual numbers and volumes of small refined oil spills resulting from future incremental step activities are presented in Table 2–6. BOEM and BSEE estimate that approximately 535 spills of refined oil and 222 spills of crude or condensate oil or liquid nature gas could occur during future incremental steps. BOEM and BSEE anticipate that these spills would be <1–5 bbl each but assumes that one of the on-shore spills would be a roughly 700-bbl spill occurring along the 300–320 mi onshore pipeline.

Table 2–6. Annual and Total Potential Small Spills from Future Incremental Step Activities.

Activity Phase	Estimated Total Number of Small Spills	Estimated Total Volume of Small Spills (bbl)
	Small Refined Oil Spills	
Exploration Geological and Geophysical Activities	0 – 9	0 – < 9
Exploration and Delineation Drilling	0 – 6	0 – < 30
Development and Production	0 – 520	0 – 1,600
	Small Crude or Liquid Natural Gas Condensate Oil Spills	
Development and Production	0 – 222	0 – 2,000

Large Spills. A large spill could potentially come from four sources associated with OCS exploration or development operations: (1) pipelines (2) facilities (3) tankers or (4) support vessels. During the development of the second SEIS (USDOI, BOEM, 2014), BOEM and BSEE reviewed those four sources and determined well-control incidents (LOWCs) have the potential for the largest spill volumes, assuming all primary and secondary safeguards fail and the well does not bridge (collapse in on itself). At this time, pipelines are the preferred mode of petroleum transport (over tankers) in the Chukchi OCS and, therefore, BOEM and BSEE did not consider the loss of a fully loaded tanker reasonably foreseeable. The loss of the entire volume in an offshore pipeline would be less than a long duration well control incident with high flow rates. Sizes of spills from support vessels were considered based on foundering and the loss of entire fuel tanks, and determined to be lower in volume than a well control incident where all primary and secondary safeguards failed.

To estimate the effects of a large oil spill resulting from the Proposed Action, BOEM and BSEE estimated information regarding the general source(s) of a large oil spill (such as a pipeline, platform or well), the location and size of the spill, the type and chemistry of the oil, how the oil will weather (naturally degrade in the environment), how long it will remain prior to naturally degrading, and where it may go. BOEM and BSEE also estimated the mean number of large spills and the chance of one or more large spills occurring over the life of the Proposed Action.

The large spill-size assumptions BOEM and BSEE used are based on the reported spills in the Gulf of Mexico and Pacific OCS because no large spills have occurred on the Alaska OCS from oil and gas activities. BOEM used the median OCS spill size as the likely large spill size (Anderson, Mayes, and LaBelle, 2012) because it is the most probable size for that spill size category. The Gulf of Mexico and Pacific OCS data show that a large spill most likely would be from a pipeline or a platform. The median size of a crude oil spill ≥1,000 bbl from a pipeline on the OCS over the last 15 years is 1,720 bbl, and the average is 2,771 bbl (Anderson, Mayes, and LaBelle, 2012). The median spill size for a platform on the OCS over the entire record from 1964–2010, is 5,066 bbl, and the average is 395,500 bbl (Anderson, Mayes, and LaBelle, 2012). Outliers such as the Deepwater Horizon (DWH) incident spill volume skew the average and the average is not a useful statistical measure. For purposes of analysis for the second SEIS, BOEM/BSEE used the median spill size, rounded to the nearest hundred shown below, as the likely large spill sizes.

BOEM and BSEE estimate that there is a 75% change of one or more large spills (>1,000 bbl) occurring from platforms or pipelines during future incremental steps. For the OSRA in the second SEIS, BOEM and BSEE assume that two large spills would occur during the lifetime of the Proposed Action: one of these large spills would be from a production platform and the other from large offshore pipeline. No large spills are assumed to occur onshore.

Large condensate and diesel fuel spills would evaporate and disperse generally within 1–13 days. A large crude oil spill, however, is estimated to persist much longer: after 30 days 28–40% would evaporate, 3–16% would disperse, and 44–62% would remain. A large crude oil spill from a platform (5,100 bbl) into open water would cover an estimated discontinuous area of 54 km^2 after 3 days and 1,063 km^2 after 30 days A large crude oil spill from a platform on to the ice surface during November through May would cover an estimated discontinuous area of 18 km^2 after 3 days and 351 km^2 after 30 days. A large crude oil spill from an offshore pipeline (1,700 bbl) during open water would cover an estimated discontinuous area of 31 km^2 after 3 days and 615 km^2 after 30 days. A large crude oil spill from an offshore pipeline on to the ice surface during November through May would cover an estimated discontinuous area of 10 km^2 after 3 days and 200 km^2 after 30 days. Oiled ice that drifts and subsequently melts during open water would introduce oil into surface waters in new areas. A discussion of large spill cleanup activities is presented in Section 2.2.1.1.4 of this BA and further details presented in Section 4.2 of the second SEIS (USDOI, BOEM, 2014).

BOEM and BSEE analyzed the potential impacts of a VLOS (a spill of >150,000 bbl) scenario in the second SEIS for the purposes of evaluating a low-probability, high-impact event in the Leased Area. VLOS are analyzed separately from large oil spills due to their lower level of probability. Because a VLOS is a highly unlikely event and is not reasonably certain to occur it is not considered for the purposes of this BA to be an IPF of the Proposed Action. The VLOS scenario and analysis are detailed in Section 4.2 and Appendix A of the draft second SEIS (USDOI, BOEM, 2014).

Large Spill Cleanup Activities. Cleanup activities would likely occur after a large spill. Activities could include vessel traffic, aircraft traffic, in-situ burning, animal rescue, use of dispersants, booming, beach cleaning, drilling of a relief well, and bioremediation (USDOI, BOEM, 2014). Detailed descriptions of these activities are presented in Section 4.2 of the draft second SEIS (USDOI, BOEM, 2014). Based on clean-up activities with the Exxon Valdez Oil Spill where only about 14% was recovered or disposed (Wolf et al., 1994), spill response may be largely unsuccessful in remote open water conditions, and spill response drills have had various levels of success in the cleanup of oil in broken-ice conditions (Dickens, 2011). It is difficult to say how effective cleanup efforts would be at reducing the volume of oil in the environment if a large oil spill occurred.

Pollution prevention and oil spill response regulations and methods implemented by BOEM, BSEE, and offshore operators since the Deepwater Horizon event (USDOI, BOEMRE, 2011b; Visser, 2011) have improved oil exploration and development/production operations, with the goal of reducing the likelihood of a large spill. However, if an oil spill does occur, cleanup efforts would likely take place. 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. These activities could involve multiple marine vessels and aircraft operating in the spill area for a long time (USDOI, BOEM, 2014).

2.2.2.6. Transportation

During future incremental step construction activities, BOEM and BSEE estimate up to three helicopter flights per day and three support vessel trips per week would be made to the central platform site, either from the shore base or from Barrow. Heavy equipment and other materials for construction would likely be transported to the shore base site via barges (estimated at two barge trips per year) and aircraft (five C-130 flights per week).

In the production phase, the number of helicopter trips to the production platforms would likely remain the same, while vessel traffic would drop to one trip every one to two weeks. Two barge trips per year for six years may also be required to remove cuttings and spent mud from the subsea templates and central platform. Two to three daily aircraft flights are expected at the shorebase and ice roads may be constructed as needed. Table 2–4 presents transportation types and trip frequencies estimated to occur during future incremental steps by activity type.

2.2.2.7. Decommissioning

Decommissioning would commence after both oil and gas resources are depleted and income from production no longer pays operating expenses. MODUs (two to three per open-water season over an estimated 12 years) would be used to permanently plug wells with cement. Wellhead equipment would be removed and processing modules would be moved off the platforms. Subsea pipelines and flowlines would be decommissioned by cleaning the line, plugging both ends, and leaving it in place buried in the seabed. The overland oil and gas pipelines are likely to be used by other fields in the NPR-A and would remain in operation. Lastly, the platform would be disassembled and removed from the area and the seafloor site would be cleared of all obstructions. Post-decommissioning surveys would be required to confirm that no debris remains following decommissioning and that pipelines were abandoned properly.

2.3. Mitigation Measures

The following sections describe a variety of mitigation measures typically required for the types of activities comprising the Proposed Action. As described below, at the lease sale stage these mitigations typically take the form of lease stipulations; post-lease activities may have mitigation imposed through conditions of approval of plans, permit conditions, or other mechanisms. we note, however, that while the Proposed Action represents a reasonably foreseeable suite of exploration, development, production, and decommissioning activities that could potentially occur, considerable uncertainty exists as to what activities will actually be proposed in the future. 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 particular technologies to be employed – will be considered and evaluated in additional ESA consultations and other analyses (such as NEPA) as appropriate. Through this multi-stage process, a dynamic analysis of the potential effects of oil and gas activities is ensured, and additional mitigation measures and protections may be developed and at any stage based on the specific details of the particular projects.

There are a variety of typical design features and operational procedures used to mitigate the potential impacts of petroleum activities. Leaseholders and other permittees routinely request, and are expected to obtain, authorizations, including Incidental Harassment Authorizations (IHAs) and Letters of Authorization (LOAs) for activities that could result in the “take” marine mammals under the MMPA. These authorizations contain mitigation measures to ensure the authorized activities would result in the take of no more than small numbers of marine mammals and have no more than a negligible impact on marine mammal stocks. This standard represents a threshold for impacts than the jeopardy standard under the ESA. Mitigation measures typically required for activities in the Chukchi Sea are described below and analyzed in Section 5. As such measures are continually being revised or updated, and can be site-specific, the list below is not intended as a commitment for any particular activity. The final design features and operational procedures used for mitigation are identified in each LOA or IHA prior to commencement of activities in the Alaska OCS.

In the following sections, BOEM and BSEE discuss the kinds of mitigation measures that are typically applied to the types of activities comprising the first incremental step and then those specific to future incremental step activities. The final section addresses two new technologies with potential for ameliorating the effects of airguns, as well as several new technologies with potential for replacing airguns as a means of reducing potential adverse effects on marine mammals. BOEM did not identify any additional mitigation measures specific to the natural gas development and production scenario evaluated in the Lease Sale 193 Exploration and Development Scenario in the 2014 second SEIS (USDOI, BOEM, 2014)

2.3.1. Lease Sale 193 Stipulations

Mitigation measures are associated with each lease sale in the form of lease stipulations. Stipulations are requirements added to the lease that become contractual obligations that the lessee must follow. The seven stipulations that apply to the leases issued pursuant to Chukchi Sea OCS Oil and Gas Lease Sale 193 are set forth in Appendix D of the Second SEIS (USDOI, BOEM, 2014). The list of lease stipulations below remains comprehensive:

1. Protection of Biological Resources
2. Orientation Program
3. Transportation of Hydrocarbons
4. Industry Site-Specific Monitoring for Marine Mammal Subsistence Resources
5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvest Activities
6. Pre-Booming Requirements for Fuel Transfers
7. Measures to Minimize Effects on Spectacled And Steller's Eiders from Exploration Drilling

Of particular relevance to this BA are lease stipulations 1, 4, 5, and 7. Lease stipulation 1 gives BOEM and BSEE additional authority when a previously unidentified biological population or habitat is discovered in the lease area, including the authority to require that the lessee conduct biological surveys to determine the presence, extent, and composition of the biological population(s) or habitat(s), and relocate and/or modify the types and timing of operations to minimize impacts to the biological population(s) and/or habitat(s). Stipulation 4 requires that lessees who are proposing to conduct exploration operations on lease blocks that were identified during Lease Sale 193 as important areas for subsistence (see Appendix A) conduct a Regional Supervisor, Field Operations (RS/FO)-approved site-specific monitoring program unless the RS/FO, in consultation with appropriate agencies (i.e., NMFS, USFWS) and co-management organizations (e.g., Alaska Nanuuq Commission, Eskimo Walrus Commission (EWC)), determines that a monitoring program is not necessary. Stipulation 5 requires that all exploration, development, and production operations (and support activities associated with such operations) within lease blocks that were identified during Lease Sale 193 as important areas for subsistence (see Appendix A) and in all federal waters landward of the Lease Sale 193 area be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities. Lease stipulation 7 outlines actions that lessees are required to take that will minimize the likelihood that Spectacled and Steller's eiders will strike drilling structures or vessels. Lease stipulation 7 also provides additional protection to eiders within the blocks listed below and Federal waters landward of the sale area, including the Ledyard Bay Critical Habitat Area (LBCHA), during times when eiders are present.

In addition to stipulations, lease sales may also have ITLs (Information to Lessees) and NTLs (Notices to Lessees) associated with them. Certain ITLs and NTLs provide additional information to the lessees on best practices or ways to further mitigate the potential for impacts. For a full list of mitigation measures associated with existing leases in the Chukchi Sea, see Appendix A.

2.3.2. Mitigation Measures Associated with First and Future Incremental Step Activities

Mitigation measures are specific to the different types of activities in each phase of oil and gas development. Below, with respect to exploration, mitigation measures and typical monitoring protocols for seismic operations are addressed first, and then mitigation measures associated with 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 USFWS 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.

2.3.2.1. Seismic Operations

Seismic operations include deep penetration (primarily marine streamer 2D and 3D surveys; see Section 2.2.1.1.1) and ancillary activities (high-resolution surveys; see Sections 2.2.1.1.2 and 2.2.1.1.3). Monitoring is conducted by on-board Protected Species Observers (PSOs) to activate appropriate mitigation measures to protect ESA-listed species during completion of specific activities. Therefore, monitoring protocols are discussed first, followed by mitigation measures in four categories of seismic survey.

2.3.2.2. Seismic Survey Mitigation

The monitoring protocols below are important for ensuring that the following mitigation measures are implemented as appropriate. Mitigation measures vary with the specific category of seismic survey being utilized. Four categories are discussed below.

2.3.2.2.1. Vessel-based Seismic Surveys

BOEM and BSEE’s G&G permit stipulations for vessel-based surveys include:

- ***Timing and location**:* Timing and locating survey activities to avoid interference with the marine mammal hunts.
- ***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.
- ***Established safety zones**:* Early season field assessment to establish and refine (as necessary) the appropriate 180-dB and 190-dB safety zones, and other radii relevant to behavioral disturbance.

The potential disturbance of marine mammals during seismic survey operations is minimized further through the typical implementation of several ship-based mitigation measures, which include 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.

- ***Safety and disturbance zones:*** Operators are required to use NMFS-approved observers onboard the survey vessel to monitor the 190-, 180-, and 160-dB (rms) safety radii for pinnipeds, cetaceans, and polar bears, and to implement other appropriate mitigation measures.

  Safety radii for marine mammals around airgun arrays are customarily defined as the distances within which received pulse levels are greater than or equal to 180 dB re 1 μPa (rms) for walrus, and 190 dB re 1 μPa (rms) for polar bears.
- ***Ramp-up***: A ramp-up (or "soft start") of a sound source array provides a gradual increase in sound levels, and involves a step-wise increase in the number and total volume of airguns until the desired operating level of the full array is attained. The purpose of a ramp-up is to alert marine mammals in the vicinity to the presence of the sound source and to provide them time to leave the area and thus avoid any potential injury or impairment of their hearing abilities. During a survey program, the operator is required to ramp up sound sources slowly (if the sound source being utilized generates sound energy within the frequency spectrum of pinnipeds hearing). 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 any time electrical power to the airgun array has been discontinued for a period of 10 min or more and the observer watch has been and the observer watch has been suspended. The entire safety zone must be visible and monitored by observers during the 30 min lead-in to a full ramp-up, and clear of marine mammals for 15 min prior to beginning the ramp-up from a cold start, to ensure that no marine mammals enter the safety zone. Lead-in to a full ramp-up from a cold-start to ensure that no marine mammals have entered the safety zone.
- ***Power-downs and Shutdowns:*** A power-down is the immediate reduction in the number of operating energy sources from all firing to some smaller number. A shutdown is the immediate cessation of firing of all energy sources. The arrays will be immediately powered down whenever a marine mammal is sighted approaching near or close to the applicable safety zone of the full arrays but is outside the applicable safety zone of the single source. If a marine mammal(s) is sighted within the applicable safety zone of the single energy source, the entire array will be shut down (i.e., no sources firing).
- ***Following a power-down or 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 min 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 min for pinnipeds and 30 min for baleen whales. The vessel operator and observers will maintain records of the times when ramp-ups start and when the airgun arrays reach full power.

  During periods of transit between survey transects and turns, one airgun (or sound source) will remain operational. The ramp-up procedure still must be followed when increasing the source levels from one gun to the full array. Keeping an air gun firing avoids the prohibition of a cold start during darkness or other periods of poor visibility. Survey operations can resume upon entry to a new transect without a full ramp-up and the associated 30 min lead-in observations as long as the exclusion zones are free of marine mammals.
- ***Operations at Night and in Poor Visibility:*** Most operators conduct seismic operations 24 hr/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, observers will not routinely be on watch at night, except in periods before and during ramp-ups. As stated earlier, if the entire safety zone is not visible for at least 30 min prior to ramp-up from a cold start, then ramp-up may not proceed. It should be noted that if one small airgun has remained

firing, the rest of the array can be ramped up during darkness or in periods of low visibility. Survey operations may continue under conditions of darkness or reduced visibility.

Note: An exception to this is when in-ice surveys are conducted. For in-ice surveys only, vessel-based observers would typically be required to monitor for marine mammals near the seismic source vessel during all periods of airgun survey operations and prior to any ramp up of the airgun array. Observers would not be required to monitor for marine mammals during turns and during transit between seismic survey lines when a mitigation airgun is operating.

- ***Speed and Course Alterations****:* If a marine mammal (in water) is detected outside the safety radius and, based on its position and the relative motion, is likely to enter the safety 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 approach within the safety radius. If the mammal is sighted approaching near or close to the applicable safety radius, further mitigative actions must be taken, i.e., either further course alterations or power-down or shutdown of the airgun(s).
- In the event that an injured or dead marine mammal is sighted within an area where the operator deployed and utilized airguns within the past 24 hr, the airguns must be shut down immediately and the Marine Mammal Stranding Network/USFWS 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.

2.3.2.2.2. In-Ice Seismic Surveys

A recent proposal for an in-ice seismic survey incorporated design features and operational procedures for minimizing the potential for impacts to marine mammals (NMFS, 2013a). The survey was designed to proceed as follows:

- The survey was scheduled to occur in late September–December to avoid higher local marine mammal abundance.
- The seismic survey would have begun in the deep water area of the northeastern U.S. Beaufort Sea where marine mammals would be least abundant.
- PSOs were required to be on duty whenever airguns were firing during daylight and during the 30-min periods prior to ramp up. PSOs were on standby for monitoring during periods of darkness. The PSOs could be called to duty when marine mammals were sighted and/or during ramp up of the powered-down array when the mitigation gun was firing during low visibility.
- The survey would have proceeded along a course designed in part to avoid interference with marine mammal migrations.

Authorization of an in-ice seismic survey is anticipated to require the same basic mitigation measures as required for open-water vessel-based seismic surveys, with additional measures to account for longer periods of darkness:

- ***Safety zones****:* As with other seismic surveys, a 180-dB (for cetaceans)/190-dB (for pinnipeds and polar bears) isopleth zone around the seismic-survey-sound source must remain free of marine mammals before the survey can begin and must remain free of marine mammals during the survey.
- ***Observers****:* Trained observers would watch for and identify marine mammals; recording their numbers, distances, and reactions to the survey operations. The observers have the authority to initiate a power-down or shutdown.

- ***Equipment:*** The observers would have 7×50 reticle binoculars, +20× binoculars, a GPS unit, laptop computers, and night vision binoculars available. The observers may use night vision binoculars or floodlights to aid monitoring during periods of darkness. A forward looking infrared thermal imaging (FLIR) camera system mounted on a high point in front of the icebreaker would also be available to assist with detecting the presence of seals on ice and in water ahead of the airgun array.
- ***Ramp up:*** If the airgun array is shut down for any reason, it will not be ramped up again until no marine mammals are detected within the 180/190-dB exclusion zone for 30 min.
- ***Exclusion zone:*** While ice would be more prevalent during the post-September period, observations of a seal on ice would not trigger a shutdown unless the seal entered the water within the exclusion zone.

BOEM requires detailed weekly operations reports, which includes observer reports during operations, and a comprehensive completion report due 30 days after operations cease. Any harm or mortality to a marine mammal must be reported to BOEM, BSEE, and USFWS immediately. Review of the observer reports, vessel track, and activity reports can be used as a management tool to monitor disturbance events during the survey and to modify survey plans, if necessary.

2.3.2.2.3. Protected Species Monitoring

Monitoring for protected species during seismic surveys will be conducted throughout the period of survey operations by PSOs. The observers are stationed aboard the survey source vessel. Duties of the observers include watching for and identifying polar bears and pinnipeds; recording their numbers, distances, and reactions to the survey operations; initiating mitigation measures; and reporting the results.

The observers must be on watch during all daylight periods when the energy sources are in operation and when energy source operations are to start up at night. A shift does not exceed four consecutive hours, and no observer works more than three shifts in a 24-hr period (i.e., 12 hr total per day) in order to avoid fatigue. Observers are biologists/local experts who have previous marine mammal observation experience and field crew leaders are highly experienced with previous vessel-based monitoring projects. Qualifications for these individuals are typically provided to NMFS for review and acceptance. All observers complete a training session on marine mammal monitoring shortly before the start of their season.

Monitoring Methods

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

- ***Vantage point:*** The observer(s) 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:*** The observer(s) will scan systematically with the naked eye and 7 x 50 reticle binoculars, supplemented with 20 x 50 image stabilized binoculars, and night-vision equipment when needed.
- ***Safety zones:*** The observer(s) will give particular attention to the areas within the “safety zone” around the source vessel. These zones are the maximum distances within which received levels may exceed 180 dB re 1 μPa (rms) for cetaceans or 190 dB re 1 μPa (rms) for pinnipeds. The observers will also monitor the 160 dB re 1 μPa (rms) radius for Level B harassment takes. When a marine mammal is seen within the applicable safety radius, the geophysical crew will be notified immediately so that the required mitigation measures can

be implemented. It is expected that the airgun arrays will be shut down or powered down within several seconds-often before the next shot would be fired, and almost always before more than one additional shot is fired. The observer will then maintain a watch to determine when the mammal(s) is outside the safety zone such that airgun operations can resume.

- ***Sighting information:*** When a marine mammal sighting is made, the following information about the sighting is 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. This information will be recorded by the observers at times of marine mammal sightings.
- ***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 min 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 190-dB (or other) safety zone applicable to pinnipeds) will be estimated with binoculars (7 x 50) 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.
- ***Observation equipment:*** Prior to mid-August, there will be no hours of total darkness in the Chukchi Sea Program Area. Onboard observers will scan systematically with the naked eye, and the operators will also provide or arrange for the following specialized field equipment for use by the observers: reticule binoculars, 20 x 50 image stabilized binoculars, Big Eye binoculars, laser rangefinders, inclinometer, and laptop computers. Night vision equipment will be available for use when needed.

Acoustic Sound Source Verification Measurements

The operator or leaseholder is typically required by NMFS to conduct acoustic measurements of their equipment (including source arrays) at the source. These sound source verification (SSV) tests will be utilized to determine safety radii for the airgun array. A report on the preliminary results of the acoustic verification measurements, including as a minimum the measured 190-, 180-, and 160-dB re 1 μPa (rms) radii of the airgun sources, will be submitted within 5 days after collection and analysis of those measurements. This report will specify the distances of the safety zones that were adopted for the survey. The measurements are made at the start of the field season so that the measured radii can be used for the remainder of the survey period.

Field Data-recording and Verification

The following procedures for data recording and verification 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 observers 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 running a custom computer database.
- ***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.

Use of Passive Acoustic Arrays

Although not required, industry has jointly funded an extensive acoustic monitoring program. This program incorporates the use of dozens of recorders distributed broadly across survey area and the nearshore environment. The broad area arrays are designed to capture both general background soundscape data and marine mammal call data. From these recordings, it is anticipated that industry/government may be able to gain insights into large-scale distribution of marine mammals, identification of marine mammal species present, movement and migration patterns, and general abundance data. The intense area arrays are designed to support localization of marine mammal calls on and around the survey areas.

Reporting

All walrus and polar bear sightings must be reported and include the details specified in and any relevant IHA issued pursuant to the MMPA. A report that summarizes the monitoring results and operations as specified in the LOA must be received no later than 90 days after completion of the project. The reports 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 power-downs, 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, and distribution of marine mammal sightings, including date, water depth, 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.
- Estimates of take by harassment.

The take estimates are calculated using two different methods to provide both minimal and maximal estimates. The minimum estimate is based on the numbers of marine mammals directly seen within the relevant radii (160, 180, and 190 dB (rms)) by observers on the source vessel during survey activities. The maximal estimate is calculated using densities of marine mammals determined for non-acoustic areas and times. These density estimates are calculated 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 areas without data acquisition activity are applied to the amount of area exposed to the relevant levels of sound to calculate the maximal number of animals potentially exposed or deflected. These reports are due 90 days after termination of the survey season.

2.3.2.3. Exploration and Delineation Drilling

Under the Proposed Action, exploration and delineation drilling operations are expected to use MODUs with icebreaker support vessels. Drilling operations are expected to range between 30 and 90 days per well site, depending on the depth of the well, delays during drilling, and time needed for well logging and testing operations. Considering the relatively short open-water season in the Chukchi Sea OCS (June–November), BOEM and BSEE estimate that two wells per drilling rig could be drilled, tested, and abandoned during a single open-water season. Drilling operations would be supported by resupply vessels and, most likely, ice management vessels.

Drilling activities generate continuous non-pulse sounds during operations. The continuous nature of these sounds allows polar bears and pinnipeds approaching the activity to be exposed to increasing levels of noise and to have an opportunity to avoid the location well before there is any chance of injury.

Mitigation measures are unique depending on the specific circumstances of the drilling operations, as described below.

Shell Gulf of Mexico, Inc. measured the sounds produced by the *Discoverer* while drilling on the Burger Prospect (within the Leased Area) in 2012. A broadband (10 Hz – 32 kHz) source level of 182 dB was calculated for the *Discoverer* based on the measurements recorded when drilling the 26-in hole interval (Bisson et al., 2013). These estimates are considered representative of a typical industry-standard, ice-reinforced drillship that would be used for exploration drilling in the Arctic OCS.

Shell's measurements showed source levels from drilling would fall below 160 dB (rms) within 10 m from the drillship. The 2012 measurement of the distance to the 120 dB (rms) threshold for normal drilling activity by the *Discoverer* was 0.93 mi (1.5 km) while the distance of the ≥120 dB (rms) radius during mudline cellar (MLC) construction was 5.1 mi (8.2 km) (Bisson et al. 2013). These near-continuous, non-pulse source sound levels were expected to cause some temporary avoidance of the immediate area by marine mammals but no physical damage to marine mammal hearing.

Drilling activities could cease in certain areas in deference to subsistence whaling when operations are close enough to impact the hunt(s). While MODUs could be moved to another area during this period of inactivity, moving a drilling rig in the middle of the season increases the chance of a spill and poses associated safety and logistical concerns. The non-operation of MODU would avoid drilling-related effects to listed species at the drill site, however as this measure is highly location- and season-specific this type of mitigation measure cannot be considered to apply to all MODU operations. The mitigation of subsistence marine mammal harvests is a requirement of the MMPA, and is not a direct consideration of the ESA.

Previously submitted exploration plans have included the use of observers onboard the drillship and various support vessels to monitor marine mammals and marine mammal responses to industry activities. While not specifically required for inclusion in exploration plans, these monitoring efforts will help industry/government agencies evaluate the effectiveness of mitigation measures and evaluate adverse effects of the activity on marine mammals. The observers would initiate mitigation measures should in-field measurements of the operations indicate conditions represented a threat to the health and well-being of marine mammals.

Mitigation measures for authorized discharges are described according to relevant requirements of the EPA NPDES permit (see Section 2.2.1.1.4).

2.3.2.4. Vessel Operations

There are a wide variety of vessels of different types and sizes that operate in support of exploration activities. These vessels typically conform to the following operational procedures with respect to whales, as stipulated in IHAs and LOAs:

- **Maximum distance.** Operators of vessels should, at all times, conduct their activities at the maximum distance possible from groups of walruses, and must maintain a minimum 800 m (½ mi) buffer zone from walruses and polar bears.
- **Changes in direction.** Vessel operators should avoid multiple changes in direction when within ½ mi (800 m) of walruses; however, those vessels capable of steering around such groups should do so.
- **Changes in speed.** Vessels should avoid multiple speed changes; however, vessels should slow down when near groups of walruses, especially during poor visibility, to reduce the potential for collisions.
- **Groups of walruses.** Vessels may not be operated in such a way as to separate members of a group of walruses.

Some oil and gas exploration activity includes the use of an icebreaker. Icebreakers contribute greater sound levels during ice-breaking activities than ships of similar size during normal operation in open water (Greene and Moore, 1995). As the icebreakers would not generate noise above 160 dB re 1µPa (rms), and because the icebreaker activity would most likely be needed to protect the safety of fleet/drilling platform, there are no associated mitigation measures or provisions for shutdowns, power-downs, or ramp-ups. The icebreakers could be required to have on-board PSOs whose duties will include watching for and identifying marine mammals, recording their numbers, recording distances, and recording their reactions to the drilling operations.

2.3.2.5. Aircraft Operations

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

- **Helicopters:** Helicopters may not hover or circle above marine mammals or pass within ½ mi (800 m) lateral distance of groups of walruses or polar bears.
- **Inclement weather:** When weather conditions do not allow a 1,500 ft flying altitude, such as during storms or when cloud cover is low, aircraft may be operated below 1,500 ft, but the operator should avoid known walrus concentration areas and take precautions to avoid flying directly over or within ½ mi (800 m) of walruses.
- **Support aircraft:** Support aircraft must avoid extended flights over the coastline to minimize effects on marine mammals in nearshore waters or the coastline.

Aerial marine mammal surveys have not been required in the Chukchi Sea because of a lack of adequate landing facilities and the prevalence of fog and other inclement weather in that area, potentially resulting in an inability to return to the airport of origin, and thereby resulting in safety concerns.

2.3.2.6. Onshore Operations

Onshore activities associated with the Proposed Action would be subject to permits, authorizations, stipulations, required operating procedures (ROPs), and best management practices (BMPs) as recommended or required by the appropriate land-based resource and management agencies. The U.S. Bureau of Land Management's 2013 Record of Decision (ROD) for the National Petroleum

Reserve – Alaska Integrated Activities Plan (USDOI, BLM, 2013) presents stipulations and BMPs that are typical of the types of mitigation BOEM anticipates for onshore oil and gas activities described in the Proposed Action if located on Federal lands. These mitigation measures provide operators with guidance in minimizing impacts to wildlife, vegetation, and subsistence resources, including requirements for water and mineral withdrawals, waste disposal, construction footprints, and contaminant and spill handling. Of particular applicability to ESA-listed species are the following BMPs:

A–8: Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities.

Requirement/Standard: Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans.

C–1: Objective: Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.

Requirement/Standard:

a. Cross-country use of heavy equipment and seismic activities is prohibited within ½ mile of occupied grizzly bear dens identified by the Alaska Department of Fish and Game unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game.
b. Cross-country use of heavy equipment and seismic activity is prohibited within 1 mile of known or observed polar bear dens or seal birthing lairs. Operators near coastal areas shall conduct a survey for potential polar bear dens and seal birthing lairs and consult with USFWS and/or NOAA-Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.

E–4: Objective: Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents.

Requirement/Standard: All pipelines shall be designed, constructed, and operated under an authorized officer-approved Quality Assurance/Quality Control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.

E–5: Objective: Minimize impacts of the development footprint.

Requirement/Standard: Facilities shall be designed and located to minimize the development footprint. Issues and methods that are to be considered include:

a. Use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads;
b. sharing facilities with existing development;
c. collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads;
d. integration of airstrips with roads;
e. use of gravel-reduction technologies, e.g., insulated or pile-supported pads; and,
f. coordination of facilities with infrastructure in support of offshore development.

Note: Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.

E–8: Objective: Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.

Requirement/Standard: Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider:

a. Locations outside the active flood plain.
b. Design and construction of gravel mine sites within active flood plains to serve as water reservoirs for future use.
c. Potential use of the site for enhancing fish and wildlife habitat.
d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.

E–10: Objective: Prevention of migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions.

Requirement/Standard: Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.

E–11: Objective: Minimize the take of species, particularly those listed under the Endangered Species Act and BLM Special Status Species, from direct or indirect interaction with oil and gas facilities.

Requirement/Standard: In accordance with the guidance below, before the approval of facility construction, aerial surveys of the following species shall be conducted within any area proposed for development.

Special Conditions in Spectacled and/or Steller's Eiders Habitats:

a. Surveys shall be conducted by the lessee for at least 3 years before authorization of construction, if such construction is within the USFWS North Slope eider survey area and at least 1 year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below.
b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels.
c. To reduce the possibility of spectacled and/or Steller's eiders or other birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to USFWS when exceptions are authorized.
    1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad;

2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or
3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.

d. To reduce the likelihood of spectacled and/or Steller's eiders or other birds colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low flying birds. Such markings shall be developed through consultation with USFWS.

E–18: Objective: Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests.

Requirement/Standard: Ground-level activity (by vehicle or on foot) within 200 m of occupied Steller's and/or spectacled eider nests, from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 m of occupied Steller's and/or spectacled eider nests will be prohibited. In instances where summer (June 1 through August 15) support/construction activity must occur off existing thoroughfares, USFWS-approved nest surveys must be conducted during mid-June prior to the approval of the activity. Collected data will be used to evaluate whether the action could occur based on employment of a 200-m buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. Also, in cases in which oil spill response training is proposed to be conducted within 200 m of shore in riverine, marine, or intertidal areas, the BLM will work with USFWS to schedule the training at a time that is not a sensitive nesting/brood-rearing period or require that nest surveys be conducted in the training area prior to the rendering a decision on approving the training. The protocol and timing of nest surveys for Steller's and/or spectacled eiders will be determined in cooperation with USFWS, and must be approved by USFWS. Surveys should be supervised by biologists who have previous experience with Steller's and/or spectacled eider nest surveys.

F–1 (i): Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities.

Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (Note: This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.):

Subsection (i): Aircraft used as part of a BLM-authorized activity along the coast and shorefast ice zone shall maintain minimum altitude of 3,000 feet when within 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.

K–3: Objective: Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, and marine mammals), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies.

Requirement/Standard (Development): With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within ¾ mile seaward of the shoreline (as measured from mean high tide) of the major coastal waterbodies or the natural coastal islands (to the extent that the seaward subsurface is within NPR-A). These areas include: Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon, and their associated Islands. Elsewhere, permanent facilities within the major coastal waterbodies will only be permitted on or under the water if they can meet all the following criteria:

a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.
b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.
c. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal waterbodies as identified by the North Slope Borough.
d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and “top-setting” of hydrocarbon-bearing zones.
e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound “direct spill” related impacts on area resources and subsistence uses.
f. Before conducting open water activities, the permittee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.

K–6: Objective: Protect coastal waters and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect the summer and winter shoreline habitat for polar bears, and the summer shoreline habitat for walrus and seals; prevent loss of important bird habitat and alteration or disturbance of shoreline marshes; and prevent impacts to subsistence resources and activities.

Requirement/Standard:

a. Exploratory well drill pads, production well drill pads, or a central processing facility for oil or gas would not be allowed in coastal waters or on islands between the northern boundary of the Reserve and the mainland, or in inland areas within one mile of the coast. (Note: This would include the entirety of the Kasegaluk Lagoon and Peard Bay Special Areas.) Other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Nor would this stipulation preclude infrastructure associated with offshore oil and gas exploration and production or construction, renovation, or replacement of facilities on existing gravel sites. Lessees/permittees shall consider the practicality of locating facilities that necessarily must be within this area at previously occupied sites such as various Husky/USGS drill sites and Distant Early Warning-Line sites. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains associations to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.
b. Marine vessels used as part of a BLM-authorized activity shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Marine vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.
c. Marine vessels used as part of a BLM-authorized activity shall maintain a ½-mile buffer from shore when transiting past an aggregation of walrus using a terrestrial haulout.

2.3.3. Mitigation Measures Considered for Alternative Exploration Technologies and Decreasing Airgun Noise

The impulsive airgun has been under scrutiny and criticism as a sound source for seismic exploration due to the belief that the propagated sound waves may harm marine life during operations. BOEM frequently receives comments from stakeholders who suggest that airguns should be replaced by more “environmentally-friendly” alternative technologies and other techniques to mitigate current technologies used in oil and gas exploration. The 2011 BE for Oil and Gas Leasing and Exploration Activities in the Beaufort Sea and Chukchi Sea Planning Areas (USDOI, BOEMRE, 2011b) provides detailed clarification on the status of these proposed technologies, including hydraulic and electric marine vibrators, Low-level Acoustic Combustion Sources (patented, LACS), Deep-towed Acoustics/Geophysics Systems (DTAGS), low frequency passive seismic methods (e.g., natural seismicity, ocean waves, microseism surface waves), and fiber optic receivers, and why they are not currently practicable. Technologies supplemental to seismic operations such as gravity/gradiometry and controlled source electromagnetics are commercially available and discussed in BOEM’s 2011 BE (USDOI, BOEMRE, 2011b).

2.3.3.1. Mitigation by Decreasing Airgun Impacts

In addition to alternative methods for seismic data collection, industry and the public sector have actively investigated the use of the technology-based mitigation measure to lessen the impacts of airguns in water.

2.3.3.2. Air Gun Silencer

One new technology-based measure to lessen the impacts of the airguns currently in use is an airgun silencer, which has acoustically absorptive foam rubber on metal plates mounted radially around the airgun. This technology has demonstrated 0–6 dB reductions at frequencies above 700 Hz, and 0–3 dB reductions at frequencies below 700 Hz. This system has been tested only on low pressure airguns and is not a practicable mitigation tool because it needs to be replaced after 100 shots (Spence et al., 2007).

2.3.3.3. Bubble Curtain

Bubble curtains are another technology for reducing the impacts of airguns. Bubble curtains generally consist of a rubber hose or metal pipe with holes to allow air passage and a connector hose attached to an air compressor. They have successfully been tested and used in conjunction with pile driving and at construction sites to frighten away fish and decrease the noise level emitted into the surrounding water (Würsig et al., 2000; Sexton, 2007; Reyff, 2009). They have also been used as stand-alone units or with light and sound to deflect fish away from dams or keep them out of specific areas (Weiser, 2010; Pegg, 2005).

The use of bubbles as a mitigation measure for seismic noise has also been pursued. During an initial test of the concept, the sound source was flanked by two bubble screens; it demonstrated that bubble curtains were capable of attenuating seismic energy up to 28 dB at 80 Hz while stationary in a lake. This two-bubble curtain configuration was field tested from a moving vessel in Venezuela and Aruba where a 12 dB suppression of low frequency sound and a decrease in the level of laterally projecting sound was documented (Sixma, 1996; Sixma and Stubbs, 1998). A different study in the Gulf of Mexico tested an “acoustic blanket” of bubbles as a method to suppress multiple reflections in the seismic data. The results of the acoustic blanket study determined that suppression of multiple reflections was not practical using the current technology. However, the acoustic blanket measurably suppressed tube waves in boreholes and has the capability of blocking out thruster noises from a laying vessel during an ocean-based cable (OBC) survey, which would allow closer proximity of the shooting vessel and increase productivity (Ross et al., 2004, 2005).

A recent study “Methods to Reduce Lateral Noise Propagation from Seismic Exploration Vessels” was conducted by Stress Engineering Services Inc. under the BOEM Technology Assessment & Research (TA&R) Program. The first phase of the project was spent researching, developing concepts for noise reduction, and evaluating the following three concepts: (1) an air bubble curtain; (2) focusing arrays to create a narrower footprint; and (3) decreasing noise by redesigning airguns. The air bubble curtain was selected as the most promising alternative, which led to more refined studies the second year (Ayers, Hannay, and Jones, 2009). A rigorous 3D acoustic analysis of the preferred bubble curtain design, including shallow-water seafloor effects and sound attenuation within the bubble curtain, was conducted during the second phase of the study. Results of the model indicated that the bubble curtains performed poorly at reducing sound levels and are not viable for mitigation of lateral noise propagation during seismic operations from a moving vessel (Ayers, Hannay, and Jones, 2010).

3.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

3.1. Spectacled Eiders

3.1.1. Status and Distribution

The spectacled eider was listed throughout its range as threatened on May 10, 1993 (58 *FR* 27474) because of documented population declines on the Yukon Kuskokwim Delta. Historically, spectacled eiders nested in Alaska discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada's Yukon Territory (Phillips, 1922–1926; Bent, 1925; Bailey, 1948; Dau and Kistchinski, 1977; Derksen et al., 1981; Garner and Reynolds, 1986; Johnson and Herter, 1989). Currently, this species consists of three primary breeding populations: those on Alaska's North Slope (or Arctic Coastal Plain (ACP), the Yukon-Kuskokwim Delta (Y-K Delta), and northern Russia (Figure 3–1). The Y-K Delta population had declined 96% between the 1970s and early 1990s (Stehn et al., 1993; Ely et al., 1994). Research and spring aerial surveys have provided data on spectacled eider populations on the ACP since 1992. The aerial population index obtained from ACP Surveys suggests population growth rate is approximately stable over the long term (0.99, 90% Confidence Interval (CI) = 0.98–1.00) and last 10 years (0.98, 90% CI = 0.93–1.02) on the ACP (Table 5 in Stehn et al., 2013).

After breeding, spectacled eiders migrate to several discrete molting areas (Figure 3–1), with birds from the different populations and genders apparently favoring different molting areas (Petersen et al., 1999). After molting, spectacled eiders migrate to openings in the pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Petersen et al.,1999), where they remain until March or April (Lovvorn et al., 2003).

Figure 3-1. Distribution of spectacled eiders. Molting areas (green) are used July through October. Wintering area (yellow) are used October through April. The full extent of molting and wintering areas is not yet known and may extend beyond the boundaries shown.

3.1.2. Life History

3.1.2.1.1. Breeding–North Slope Population

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Breeding density varies across the North Slope (Figure 3–2). Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Smith et al., 1994; Anderson and Cooper, 1994; Anderson et al., 1995; Bart and Earnst, 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst, 2005). Spectacled eider clutch size near Barrow has averaged 4.1 to 4.7 (Safine, 2011; Safine, 2012). Incubation lasts 20–25 days (Kondratev and Zadorina, 1992; Harwood and Moran, 1993; Moran and Harwood, 1994; Moran, 1995), and hatching occurs from mid- to late July (Warnock and Troy, 1992). On the nesting grounds, spectacled eiders feed on mollusks insect larvae, small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina, 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Young fledge approximately 50 to 55 days after hatch, and females with broods move from freshwater to marine habitats just prior to or after fledging (Safine, 2011).

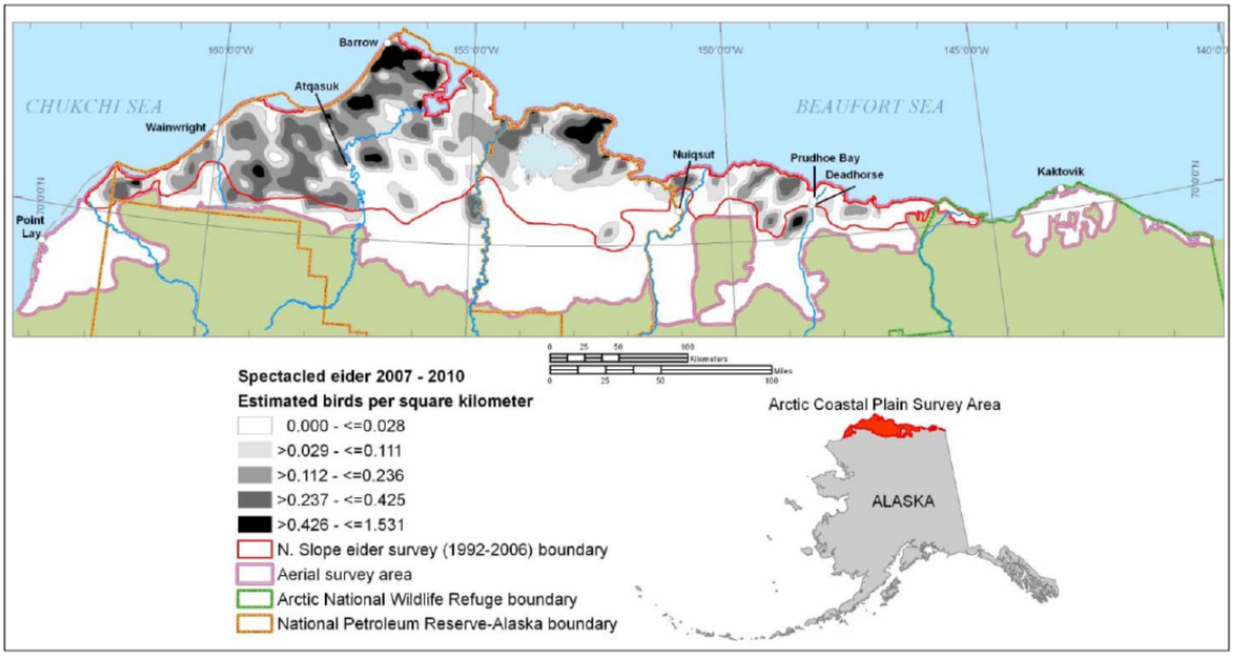

Figure 3-2. Density distribution of spectacled eiders (*Somateria fischeri*) observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007-2010. From Larned et al., 2011.

Nest success is highly variable and greatly influenced by predators. In arctic Russia, apparent nest success was estimated as <2% in 1994 and 27% in 1995; predation was believed to be the cause of high failure rates, with foxes, gulls and jaegers the suspected predators (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP varied from 25–40% (Warnock and Troy, 1992; Anderson et al., 1998). Nest survival probability for spectacled eiders in an area near Barrow employing fox control in 2011 was 72 % (95% CI = 27–92%; Safine, 2012).

3.1.2.2. Post-breeding – North Slope

Males generally depart breeding areas when females begin incubation in late June (Anderson and Cooper, 1994; Bart and Earnst, 2005). Use of the Beaufort Sea by departing males is variable. Some appear to move directly to the Chukchi Sea over land, while the majority moved rapidly (average travel of 1.75 days), over nearshore waters of the Beaufort Sea from the breeding grounds to the Chukchi Sea (TERA, 2002). Males seem to prefer large river deltas such as the Colville River containing open water in early summer when much of the Beaufort Sea is still frozen. About half of the adult males marked in northern and western Alaska in a satellite telemetry study migrated to northern Russia to molt (Matt Sexson, USGS, unpublished data). Results from this study also suggested that male eiders follow coast lines and migrate straight across portions of the northern Bering and Chukchi seas in route to northern Russia (Matt Sexson, USGS, unpublished data).

Females generally depart the breeding grounds after males; more of the Beaufort Sea is ice-free at this time, allowing more use of marine waters (Peterson et al., 1999; TERA, 2002). Females spent an average of two weeks in the Beaufort Sea (range 6–30 days) mostly in its western portion (TERA, 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than males (Peterson et al., 1999). Telemetry data indicates that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid (two weeks) compared to two to three months spent by these females in the Chukchi Sea (Matt Sexson, USGS, unpublished data).

3.1.2.3. Molt

Avian molt is energetically demanding, especially for species such as spectacled eiders that complete molt in a few weeks. Also, birds are particularly vulnerable to predation during the time they are flightless. Spectacled eiders use four molting areas from July to late October (Figure 3–1; Larned et al., 1995; Peterson et al., 1999). Females generally use molting areas nearest their breeding grounds, and most females that nest on the ACP molt in Ledyard Bay (Petersen et al., 1999). Males do not show strong molting site fidelity; males from all three breeding areas molt in Ledyard Bay, Mechigmenskiy Bay, and the Indigirka/Kolyma River Delta. Males reach molting areas first, beginning in late June, and remain through mid-October. Non-breeding females and those with failed nests arrive at molting areas in late July, while successfully-breeding females and young of the year reach molting areas in late August or September and remain through October.

The importance of Ledyard Bay to molting spectacled eiders is reflected in the designation of the Ledyard Bay Critical Habitat Unit (see Critical Habitat section below).

3.1.2.4. Wintering

After molting, spectacled eiders migrate offshore in the Chukchi and Bering Seas to a single wintering area in openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 3–1). Hundreds of thousands of spectacled eiders (Petersen et al. 1999) rest and feed by diving up to 70 m to eat benthic bivalves, mollusks, and crustaceans (Cottam, 1939; Petersen et al., 1998; Petersen and Douglas, 2004). Sampling over several decades suggests that the benthic community in the overwintering area has shifted from larger to smaller species of clams (Lovvorn et al., 2000; Richman and Lovvorn, 2003).

3.1.2.5. Late Winter/Spring

Spectacled and other eiders probably make extensive use of the eastern Chukchi spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring aerial observations in the eastern Chukchi have documented dozens to several hundred common eiders (*Somateria mollissima*) and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, University of Wyoming, pers. comm in USFWS, 2013, p.28). Woodby and Divoky (1982) documented large numbers of king eiders (*S. spectabilis*) and common eiders using the eastern Chukchi lead system, advancing in pulses during days of favorable following winds, and concluded that an open lead is probably requisite for spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure 3-3; USGS, unpublished data) suggest that spectacled eiders also use this lead system during spring migration.

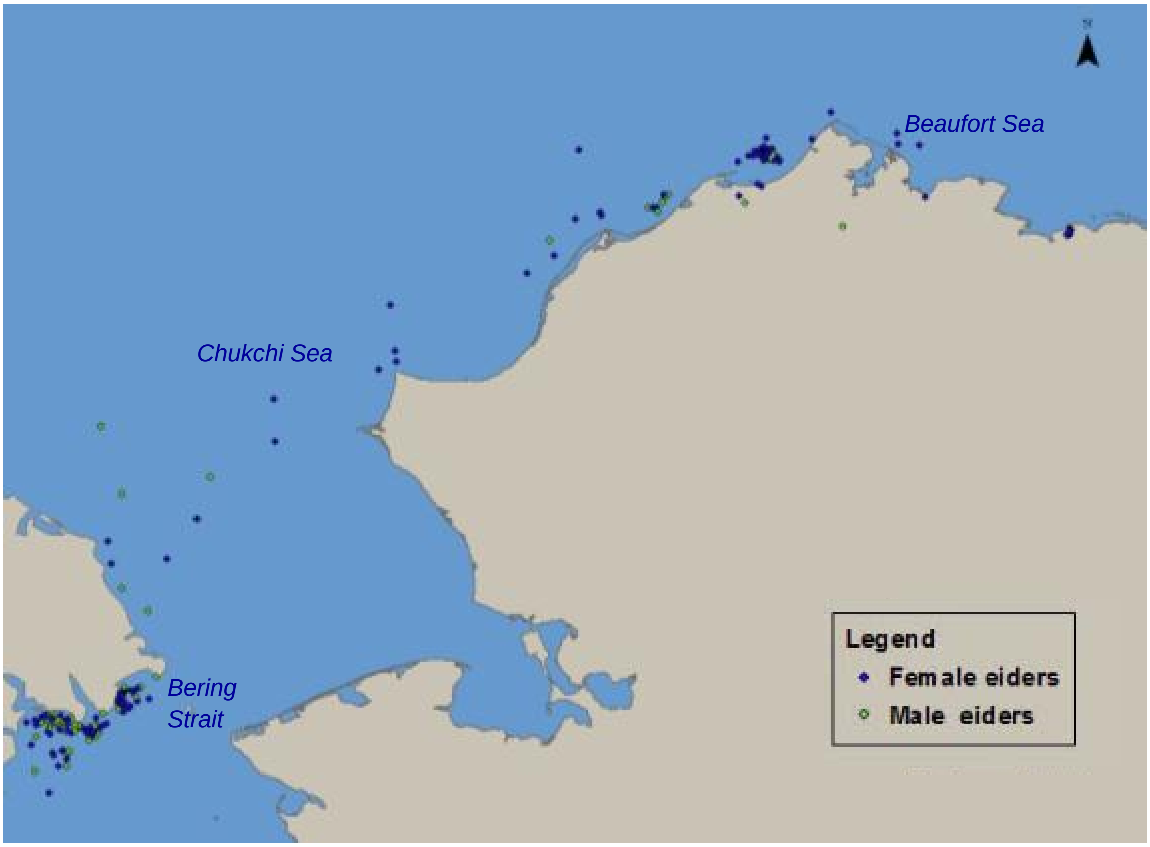

Figure 3-3. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished).

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate their eggs while living primarily off body reserves (Korschgen, 1977, Drent and Daan, 1980; Parker and Holm, 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Coulson, 1984; Raveling 1979; Parker and Holm, 1990). Body reserves must be maintained from winter or acquired during the 4–8 weeks (Lovvorn et al., 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during spring migration through the Chukchi Sea (including Ledyard Bay). Common eider female body mass has been found to increase 20% during the 4–6 weeks prior to egg laying (Gorman and Milne, 1971; Milne, 1976; Korschgen, 1977; Parker and Holm, 1990). For spectacled eiders, average female body weight in late March in the Bering Sea was 1,550 ± 35 g (n = 12), and slightly (but not significantly) more upon arrival at breeding sites (1,623 ± 46 g, n = 11; Lovvorn et al., 2003), indicating that spectacled eiders maintain or enhance their physiological condition during spring staging.

3.1.3. Abundance and Trends

The first range-wide estimate of the total number of spectacled eiders was 363,000 birds (333,526; 95% CI = 392,532), obtained by aerial surveys of the wintering area in the Bering Sea in late winter

1996–1997 (Petersen et al., 1999). Winter/spring aerial surveys using aerial photo census techniques were repeated in 2009 and 2010. The minimum global population estimate from these surveys was 369,122 (90% CI = 4,932; Larned et al., 2012b), suggesting global population stability over the interval.

Population indices for North Slope-breeding spectacled eiders are unavailable prior to 1992. However, Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 to 1991 in the Prudhoe Bay area. Since 1992, the Service has conducted annual aerial surveys for breeding spectacled eiders on the ACP. The average total bird index for SPEI from 1992–2012 was 7,158 (90% CI = 6,536–7,781). Over that same period, the total growth rate was 0.99 (0.99, 90% CI = 0.98–1.01), which is not significantly different from 1.0, and indicates a stable population.

The Y-K Delta spectacled eider population was thought to be about 4% of historical levels in 1992 (Stehn et al., 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994) with the documentation of a 79% decline in eider nesting between 1969 and 1992 for areas near the Kashunuk River. Aerial and ground survey data indicated that spectacled eiders were undergoing a decline of 9–14% per year from 1985–1992 (Stehn et al., 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the Y-K Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al., 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski, 1977).

Fischer et al. (2011) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the Y-K Delta in 2011 and evaluate long-term trends in the Y-K Delta breeding population from 1985 to 2011. The estimated total number of nests measures the minimum number of breeding pairs in the population in a given year and does not include potential breeders that did not establish nests that year or nests that were destroyed or abandoned at an early stage (Fischer et al., 2011). The total number of nests in 2011 was estimated at 3,608 (SE = 448) spectacled eiders nests on the Y-K Delta, the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI = 0.994–1.105) in 2002–2011 and 1.003 (90% CI = 0.991–1.015) in 1985–2011 (Fischer et al., 2011). Log-linear regression based solely on the long-term Y-K Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI = 1.046–1.100) in 2001–2010 and 1.070 (90% CI = 1.058–1.081) in 1988–2010 (Platte and Stehn, 2011).

3.1.4. Spectacled Eider Recovery Criteria

The Spectacled Eider Recovery Plan (USFWS, 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the ESA is no longer required. Although the cause or causes of the spectacled eider population decline is not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al., 1995; Grand et al., 1998), and other factors such as habitat loss, increased nest predation, overharvest, and disturbance and collisions caused by human infrastructure (factors discussed in the Section 4). Exposure to other contaminants, including petroleum-related compounds, organochlorine compounds, and elements, may also be a factor contributing to spectacled eider population declines. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs; or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

3.2. Spectacled Eider Critical Habitat

Critical habitat was designated for the spectacled eider in Ledyard Bay, Norton Sound, the Yukon-Kuskokwim Delta (Y-K Delta), and the Bering Sea between St. Lawrence and St. Matthew islands (USFWS, 2001). Only the Ledyard Bay Critical Habitat Unit (LBCHU) occurs within the Action Area. The LBCHU includes the waters of Ledyard Bay within about 74 km (40 nm) of shore, excluding waters less than 1.85 km (1 nm) from shore. The LBCHU totals approximately 13,960 km^2 (38,991.6 mi2), and is fully contained by the Action Area.

Primary constituent elements for the LBCHU includes all marine waters greater than 5 m (16.4 ft) and less than or equal to 25 m (82.0 ft) in depth at mean lower low water (MLLW), along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community (USFWS, 2001). The LBCHU was determined essential to the conservation of the spectacled eider due to (1) the extremely high use of the area by birds that are known to be undergoing a flightless molt; (2) the energetic demands placed upon the birds while they are molting; and (3) the assertion by Petersen et al. (1999) that this is the principle molting area for breeding female spectacled eiders from the North Slope, and most female birds molting here are from the North Slope (Petersen et al., 1999).

Spectacled eiders molting in Ledyard Bay congregate in large, dense flocks that may be particularly susceptible to disturbance and environmental perturbations (USFWS, 2001). During their time on the molting grounds (early July through October), each bird is flightless for a few weeks. However, there is no time in which all birds are simultaneously flightless (Petersen et al., 1999).

3.3. Steller's Eiders

3.3.1. Status and 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. The Alaska breeding population of the Steller's eider was listed as threatened on July 11, 1997 based on substantial contraction of the species' breeding range on the ACP and on the Y-K Delta in Alaska, reduced numbers of Steller's eiders breeding in Alaska, and the resulting vulnerability of the remaining breeding population to extirpation (62 *FR* 31748). In Alaska, Steller's eiders breed almost exclusively on the Arctic Coastal Plain (ACP) and molt and winter, along with the majority of the Russia-breeding population, in southcentral Alaska (Table 3–4). Periodic non-breeding of the entire population of Steller's eiders breeding near Barrow, AK, the species' primary breeding grounds, coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al., 2004) and may make the population particularly vulnerable to extirpation.

The most recent estimate of the North Slope Steller's eider population is 680 birds. This is based on the average size of the indicated total bird index (204; 90% CI = 124-283) over all years of eider surveys (1989-2012), and an estimated detection rate of 30% (Stehn and Platte 2013). These same data showed an average growth rate of 0.95 (90% CI = 0.89-1.01), which is negative. However, Stehn and Platte (2013) warn that this is a very imprecise estimation, and that it does not support a definitive conclusion on population trend. This is due primarily to high sampling error resulting from relatively few observations of Steller's eiders in many years, and their apparent irregular tendency for nesting and occupancy on the North Slope.

Steller's eiders generally occur in low densities throughout the ACP (Figure 3-4), but their density increases south to north, with the highest density occurring near Barrow (Obritschkewitsch and Ritchie, 2011; Larned et al., 2012). To illustrate, Obritschkewitsch and Ritchie (2012) estimated density within the Barrow survey area (Figure 3-6) to be 0.0307 total birds/km^2, whereas Larned et al. (2012a) estimated 0.0047 indicated total birds/km^2 in the larger, more inclusive ACP north coastal strata area. This suggests the Steller's eider density near Barrow may be approximately 6.5 times higher near Barrow than that in the north coastal area of the ACP.

3.3.2. Life History

3.3.2.1. North Slope Breeding

Steller's eiders arrive in pairs on the ACP in early June, but nests have been found near Barrow in only 64% of the years since 1991 (14 of 22 years; USFWS, unpublished data). Non-breeding has been observed in long-lived eider species and is typically related to inadequate body condition (Coulson, 1984), but reasons for Steller's eiders variable nesting effort may be more complex. Periodic non-breeding by Steller's eiders near Barrow seems to be associated with fluctuations in lemming populations and related breeding patterns in pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Nyctea scandiaca*) (Quakenbush et al., 2004). In years with high lemming abundance, Quakenbush et al. (2004) reported that Steller's eider nesting success was a function of a nest's distance from pomarine jaeger and snowy owl nests. These avian predators nest only in years of high lemming abundance and defend their nests aggressively against arctic foxes. By nesting within jaeger and owl territories, Steller's eiders may benefit from protection against arctic foxes even at the expense of occasional partial nest depredation by the avian predators themselves (Quakenbush et al., 2002, 2004). Steller's eiders may also benefit from the increased availability of alternative prey for both arctic foxes and avian predators in high lemming years (Quakenbush et al., 2004).

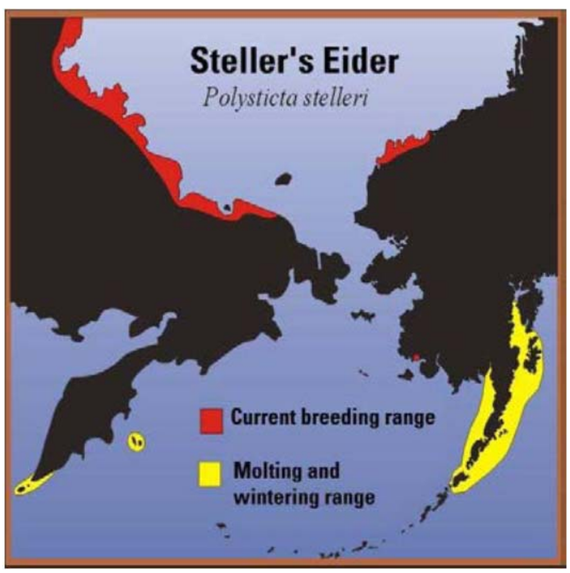

Figure 3-4. Steller's eider distribution in the Bering, Beaufort, and Chukchi seas.

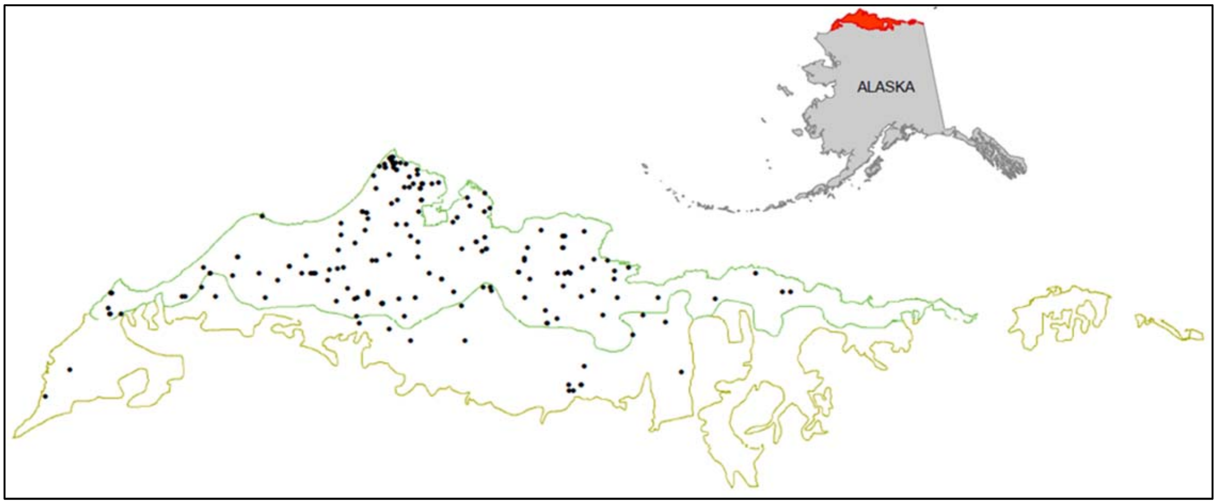

Figure 3-5. All sightings from the Arctic Coastal Plain (ACP) survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 km^2); the NSE includes only the northern portion outlined in green (30,465 km^2). Modified from Stehn and Platte, 2009.

When they do nest, Alaska-breeding Steller's eiders use coastal tundra adjacent to small ponds or within drained lake basins, occasionally as far as 90 km inland. Nests are initiated in the first half of June (Quakenbush et al., 2004). Mean clutch size near Barrow was 5.4 ± 1.6 (range = 1–8) in 1991–1999 (Quakenbush et al., 2004). In years with fox control near Barrow, clutch size averaged ranged from 5.8 to 6.6 eggs (2006–2011; Rojek, 2007; Rojek, 2008; Safine, 2011; and Safine, 2012).

As with spectacled eiders, nest and egg loss was attributed partially to predation by jaegers, common raven (*Corvus corax*), arctic fox, and possibly glaucous gulls (*Larus hyperboreus*; Quakenbush et al., 1995; Obritschkewitsch et al., 2001). During 2008–2011, nest cameras near Barrow documented partial and complete nest predation of sea duck nests, including those of Steller's eiders, by pomarine and parasitic jaegers, arctic fox, glaucous gulls, and polar bears (Safine 2011, Safine 2012).

Predator population levels likely influence the probability that females will be able to hatch at least one egg (termed "mean nest survival") across the landscape. Near Barrow, mean nest survival was 0.23 (± 0.09 SE) from 1991–2004, before implementation of fox control. During breeding seasons with fox control (2008–2012), mean nest survival was 0.47 (±0.08 SE; USFWS, unpublished data). Thus, predator control may be a useful tool in reducing egg loss of Steller's eiders.

Hatching occurs from mid-July through early August (Rojek, 2006, 2007, 2008). Within about one day after hatch, hens move their broods to adjacent ponds with emergent vegetation, particularly *Carex aquatilis* and *Arctophila fulva* (Rojek, 2006; Rojek, 2007; Safine, 2011; Safine, 2012). Here, they feed on insect larvae and other wetland invertebrates. Broods may move up to several kilometers from the nest prior to fledging (Rojek, 2006). Fledging occurs from 32–37 days post hatch (Obritschkewitsch et al.. 2001; Rojek, 2006).

Limited information from intra-year recapture of females suggests Steller's eiders may exhibit breeding site fidelity in the Barrow area, their primary breeding location in Alaska (USFWS, unpublished data, September 2012). Breeding site fidelity could limit nesting effort in other suitable habitat by displaced females, which in turn could decrease breeding effort.

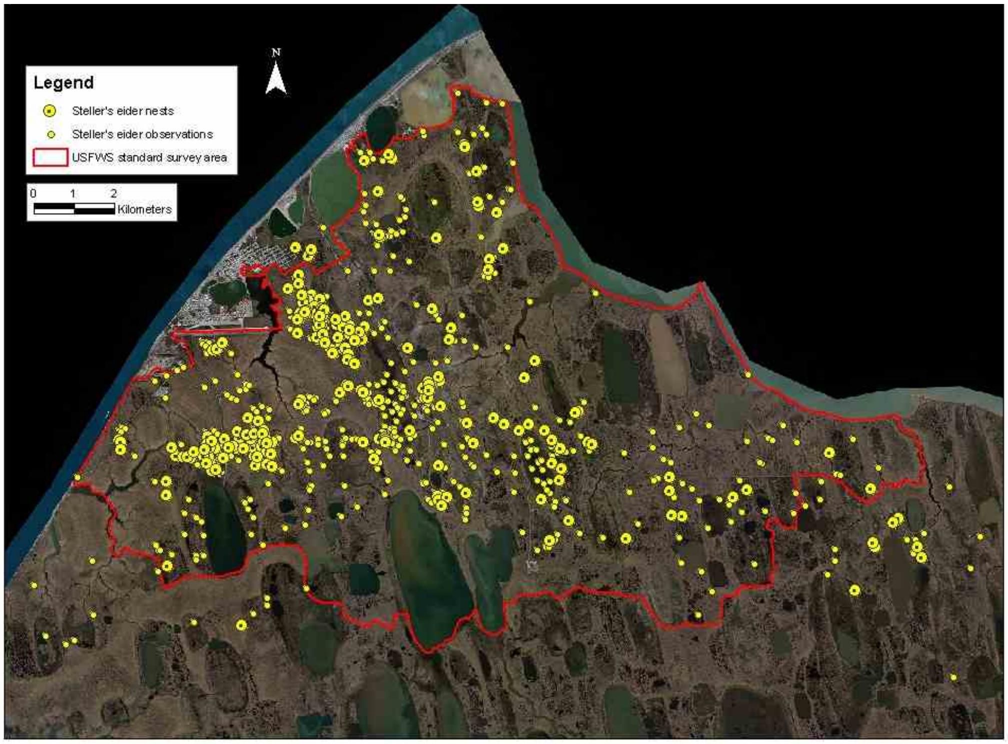

Figure 3-6. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010) in the standard survey area near Barrow. The standard survey area is surveyed annually. The survey is expanded beyond the standard area in some years**.**

3.3.2.2. Use of Non-breeding Habitats

Departure from the breeding grounds differs by sex, breeding status, and nesting success; for example, female departure time depends on whether or not a female has nested and her success. Migration generally begins with most Steller's eiders near Barrow staging in areas such as Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea both north and south of Pigniq ("Duck Camp;" Figure 3-7). For example, satellite telemetry data indicated at least 5 of 14 birds used Elson Lagoon (Martin et al., in review).

Males and non- or failed breeding Steller's eider females typically depart the breeding grounds before successfully nesting females. In late June and early July, male and female (non- or failed breeding) Steller's eiders dispersed across the area between Wainwright and Admiralty Inlet with most birds entering marine waters by the first week of July (Martin et al., in prep.). In years when nests were found near Barrow, flocks of males and non- or failed breeding female Steller's eiders were comprised of mostly males and persisted until about the second week of July (J. Bacon, North Slope Borough Department of Wildlife Management [NSBDWM], pers. comm. in USFWS, 2013).

Later in the season adult females and juveniles will use the areas listed above. In a post-fledging and post-failure movements study of radio-marked nesting Steller's eider females in 2011 (*n*=10), most females reared their brood until fledging, one female failed to fledge young, and one female failed to hatch a nest (Safine, 2012). For the females whose broods fledged, females and broods were first located post-fledging near their brood-rearing areas; later, most were found in nearby marine areas. Over half of the successful adult females were located subsequently in marine areas near Barrow, and the remaining females could not be located after leaving brood rearing areas (Safine, 2012). From late

August through early September when telemetry monitoring ceased, females and fledged juveniles were sighted on the Chukchi and Beaufort sea sides of the narrow spit extending to Point Barrow (Safine 2012). During this time, adult females and juveniles were also observed further south along the Chukchi Sea coast, near the City of Barrow (Safine, 2012). One of the two failed females was also recorded in the same marine areas as the successful females and fledged juveniles (Safine, 2012). A single failed nesting female equipped with a satellite transmitter in 2000 near Barrow remained near the breeding site until the end of July and stayed in the Beaufort Sea off Barrow until late August (Martin et al. in review).

In years when nests are not found near Barrow, groups of Steller's eiders have been opportunistically sighted just off the shoreline of the Chukchi Sea from the gravel pits (southwest of the Barrow Airport) north to Pt. Barrow; they were absent earlier in the season and the sex ratios were more even compared to breeding years (J. Bacon, NSBDWM, pers. comm. in USFWS, 2013).

The above information indicates coastal lagoons and nearshore waters of the Chukchi Sea near Barrow are important to adult and juvenile Steller's eiders.

Figure 3-7. Location of Steller's eider post-breeding staging areas in relation to Pigniq (Duck Camp) hunting area north of Barrow, Alaska.

Limited information on the migratory movements of Steller's eiders is available, particularly connecting breeding populations with migratory routes or specific molting or wintering areas. The best information available is from two satellite telemetry studies of Steller's eiders. One study marked Steller's eiders wintering on Kodiak Island, Alaska and followed birds through the subsequent spring (n=24) and fall (n=16) migrations from 2004 –2006 (D. Rosenberg, Alaska Department of Fish and Game [ADFG]). Most of the birds marked on Kodiak returned to eastern arctic Russia during the nesting period, and none of these birds (all presumed to be from the Russian breeding population) were relocated on land or the nearshore waters of Alaska north of the mouth of the Yukon River (ADFG, unpublished data). The second (but earlier) study marked birds (n=14) near Barrow, Alaska in 2000 and 2001 (Martin et al., in review). Birds from this study were relocated along arctic coast of Alaska southwest of Barrow to areas near Point Hope, on the Seward Peninsula, and in southern Norton Sound (Martin et al., in review). The birds marked near Barrow were also relocated further south in Alaska and in eastern arctic Russia in similar locations to birds marked in Kodiak. These studies did not delineate where the Russia and Alaska breeding populations merge and diverge during molt and spring migrations.

3.3.2.3. Molt and Winter Distribution

During post-breeding migration, Steller's eiders move towards molting areas in the nearshore waters of Southwest Alaska where they undergo a complete flightless molt for about three weeks. The combined (Russian and Alaskan-breeding) Pacific population molts in numerous locations in Southwest Alaska, with exceptional concentrations in four areas along the north side of the Alaska Peninsula: Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands (Gill et al., 1981; Petersen 1981; Metzner, 1993). However, Kuskoskwim Shoals, in northern Kuskokwim Bay, may also be an important molting location for Alaska-breeding Steller's eiders (Martin et al., in review), especially considering the high molting site fidelity reported by Flint et al. (2000): Martin et al. (in review) also reported >2,000 eiders molting in lower Cook Inlet near the Douglas River Delta, and smaller numbers of molting Steller's eiders have been reported from around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (e.g., Dick and Dick, 1971; Petersen and Sigman, 1977; Wilk et al., 1986; Dau 1987;Petersen et al., 1991).

After molt, many of the Pacific-wintering Steller's eiders disperse to areas in the eastern Aleutian Islands, the south side of the Alaskan Peninsula, Kodiak Island, and as far east as Cook Inlet, although thousands may remain in lagoons used for molting unless or until freezing conditions force them to move (USFWS, 2002). The USFWS estimates the Alaska-breeding population comprises only ~ 1% of the Pacific-wintering population of Steller's eiders. Wintering Steller's eiders usually occur in shallow waters (< 10 m deep), which are generally within 400 m of shore or at offshore shallows (USFWS, 2002). However, Martin et al. (in review) reported substantial use of habitats > 10 m deep during mid-winter. Use of these habitats by wintering Steller's eiders may be associated with night-time resting periods or with shifts in the availability of local food resources (Martin et al., in review).

3.3.2.4. Northward Spring Migration

During spring migration thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including some molting lagoons, and at the Kuskokwim Shoals near the mouth of the Kuskokwim River in late May (Larned, 2007; Martin et al., in review). Like other eiders, Steller's eider may use spring leads for feeding and resting, but there is little information on habitat use during spring migration. Steller's eiders are thought to generally move along coastlines, although some cut across Bristol Bay (W. Larned, USFWS, pers. comm. 2000 in USFWS, 2013). Interestingly, despite many daytime aerial surveys, Steller's eiders have not been seen in migratory flights (W. Larned, USFWS, pers. comm. 2000b in USFWS 2013). Larned (1998) concluded that Steller's eiders show strong fidelity to "favored" sites during migration, where they congregate in large numbers to feed.

3.3.3. Steller's Eider Recovery Criteria

The Steller's Eider Recovery Plan (USFWS, 2002) presents research and management priorities, that are re-evaluated and adjusted every year, with the objective of recovery and delisting so that protection under the ESA is no longer required. When the Alaska-breeding population was listed as threatened, factors causing the decline were unknown, but possible causes identified were increased predation, shooting, ingestion of spent lead shot in wetlands, and habitat loss from development. Since listing, other potential threats have been identified, including exposure to other contaminants, impacts from scientific research, and climate change but causes of decline and obstacles to recovery remain poorly understood.

Criteria used to determine when species are recovered are often based on historical abundance and distribution, or on the number needed to ensure the risk of extinction is tolerably low (with extinction risk estimated by population modeling). 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 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, the Alaska-breeding population would be considered for reclassification to endangered if the population has ≥ 20% probability of extinction in the next 100 years for 3 consecutive years, or the population has ≥ 20% probability of extinction in the next 100 years and is decreasing in abundance. The Alaska-breeding population would be considered for delisting from threatened status if it has ≤ 1% probability of extinction in the next 100 years, and each of the northern and western subpopulations are stable or increasing and have ≤ 10% probability of extinction in 100 years.

3.3.4. Critical Habitat

In 2001, the Service designated 2,830 mi2 (7,330 km2) of critical habitat for the Alaska-breeding population of Steller's eiders at historic breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and molting areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (66 FR 8850). No critical habitat for Steller's eiders has been designated on the ACP or other parts of the Action Area. Therefore, critical habitat for Steller's eider is not further addressed in this document.

3.4. Polar Bears

3.4.1. Status and Distribution

Due to threats to its sea ice habitat, on May 15, 2008 the Service listed the polar bear as threatened (73 *FR* 28212) throughout its range under the ESA. In the U.S., the polar bear is also protected under the Marine Mammals Protection Act and the Convention on International Trade in Endangered Species of Wildlife Fauna and Flora (CITES) of 1973.

Polar bears are widely distributed throughout the Arctic where the sea is ice-covered for large portions of the year (Figure 3–8). The number of polar bears worldwide is estimated to be 20,000–25,000 with 19 recognized management subpopulations or "stocks" (Obbard et al., 2010). The International Union for Conservation of Nature and Natural Resources, Species Survival Commission (IUCN/SSC) Polar Bear Specialist Group ranked 11, four, and three of these stocks as "data deficient," "reduced," and "not reduced," respectively (Obbard et al., 2010). The status designation of "data deficient" for 11 stocks indicates that the estimate of the worldwide polar bear population was made with known uncertainty.

Two stocks or populations of polar bears occur in the Action Area: the Alaska-Chukotka (A-C; formerly called Chukchi Sea) and Southern Beaufort Sea (SBS) stocks. (Figure 3–9). The two stocks overlap in the eastern Chukchi Sea/Western Beaufort region, but have been distinguished by animal movement data and tissue contaminants (Amstrup et al., 2004; Amstrup et al., 2005). Furthermore, only the SBS stock dens in western Alaska, due to the relative close proximity of the Beaufort Sea's ice edge to terrestrial habitats during fall when some pregnant females come ashore. Both of these stocks range beyond the US to utilize habitats under the jurisdiction of other nations; the A-C population also ranges in Russia, and the Beaufort population ranges in Canada.

Figure 3-8. Distribution of polar bear stocks throughout the circumpolar basin (from Obbard et al., 2010).

3.4.2. Life History

For a complete life history of the polar bear, please see 73 *FR* 28212. A brief description is provided below.Most polar bear stocks use terrestrial habitat partially or exclusively for maternity denning; therefore, females must adjust their movements to access land at the appropriate time (Stirling, 1988; Derocher et al., 2004). Most pregnant female polar bears excavate snow dens in the fall–early winter period (Harington, 1968; Lentfer and Hensel, 1980; Ramsay and Stirling, 1990). The only known exceptions are in Western and Southern Hudson Bay where polar bears excavate earthen dens and later reposition into adjacent snow drifts (Jonkel et al., 1972; Richardson et al. 2005), and in the southern Beaufort Sea where a portion of the population dens in snow caves on sea ice (Schliebe et al., 2006: 30). The A-C stock has historically denned in Russia on Wrangel Island and the Chukotka Peninsula, areas that are in proximity to the sea-ice edge when sea ice is at its minimum extent in the fall (USFWS, 2010). Polar bears give birth in the dens during midwinter (Kostyan, 1954; Harington, 1968; Ramsay and Dunbrack, 1986). Family groups emerge from dens in March and April when cubs are approximately three months old (Schliebe et al., 2006: 30).

Polar bears are characterized by a late age of sexual maturity, small litter sizes, and extended parental investment in raising young, factors that combine to contribute to a very low reproductive rate (Schliebe et al., 2006: 17). Females may give birth for the first time at age four to six depending on local conditions such as seal abundance (Schliebe et al., 2006: 17–18), and litters per female varies from 0.25 to 0.45 per adult female (Schliebe et al., 2006: 19–20). Likewise, litter size and production rate vary geographically with hunting pressure, environmental factors and other population perturbations. Two-cub litters are most common (Schliebe et al., 2006: 19). Body weights of mothers and their cubs decreased markedly in the mid-1970s in the Beaufort Sea following a decline in ringed and bearded seal pup production (Stirling et al., 1976, 1977; Kingsley, 1979; DeMaster et al., 1980; Amstrup et al., 1986). Declines in reproductive parameters varied by region and year with the severity of ice conditions and corresponding reduction in numbers and productivity of seals (Amstrup et al., 1986).

Sea ice provides a platform for hunting and feeding, seeking mates and breeding, denning, resting, and long-distance movements. Ringed seals are polar bear's primary food source, and the most productive hunting grounds are areas near ice edges, leads, or polynyas where ocean depth is minimal (Durner et al., 2004). While polar bears primarily hunt seals, they may occasionally consume other marine mammals (73 *FR* 28212); for example, bowhead whale carcasses have been available as a food source on the North Slope since the early 1970s (Koski et al., 2005) and may affect local polar bear distributions. Barter Island (near Kaktovik) has had the highest recorded concentration of polar bears on shore (17.0 ± 6.0 polar bears/100 km) followed by Barrow (2.2 ± 1.8) and Cross Island (2.0 ± 1.8; Schliebe et al., 2008). Record numbers of polar bears were observed in 2012 in the vicinity of the bowhead whale carcass "bonepile" on Barter Island; the USFWS observed a minimum, maximum, and average of 24, 80, and 52 bears respectively (USFWS, 2012b). The high number of bears on/near Barter Island compared to other areas is thought to be due in part to the proximity to the ice edge and high ringed seal densities (Schliebe et al., 2008), the whale harvest at Kaktovik is lower than that at Barrow or Cross Island. The use of whale carcasses as a food source likely varies among individuals and years. Stable isotope analysis of polar bears in 2003 and 2004 suggested that bowhead whale carcasses comprised 11–26% (95% CI) of the diets of sampled polar bears in 2003, and 0–14% (95% CI) in 2004 (Bentzen et al., 2007). Because polar bears depend on sea ice to hunt seals, and temporal and spatial availability of sea ice will likely decline, polar bear use of whale carcasses may increase.

3.4.3. Abundance and Trends

Accurate population estimates for the two US polar bear populations are difficult to obtain because polar bears are widely distributed at low densities, they move across international borders, and their sea ice habitat is not all accessible. Furthermore, logistical and budgetary considerations present significant additional constraints (Amstrup and DeMaster, 1988; Garner et al., 1992). Regardless, the best available science is presented here on abundance and trends.

The most recent estimate of the SBS stock, which utilized an open population mark/recapture method, indicates that approximately 900 bears existed in 2010 (90% C.I. = 606–1,212; Bromaghin et al. in press). Available trend data suggest this stock has experienced varying periods of stability and decline over the past few decades. Little or no growth was observed during the 1990s (Amstrup et al., 2001). An overall population decline rate of 3% per year was reported from 2001–2005 (Hunter et al., 2007). Regehr et al. (2006, 2009) reported declining survival and recruitment from 2004 through 2006, which were years when summer and fall sea ice were reduced (NSIDC, 2014). This led to a 25–50% decline in abundance, which was hypothesized to result from unfavorable ice conditions that limited access to prey, and possibly, low prey abundance (Bromaghin et al. in press). For reasons not understood, survival of adults and cubs began to improve in 2007 (Bromaghin et al. in press), which was a record low year for September sea ice (NSIDC, 2007). Abundance was comparatively stable between 2008 and 2010.

The most recent population estimate for the A-C stock is older and less reliable than the SBS estimate. Approximately 2,000 bears were estimated by Lunn (2002) using an extrapolation of aerial den survey data from Wrangel Island. This figure has wide confidence intervals and is not sufficient to evaluate status or trends (USFWS, 2009). Currently, the IUCN lists the A-C stock as declining based on reported high levels of illegal killing in Russia, continued legal harvest in the US, and observed and projected losses in sea ice habitat (USFWS, 2012).

Shipboard surveys conducted for the Chukchi Sea Environmental Studies Program (CSESP) resulted in a total of six polar bear sightings (totaling seven individual bears) in or near the Action Area during

2013 (Aerts et al., 2014). This includes bears sighted away from established survey transects as well as those on transects. Overall, the effort yielded a sighting rate of approximately 0.08 individual bears per 100 km[1]. All bears were observed during August, during the open water season. Most bears were on ice floes (five bears, including a mother-cub pair); two bears were observed swimming. The 2013 sightings, along with other polar bear sightings from this survey effort since 2008, are shown in Figure 3–9).

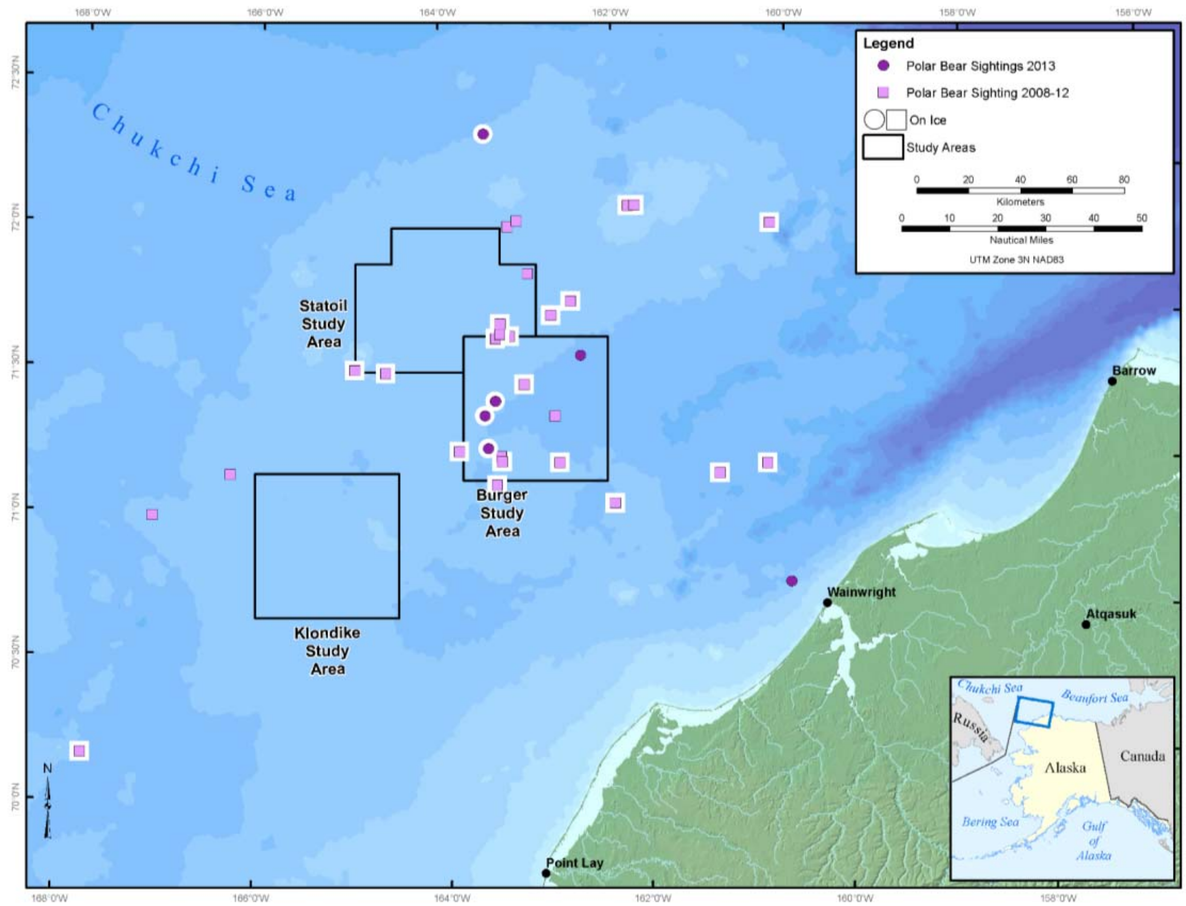

Figure 3-9. All polar bear sightings (i.e., including all effort types and sea states) recorded on sea ice and in the water in the Chukchi Sea during CSESP surveys in 2013 (purple circles) and 2008–2012 (pink squares). From Aerts et al., 2014.

3.4.4. Polar Bear Recovery Criteria

A recovery plan with recovery criteria is not yet developed for the polar bear. The USFWS is currently preparing a conservation and recovery plan that will address management needs under both the MMPA and the ESA.

3.4.5. Critical Habitat

The final rule designating critical habitat for the polar bear was issued on December 7, 2010 (75 *FR* 76086). On January 11, 2013, the final rule was vacated and remanded to the Service by the U.S. District for the District of Alaska in *Alaska Oil and Gas Association et al. v. Salazar, et al.* (D. Alaska)(3:11-cv-00025-RRB). The Service filed a motion for reconsideration of the District Court's decision. The motion was denied on May 15, 2013. Thus, at this time, there is no critical habitat designated for polar bears.

4.0 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. In this section, past oil and gas activities in the Action Area are discussed first, followed by the baseline for each species.

The environmental baseline section also includes information on regarding the effects of climate change on listed species. This BA considers ongoing and projected changes in climate using terms as defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC, 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC, 2007: 78). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide (CO2) emissions from use of fossil fuels (IPCC, 2007: 5–6 and figures SPM.3 and SPM.4; Solomon et al., 2007: 21–35). Various types of changes in climate can have direct or indirect effects on most species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC, 2007: 8–14, 18–19). This BA utilizes expert judgment to weigh relevant information, including uncertainty, in consideration of climate change.

High latitude regions such as Alaska's North Slope are thought to be especially sensitive to the effects of climate change (Quinlan et al., 2005; Schindler and Smol, 2006; Smol et al., 2005). While climate change will likely affect individual organisms and communities, it is difficult to predict with specificity or reliability how these effects will manifest. Biological, climatological, and hydrologic components of the ecosystem are interlinked and operate on multiple spatial, temporal, and organizational scales with feedback between the components (Hinzman et al., 2005).

4.1. Past Oil and Gas Activities in the Chukchi Sea Planning Area

The Action Area contains 460 blocks leased by BOEM in the Chukchi Planning Area; it is therefore reasonable to expect that industry will continue to explore for hydrocarbons using techniques such as seismic surveys. Industry has also conducted high-resolution survey activities previously and plans to conduct more in the future. Likewise, some leases have been explored with wells, and industry proposes to drill more wells in the future.

To date, industry has drilled six exploration wells in the Chukchi Sea OCS; five of these have been permanently abandoned with no potential for lingering noise, disturbance or spills, and one is a shallow well ("top hole") that will be ultimately be extended in an attempt to reach liquid hydrocarbon reserves further down (USDOI,BOEM, 2014). Shell, Inc. has received permits from the U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) in support of exploratory drilling in the Chukchi Sea, and will likely obtain other necessary permits in the near future, including from BOEM.

Limited oil and gas activities have occurred in the Chukchi Sea after leases were issued from Lease Sale 193 in 2008. The most significant was the exploration drilling conducted by Shell Gulf of Mexico Inc. during the 2012 drilling season. In September, 2012, a top hole was drilled. A top hole is the part of a well drilled before encountering the hydrocarbon-bearing zones; no liquid hydrocarbon zones are penetrated until the well is extended at a later point in time. The top hole was temporarily abandoned on October 31, 2012, but the operator intends to finish drilling the well.

Ancillary activities have also been conducted pursuant to the leases issued from Lease Sale 193. Statoil conducted a site survey and geotechnical soil investigation during the 2011 open water season, and Shell conducted marine surveys in 2013, consisting of on-lease shallow hazard, site clearance, and ice gouge surveys. Two 3-D and one 2-D seismic geological and geophysical exploration surveys were conducted in the Chukchi Sea between June and November of 2006. In 2007, 2008, 2010, and 2013, one geological and geophysical survey per year was conducted.

Exploration in the Chukchi Sea Planning Area has not yet resulted in development and production activities (USDOI, BOEM, 2014). However, BOEM estimates that viable oil accumulations could be present in the Chukchi Sea Planning Area (USDOI, BOEM, 2014: 20).

This environmental baseline also includes anticipated impacts of other proposed and ongoing Federal projects and factors affecting species in the Action Area. These include:

- Planning documents and permits issued by BOEM, BSEE, BLM, USACE, and EPA for Industry-related development in the OCS;
- Documents and permits in the NPR-A issued by BLM, USACE, and EPA.
- Lease sales within the NPR-A Planning Area managed by the BLM;
- The Greater Moose's Tooth 1 Oil and Gas Development Project in the NPR-A;
- Annual summer programmatic for activities in the NPR-A (e.g., the 2014 summer programmatic BO) for the next five years;
- BLM permits in the NPR-A for winter travel on- and offshore for non-oil and gas activities for the next five years;
- Research in the OCS and NPR-A;
- U.S. Coast Guard operations;
- Polar bear abundance, distribution, and trends (when known) and factors affecting the population indices in the Action Area, including subsistence harvest and loss of sea ice resulting from climate change;
- Letters of Authorization (LOAs) for incidental take of polar bears issued under the Beaufort and Chukchi Sea Incidental Take Regulations (ITRs) pursuant to section 101(a)(5) of the MMPA;
- LOAs for intentional take of polar bears pursuant to sections 101(a)(4)(A), 109(h), and 112(c) of the MMPA;
- Polar bear research by the U.S. Geological Survey, Marine Mammal Management Office of the Fish and Wildlife Service, and the North Slope Borough;
- Passive and preventative polar bear deterrence measures;
- Non-Federal activities such as vessel transit and shipping in the Action Area;
- The USACE permit for the Alaska Stand-alone Gas Pipeline (ASAP);
- Other stressors acting on the species and Primary Constituent Elements (PCEs) of the critical habitat units, including National Science Foundation-funded ice-breaking projects and the annual on-ice science research camp.

4.2. Spectacled and Steller's Eiders

The North Slope-breeding population of spectacled eiders and Steller's eiders occupy terrestrial and marine parts of the Action Area for significant portions of their annual life cycles. Both species migrate through the Chukchi Sea, including Ledyard Bay, and the spectacled eider molts in the Bay as well. The spectacled eider nests throughout much of the ACP, whereas the Steller's eider has limited distribution across the ACP with the highest breeding density near Barrow. Neither species is present in the Action Area from approximately 15 November to 15 April.

Both species of listed eiders have undergone significant, unexplained declines in their Alaska-breeding populations. Factors that may have contributed to the current status of spectacled and Steller's eiders are discussed below and include, but are not limited to, toxic contamination of habitat, increased predator populations, harvest, development, research activities, and climate change. Factors that affect adult survival may be most influential on population growth rates. Recovery efforts for both species are underway in portions of the Action Area. Because similar factors most likely affect the baseline of spectacled and Steller's eiders, we present these factors together for these species.

4.2.1. Use of the Chukchi Sea

Specific information regarding spring migration routes for these species is lacking, but it is believed the listed eiders advance northward similarly to other species of eiders as spring leads develop in the eastern Chukchi Sea ice. Spectacled eiders and Steller's eiders occupy Ledyard Bay seasonally during their north and south migrations, although the duration of each species' use is not documented in detail. In spring they presumably move through Ledyard Bay as spring leads open, and in summer and autumn they return utilizing the open waters of Ledyard Bay, with spectacled eiders remaining in the area to molt. Large numbers of molting spectacled eiders are present in Ledyard Bay from late June until late October (Larned et al., 1995; Petersen et al., 1999). Steller's eiders that breed on the North Slope also use Ledyard Bay and nearshore Chukchi Sea waters during their southward migration (Martin et al., in review).

4.2.2. Possible Threats in the Action Area

4.2.2.1. Toxic Contamination of Habitat

The primary known contaminant threat to spectacled and Steller's eiders in the Action Area is ingestion of spent lead shot that has been deposited in tundra wetlands or nearshore marine waters used for foraging. The effect of exposure varies but both lethal and sublethal responses can occur (Hoffman, 1990). Lead is likely available to eiders, particularly breeding hens and ducklings, that feed in areas used for hunting on the ACP, especially in shallow freshwater wetlands near villages. Blood samples from hens breeding near Barrow in 1999 showed that all (7 of 7) had been exposed to lead (indicated by > 0.2 ppm lead in blood) and one had experienced lead poisoning (> 0.6 ppm; Figure 4–1). 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 statewide, and its use for hunting all birds is specifically prohibited on the North Slope. Collaborative efforts to reduce use of lead shot appear to be effecting improvement. Indicators such as the availability of lead shot in stores and spent shell casings at popular hunting sites, suggest that the use of lead shot has been greatly reduced and continues to decline on the North Slope (and elsewhere in the state).

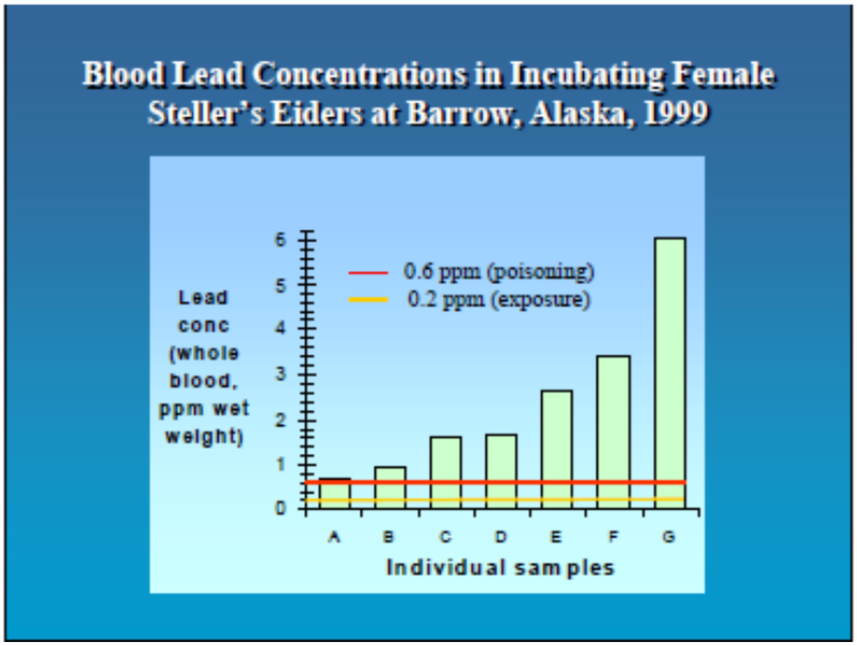

Figure 4-1. Blood lead concentrations in incubating female Steller's eiders at Barrow, Alaska, 1999 (USFWS data unpublished).

A few contaminated legacy industrial and military sites exist within the NPR-A; however, these sites pose minor if any, contamination risk to listed eiders.

4.2.2.2. Increased Predator Populations

Predator and scavenger populations may be increasing on the North Slope near sites of human habitation such as villages and industrial infrastructure (Eberhardt et al., 1983; Day, 1998; Powell and Bakensto, 2009). Reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting/denning sites on human-built structures may have resulted in increased fox, gull, and raven numbers (Day, 1998; USFWS, 2002). These anthropogenic influences on predator populations and predation rates may have affected eider populations, but this has not been substantiated. However, increasing predator populations are a concern, and Steller's eider studies at Barrow attributed poor breeding success to high predation rates (Obritschkewitsch et al,. 2001). In years when arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased substantially (Safine, 2012), reinforcing that nest depredation may be a significant population-level influence..

4.2.2.3. Subsistence Harvest

Prior to the listing of Steller's and spectacled eiders under the ESA, some level of subsistence harvest of these species occurred across the North Slope (Braund et al., 1993). Hunting for spectacled and Steller's eiders was closed in 1991 by Alaska State regulations and Service policy, and outreach efforts have been conducted by the North Slope Borough, BLM, and USFWS to encourage compliance. Harvest surveys indicate that listed eiders are taken during subsistence hunting on the North Slope, although estimates of the number taken are imprecise, and numerous unquantifiable biases compromise the reliability of estimates. Continued efforts to eliminate shooting are being implemented in North Slope villages, particularly at Barrow, where Steller's eiders regularly nest near important subsistence hunting areas. Intra-service consultations for the Migratory Bird Subsistence Hunting Regulations are conducted annually.

4.2.2.4. Impacts from Development and Disturbance

With the exception of contamination by lead shot, destruction or modification of North Slope nesting habitat of listed eiders has been limited to date, and is not thought to have played a major role in population declines of spectacled or Steller's eiders. While development activities may adversely affect listed eiders, these species were not listed as a result of the impacts of development. The majority of eider breeding habitat on the ACP remains unaltered by humans, although limited portions of each species' breeding habitat have been impacted by fill of wetlands, the presence of infrastructure that presents collision risk, and other human activities that may cause disturbance of birds or increase populations of nest predators. These impacts have resulted from the gradual expansion of communities (e.g., Barrow), limited military facilities such as the Distant Early Warning (DEW) Line sites at Cape Lonely and Cape Simpson, and, more recently, oil development since construction of the Prudhoe Bay field and TAPS in the 1970s. Gradual expansion is likely to continue for all of these sources except perhaps military facilities.

4.2.2.5. Research Impacts

Scientific, field-based research is also increasing in arctic Alaska as interest in climate change and its effects on high latitude areas continues. While many of these activities have no impacts on listed eiders, as they occur in seasons when eiders are absent from the area or use remote sensing tools, on-the-ground activities and tundra aircraft landings likely disturb a small number of listed eiders each year. The BLM consults annually with the USFWS regarding summer research activities in the NPR-A that are conducted or permitted by the BLM.

4.2.2.6. Climate Change

Arctic landscapes are dominated by lakes and ponds (Quinlan et al., 2005), such as those used by listed eiders for feeding and brood rearing. In many areas these arctic water bodies are draining and drying out during summer as the underlying permafrost thaws (Smith et al., 2005; Oechel et al., 1995), while others are losing water through increased evaporation and evapotranspiration resulting from longer ice-free periods, warmer temperatures, and longer growing seasons (Schindler and Smol, 2006; Smol and Douglas, 2007). Productivity of lakes and ponds appears to be increasing as a result of nutrient inputs from thawing soil and increasing temperatures (Quinlan et al., 2005; Smol et al., 2005; Hinzmann et al., 2005, Chapin et al., 1995). Changes in water chemistry and temperature are also resulting in changes in algal and invertebrate communities that form the basis of the food web (Smol et al., 2005; Quinlan et al,. 2005).

Historically, sea ice has served to protect shorelines from erosion; however, this protection has decreased as sea ice decreases in extent and duration. 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 salt-intolerant plants and altering soil and water chemistry, and hence, the fauna and flora of the area (USGS, 2006). Coupled with thawing permafrost, the inundation of the shoreline due to lack of sea ice has significantly increased coastal erosion rates (USGS, 2006), potentially reducing the quality or quantity of coastal tundra nesting habitat.

Changes in precipitation patterns, air and soil temperature, and water chemistry are also affecting tundra vegetation communities (Hinzmann et al., 2005; Prowse et al. 2006; Chapin et al., 1995), and boreal species are expanding their ranges into tundra areas (Callaghan et al,. 2004). Changes in the distribution of predators, parasites, and disease-causing agents resulting from climate change may have significant effects on listed species and other arctic fauna and flora. Climate change may also result in mismatched timing of migration and development of food in arctic ponds (Callaghan et al., 2004), and changes in the population cycles of small mammals such as lemmings to which many other species, including nesting Steller's eiders (Quakenbush and Suydam, 1999), are linked (Callaghan et al., 2004).

Regional-scale environmental shifts may be also be underway in the Chukchi Sea that may affect spectacled and Steller's eider populations. Ice thickness generally increases from the Siberian Arctic to the Canadian Archipelago, due mostly to convergence of drifting sea ice (Walsh, 2005). Rothrock et al. (1999; cited in Walsh, 2005) found a decrease of about 40% (1.3 m) in the sea-ice draft (proportional to thickness) in the central Arctic Ocean by comparing sonar data obtained from submarines during two periods: 1958–1976 and 1993–1997. Wadhams and Davis (2000; cited in Walsh, 2005) provide further submarine-measured evidence of reductions in sea ice thickness in the Arctic Ocean. Satellite imagery has documented a downward trend of 13.3% per decade in September sea ice extent (historically when sea ice extent is at its minimum); in fact, the ten lowest September sea ice extents have all occurred in the last ten years, with 2012 representing the record low (Figure 4–2; NSDIC, 2014). From 1979 through 2009, satellite data from 10 Arctic regions indicated that nine of 10 regions experienced trends towards earlier spring melt and later autumn freeze onset (Markus et al., 2009). For the entire Arctic, the melt season length has increased by about 20 days during this period (Markus et al., 2009). The Chukchi/Beaufort seas region, which is within the range of listed eiders, has experienced a strong trend toward later autumn freeze-up date and longer ice-free seasons (Markus et al., 2009). Such changes in sea ice extent and duration would likely affect Steller's and spectacled eider populations.

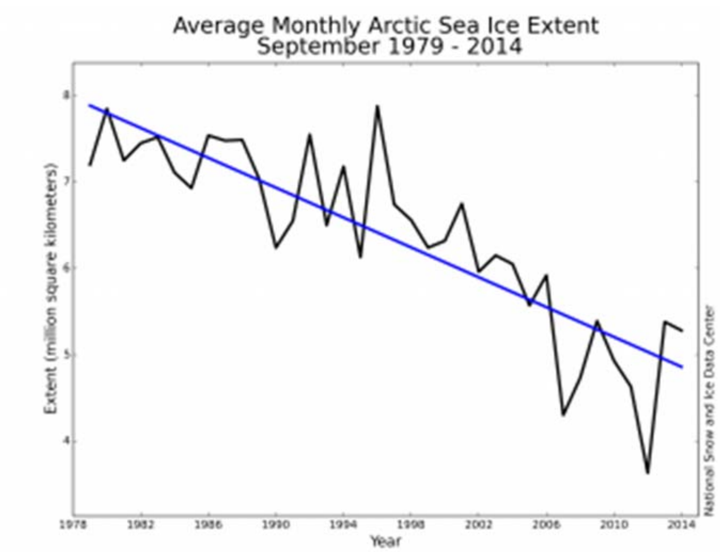

Figure 4-2. Average arctic sea ice extent in September from 1979 through 2014. From National Snow and Ice Data Center (2014).

While listed eider populations would likely be affected by climate change-induced ecological shifts in both their terrestrial and marine environments, the direction or magnitude of these impacts cannot be predicted with reasonable reliability.

4.2.3. Spectacled Eider Critical Habitat: Ledyard Bay Critical Habitat Unit

Due to the lack of industrial development and minimal human presence and vessel traffic in the region, the Chukchi Sea is currently largely in natural condition. Several key environmental factors, such as good water quality and lack of contamination, contribute to what can be considered the current good environmental conditions of the LBCHU. Current industrial impacts are minimal and pollution and/or sediments occur at very low levels in the area. The majority of water flowing into this marine environment is not subject to human activity or stressors and is considered unimpaired (Alaska's Final 2002/2003 Integrated Water Quality Monitoring and Assessment Report). There are no Section 303(d) impaired waterbodies identified within the Arctic Subregion by the State of Alaska. Background hydrocarbon concentrations in Chukchi Sea appear to be biogenic (naturally-occurring) and on the order of 1 part per billion or less; concentrations in the Hope Basin and Chukchi Sea are entirely biogenic in origin and are typical of levels found in unpolluted marine water and sediments. A study of heavy metals in sediments collected from portions of the eastern Chukchi in the 1990's (Naidu 2005) found concentrations were low and the environment was considered "pristine, although elevated levels have been found in very localized areas around old drill sites away from Ledyard Bay (Trefry, Tocine, and Cooper, 2012; Trefry et.al., 2014). Therefore, the LBCHU is currently largely in natural condition, free of physical modification or significant pollutants in either its water and sediments; and its physical and biological processes are functioning and promote production of a rich and abundant benthic community upon which spectacled eiders feed when they occupy the LBCHU.

Molting spectacled eiders in LBCHU depend on the marine benthic community to meet their high nutritional requirements during the energetically demanding molt period. Feder et al. (1989, 1994*a*, 1994*b*) found a different substrate (muddy-gravel) and invertebrate community in the western LBCHU than sites sampled further east. This information suggests the western portion of LBCHU is less favorable for molting spectacled eiders than the central and eastern LBCHU.. Satellite telemetry locations of spectacled eiders in Ledyard Bay and the eastern Chukchi Sea is shown in Figure 4–3.

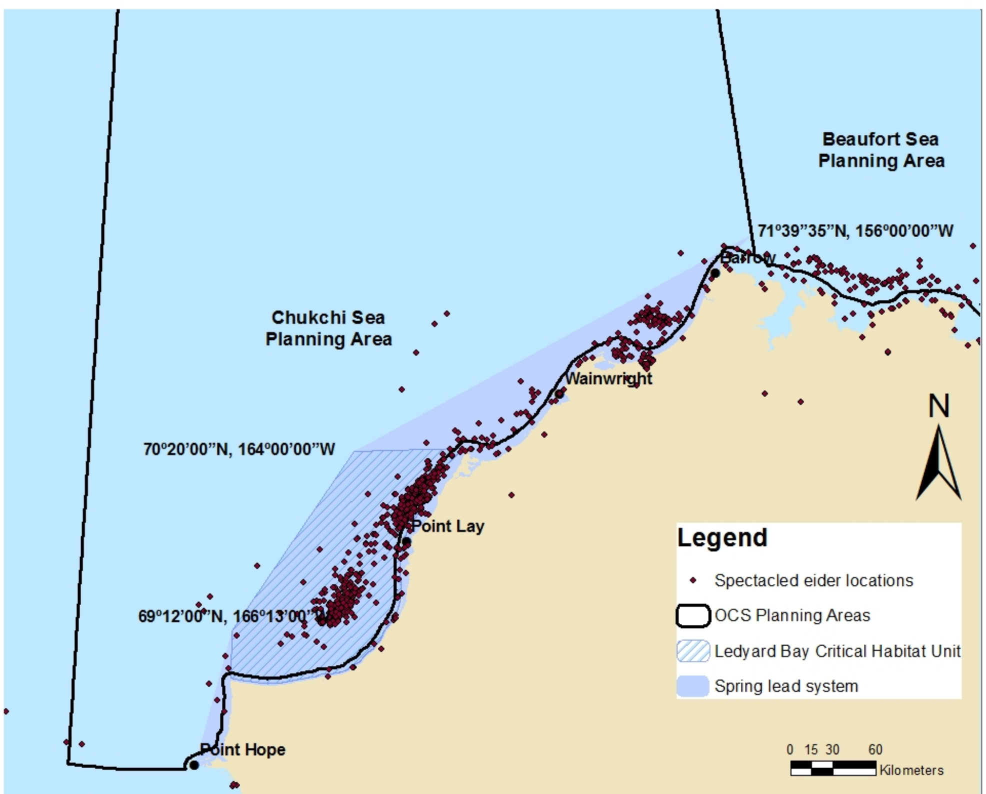

Figure 4-3. Spring and fall locations of spectacled eiders observed during aerial surveys in Ledyard Bay (USFWS data) in relation to the LBCHU boundaries and the Chukchi Sea Planning Area.

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4.3. Polar Bears

4.3.1. Threats and Possible Stressors in the Action Area

The two main stressors in the Action Area for the polar bear are loss of sea ice resulting from climate change and subsistence hunting. Other factors such as oil and gas development, research, and contaminants are also discussed in this section.

4.3.1.1. Loss of Sea Ice

Declines in sea ice have occurred in optimal polar bear habitat in the southern Beaufort and Chukchi seas since at least 1985, and the greatest declines in 21st century optimal polar bear habitat are predicted to occur in these areas (Durner et al., 2009). These stocks are vulnerable to large-scale dramatic seasonal fluctuations in ice movements which result in decreased abundance and access to prey, and increased energetic costs of hunting. The AC and the SBS are currently experiencing the initial effects of changes in sea ice conditions (Rode et al., 2010; Regehr et al., 2009;Hunter et al., 2007). Regehr et al. (2010) found that the vital rates of polar bear survival, breeding rates, and cub survival declined with an increasing number of ice-free days/year over the Continental Shelf, and suggested that declining sea ice affects these vital rates via increased nutritional stress.

Regional-scale environmental shifts may be underway in the Chukchi Sea that may affect polar bear populations. Ice thickness generally increases from the Siberian Arctic to the Canadian Archipelago, due mostly to convergence of drifting sea ice (Walsh, 2005). Rothrock et al. (1999; cited in Walsh, 2005) found a decrease of about 40% (1.3 m) in the sea-ice draft (which is proportional to thickness) in the central Arctic Ocean by comparing sonar data obtained from submarines during two periods: 1958–1976 and 1993–1997. Wadhams and Davis (2000; cited in Walsh, 2005) provide further submarine-measured evidence of reductions in sea ice thickness in the Arctic Ocean. Satellite imagery has documented a downward trend in September sea ice extent (historically when sea ice extent is at its minimum; Figure 4–2 , NSIDC, 2012). From 1979 through 2009, satellite data from 10 Arctic regions indicated that nine of 10 regions experienced trends towards earlier spring melt and later autumn freeze onset (Markus et al., 2009). For the entire Arctic, the melt season length had increased by about 20 days during this period (Markus et al., 2009). The Chukchi/Beaufort seas region, which is within the range of polar bears, has experienced a strong trend toward later autumn freeze-up date and longer ice-free seasons (Markus et al., 2009). Such changes in sea ice extent and duration will likely affect polar bear population trends. Details regarding the status of polar bears in light of climate change are presented below in the sections specifically for these species.

Historically, sea ice has protected shorelines from erosion; however, this protection has decreased as sea ice decreases in extent and duration. 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 salt-intolerant plants and altering soil and water chemistry, and hence, the fauna and flora of the area (USGS, 2006). Coupled with thawing permafrost, the inundation of the shoreline due to lack of sea ice has significantly increased coastal erosion rates (USGS, 2006), potentially reducing the quality or quantity of habitats such as bluffs with vegetation that catch snow in which polar bears den along the Chukchi Sea.

4.3.1.2. Subsistence Harvest

Subsistence hunting of polar bears believed to belong to both the SBS and AC populations occurs within the Action Area (Table 4–1). Subsistence hunting of polar bears is managed through international and other agreements. Harvest quotas are set by the Inuvialuit-Inupiat (I-I) Council (Canada-Alaska) and the U.S.-Russia Polar Bear Commission (Commission) for the Southern Beaufort Sea and Alaska-Chukotka polar bear populations, respectively.

4.3.1.2.1. Southern Beaufort Sea stock

In 1988 the I-I Council established a sustainable harvest quota for the SBS population of 80 polar bears. In 2010 the Council adjusted the quota downward to 70 polar bears (email T. DeBruyn, August 13, 2010) based on a revised population estimate of 1,526 (Regehr et al., 2006; email T. DeBruyn, August 13, 2010). The reported annual average combined (Alaska-Canada) harvest for the SBS population from 2004 to 2009 was 44, and the 2008/2009 reported harvest for Alaskan North Slope villages was 25 polar bears (DeBruyn et al., 2010).

4.3.1.2.2. Alaska-Chukotka stock

Russia and the U.S. signed the Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population (Bilateral Agreement) in 2000 which established the U.S.-Russia Polar Bear Commission and provides a common legal, scientific, and administrative framework to manage the shared A-C polar bear population; implementing legislation for the Bilateral Agreement was signed in the U.S. on January 12, 2007. Based upon reliable science and Traditional Ecological Knowledge, in June 2010 the Commission adopted an annual take limit of the A-C polar bear population of 19 females and 39 males (DeBruyn et al., 2010). Harvest will be split evenly between Native peoples of Alaska and Chukotka. The Alaskan share of the harvest is 29 polar bears per year, which is below the average of 37 polar bears harvested each year between 2004 and 2008 (USFWS, unpublished data). From 2008 through 2011, reported annual harvest in the Barrow area ranged from 10 to 14 bears (email T. DeBruyn, November 2, 2012).

Table 4–1. Reported polar bear harvest numbers from 2007 to 2011 in Alaska communities. From 78 FR 1942: 1956.

Community	Polar Bear
Barrow	49
Gambell	9
Kivalina	3
Kotzebue	3
Little Diomede	14
Nome	1
Point Hope	51
Point Lay	2
Savoonga	16
Shishmaref	6
Wainwright	4
Wales	5

4.3.1.3. Oil and Gas Activities

Most impacts of oil and gas activities are presented in the Section 5 of this document. However, some oil and gas exploration in the Action Area permitted by other agencies could occur in places for which seasonal restrictions and other mitigation measures may be required. Effects on polar bears in these areas would be similar to those in other areas.

ITRs for the Chukchi Sea have been issued under the MMPA for oil and gas activities in and adjacent to the Chukchi Sea since the early 1990s. The effects of issuing the current ITRs on polar bears are considered as part of the environmental baseline. Oil and gas companies can obtain LOAs under the appropriate regulations based on the geographical location of their activities. As part of the LOAs issued pursuant to these regulations, the oil and gas industry is required to report the number of polar bears observed, their response, and if deterrence activities were required.

4.3.2. Polar Bear Research

Currently, ongoing polar bear research takes place in the Action Area. The long-term goal of these research programs is to gain information on the ecology and population dynamics of polar bears to help inform management decisions, especially in light of climate change. These activities may cause short-term injury to individual polar bears targeted in survey and capture efforts and may incidentally disturb those nearby. In rare cases, research efforts may lead to injury or death of polar bears. Polar bear research is authorized through permits issued under the MMPA. These permits include estimates of the maximum number of bears likely to be directly harassed, subjected to biopsy darting, captured, etc., and include a condition that halts a study if a specified number of deaths, usually four to five, occur during the life of the permit; permits are typically issued for a five year period.

4.3.2.1. Other Activities

Polar bear viewing at sites such as the whale bone piles may result in disturbance of polar bears by humans on foot, ATVs, snow machines, and other vehicles. Although difficult to quantify, these disturbances are usually temporary and are not spatially very extensive which likely limits the extent and severity of their impact.

4.3.2.2. Environmental Contaminants

Exposure to environmental contaminants may affect polar bear survival or reproduction. Three main types of contaminants in the Arctic are thought to pose the greatest potential threat to polar bears: petroleum hydrocarbons, persistent organic pollutants (POPs), and heavy metals. No large oil spills from oil and gas activities have occurred in arctic Alaska to date, but this does not demonstrate that the risk of such a spill is zero. Contamination of the Arctic and sub-Arctic regions through long-range transport of pollutants has been recognized for over 30 years (Bowes and Jonkel, 1975,;Proshutinsky and Johnson, 2001; Lie et al., 2003). Arctic ecosystems are particularly sensitive to environmental contamination due to the slower rate of breakdown of POPs, including organochlorine compounds (OCs), relatively simple food chains, and the presence of long-lived organisms with low rates of reproduction and high lipid levels that favor bioaccumulation and biomagnification. Consistent patterns between OC and mercury contamination and trophic status have been documented in Arctic marine food webs (Braune et al., 2005).

5.0 EFFECTS OF THE PROPOSED ACTION

This section analyzes direct, indirect, interrelated and interdependent effects of the Proposed Action on listed eider species, the Ledyard Bay Critical Habitat Unit (LBCHU), and polar bear. we first describe anticipated effects of the first incremental step (i.e., activities associated with the exploration and delineation of an anchor field). This describes impacts that may result from subsequent future incremental steps (i.e., the development and production of the anchor field, the exploration, development, and production of the satellite prospect, and decommissioning of both fields) for each species and LBCHU.

With regard to oil spills, they could potentially result from activities in the first and future incremental steps. BOEM described and modeled hypothetical oil spill scenarios including the geographical extent of potential spills, their initial effects, and duration based on factors such as volume and seasonal timing (USDOI, BOEM 2014). This BA distinguishes small oil spills (< 1,000 barrels) from large (≥ 1,000 barrels) and very large (≥ 150,000 barrels) potential oil spills, as there are substantial differences in the likelihood that small spills will occur from the Action, as opposed to large or very large spills.

5.1. First Incremental Step

As explained in Chapter 2, the first incremental step includes all activities associated with exploration of the anchor field, including construction of supporting onshore facilities (also referred to as shorebases). In this section we analyze direct, indirect, interrelated and interdependent effects of the first incremental step activities on listed eider species, the LBCHU, and polar bears.

5.1.1. Listed Eiders

Spectacled eider and Steller's eider, with the overlap in their nesting habitats and similar use of marine habitats in the Action Area, are considered together in this first incremental step analysis. First impact-producing factors are presented for both species and the LBCHU, followed by an effects analysis for the two eiders and then the effects analysis for the LBCHU.

5.1.1.1. Impact-Producing Factors (IPFs)

This section identifies the Impact Producing Factors (IPFs) resulting from the oil and gas activities associated with the first incremental step. It discusses the manner in which each identified IPF can affect Steller's eider and spectacled eider.

5.1.1.2. Factors Causing Disturbance and Displacement

5.1.1.2.1. Aircraft Traffic

As described in Chapter 2, aircraft activities associated with the first incremental step include helicopter support for exploratory drilling, and fixed wing transport of equipment and materials associated with shorebase construction. The noise and physical presence of aircraft in the Action Area may disturb listed eiders during pre-nesting, nesting, brood-rearing, molting, and migration. Most birds react and move away from approaching aircraft, thus avoiding direct harm from the noise. In the process of moving away or diving, however, eiders could be displaced from important locations such as foraging areas or nests. This can result in lost foraging opportunities or displacement to an area of lower prey availability. There is also an energetic cost to repeatedly moving away from disturbances. Negative effects could occur if an expenditure of energy during a physiologically-demanding period of egg production, brood-rearing, or feather growth and the accumulation of energy reserves needed for later migration to wintering areas. Individual nests may be disturbed repeatedly by low-flying aircraft, especially helicopters. When disturbed, a nesting female flushes from the nest. These nests may be exposed to inclement weather, abandoned, and/or the eggs or young could die or be eaten by predators.

While specific information on the potential reactions of listed eiders is lacking, there is some information available on other seaducks (family Anatidae). For example, we expect that listed eiders would have a similar response as king eiders. King eiders in western Greenland dove when survey aircraft approached (Mosbech and Boertmann 1999). Bird response varied with time of day, and increased with decreasing plane altitude. After a preliminary dive by nearly all birds, over 50% remained submerged until the plane passed. Also, molting king eiders appeared to be sensitive to aircraft engine noise, and flushed, dove, or swam from that disturbance, sometimes leaving the area for several hours (Frimer 1994).

Ward and Sharp (1974) assessed the impacts of helicopter overflights on other seaducks, specifically molting long-tailed ducks and surf scoters at Herschel Island, Yukon Territory in August 1973. They found that all but 8% of long-tailed ducks and 2% of surf scoters reacted to the helicopter disturbance. While most molting ducks swam away from the helicopter, the rest that reacted dove underwater in response to helicopter approach. The reaction of these sea ducks to low-level flights indicated an interruption of normal behavior (such as cessation of foraging or sleeping) or displacement from foraging areas.

Lehnhausen and Quinlan (1981) observed low-flying aircraft disturbing common eider nesting colonies on barrier islands, flushing birds off their nests in "mass panic flights." The authors speculate that gulls and jaegers ("…constantly flying over [the colony]") preyed on the nests while the adults were away, resulting in decreased nesting success. Low-flying aircraft also could impact sensitive species, as has been the case withbrant feeding and resting in coastal salt marshes or long-tailed ducks molting in coastal lagoons (Lehnhausen and Quinlan, 1981).

The behavioral response of eiders to low-level aircraft flights is variable; some spectacled eiders nest and rear broods near the Deadhorse airport, indicating that some individuals tolerate frequent aircraft noise. Individual tolerances are expected to vary, however, and the intensity of disturbance, in most cases, would be less than that experienced by birds at the Deadhorse airport. Some birds may be displaced, with unknown physiological and reproductive consequences.

5.1.1.2.2. Vessel Traffic

Vessel activities associated with the first incremental step include operation of survey vessels across the leased area; positioning of drillships; operation of ice breakers, ice management vessels, and supply vessels in aid of surveys and exploratory drilling; and barge transport of materials for shorebase construction. Deep-penetration and high-resolution survey operations use one or two self-contained vessels accompanied by a one or perhaps a few small support vessels; exploratory drilling operations may use one drill ship, one or two icebreakers, and a few support vessels.

The physical presence and/or noise of vessels could impact marine and coastal birds including listed species. Vessels might disturb birds that are foraging, resting, or molting at sea. Birds normally move away from vessels, but in the process, as with the case of aircraft disturbance, could be displaced from important locations such as foraging areas. Vessel disturbance would be most likely to have an impact during those periods of the annual cycle when birds have difficulty in meeting their daily energy requirements, especially when food intake needs to be high to enable birds to build up nutrient reserves in advance of periods of high demand, such as egg-laying. There is an energetic cost to repeatedly moving away from disturbances as well as a cost in terms of lost foraging opportunities or displacement to an area of lower prey availability.

How waterfowl and marine birds respond to disturbances can vary widely depending on the species, time of year, disturbance source, habituation, and other factors (Fox and Madsen, 1997). It seems that in some species of waterfowl, the distance at which disturbances will be tolerated varies depending on flock size, because larger flocks react at greater distances than smaller flocks (Madsen, 1985).

Avoidance behaviors were recently documented by an ornithologist on a contract vessel operating in the LBCHU. ABR, Inc. (2013) reported, "Of the eiders seen, only the pair of Steller's Eiders altered their route or changed their location in response to the moving vessel. The Steller's Eiders were in the path of the vessel and were spotted 200 m ahead of the bow. The ship slowed to 4 kt as soon as the eiders were spotted. The male of the pair took off from the water, and the female flushed to the port side of the vessel and swam away from the vessel path."

Disturbance is most likely to have an impact during those periods of the annual cycle when birds have difficulty in meeting their daily energy requirements, especially when food intake needs to be high to enable birds to build up nutrient reserves in advance of periods of high demand. Frequent disturbance could result in energy expenditures that prolong the molt beyond the ice-free period or decrease the amount of stored energy reserves available for winter survival. The condition of some species during the winter period likely influences subsequent reproduction. Madsen (1994) studied the long-term effects of hunting disturbance on pink-footed geese (*Anser brachyrhynchus*) and found that geese that had used undisturbed sites reproduced better than geese from disturbed sites.

5.1.1.2.3. Seismic-Airgun Noise

Oil and gas resources need to be identified and delineated before they can be developed. Most often this assessment is completed using seismic techniques. These surveys generate intense energy pulses in the water column. Seismic survey vessels typically move slowly through an area, and ramp up the airgun array when starting a survey or after a power down. Seismic surveying with airgun arrays results in both vertical and horizontal sound propagation. Horizontal propagation is a relevant issue, because it is less likely that listed eiders would be under the array. 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 50–75 km in water 25–50 m deep (Richardson et al. 1995).

Listed eiders forage in the water column and seafloor and could be exposed to underwater noise. It is conceivable that a bird could be near enough to a marine seismic or geohazard survey sound source to be injured by a pulse. The threshold for physiological damage, namely to the auditory system, for marine birds is unknown. Although BOEM and BSEE have no information about the circumstances where this might occur, the reactions of birds to airgun noise suggest that a bird would have to be very close to the airgun to receive a pulse strong enough to cause injury, if that were possible at all. "Ramping-up," a gradual increase in decibel level as the seismic activities begin, can allow diving birds to hear the start-up of the seismic survey and help disperse them before harm occurs. During seismic surveys, diving birds likely would hear the advance of the slow-moving survey vessel and associated airgun operations and move away.

Little is known about avian behavioral response to seismic acoustics; however, 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 dive more frequently than in undisturbed areas, but the cause (vessel versus seismic acoustic source) was unclear.

While seismic airguns have the potential to alter the availability of marine bird prey, Vella et al. (2001) concluded that there generally are 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 invertebrate crustaceans, bivalves, or mollusks.

5.1.1.2.4. Exploratory Drilling

As described in Chapter 2, the first incremental step will include exploratory drilling of a maximum of 28 exploratory and delineation wells by two simultaneously-operating MODUs. Exploratory drilling may disturb and displace listed eiders from the immediate area. Because this is a horizontally stationary activity effects would be localized. Drilling operations can emit underwater sound that could injure a bird if it was very close to the drill rig. Listed eiders, however, are most likely to move away from or not approach drilling operations if the sound bothered them, similar to seismic surveys, well before the underwater sound could harm them.

5.1.1.2.5. Collisions and Disorientation

Collisions during the first incremental step could result from birds striking vessels or offshore/onshore facilities, or aircraft striking birds. Migratory birds can be killed from collisions with man-made structures (Manville, 2004), or otherwise negatively impacted through flight disorientation caused by the presence of artificial light.The potential for collisions or circulation events could be elevated where birds concentrate, such as in migratory flight corridors or the spring lead system or the LBCHU. Birds are particularly at risk when visibility is impaired during darkness or inclement weather, such as rain, drizzle, or fog (Weir, 1976). In a study of avian interactions with offshore oil platforms in the Gulf of Mexico (Russel, 2005), collision events were more common, and more severe (by number of birds) during poor weather. Certain types of lights (such as steady-state red) on structures increase these risks as well (Reed et al. 1985, Russell 2005, numerous authors cited by Manville 2000). This is particularly apparent in poor weather when migrating birds appeared to get into circulation patterns around structures after being attracted to lights and becoming unable to escape the “cone of light” (Russell 2005, Gauthreaux and Belser 2002, Federal Communications Commission 2004). Disorientation could last for hours (“circulation event”), with a time and energy cost to eiders or flocks of eiders, particularly during migration.

Vessel Strikes

High-intensity lights are needed by vessels during some nighttime operations, or when visibility is hampered by rain or fog. Lights on fishing vessels at sea have been known to attract large numbers of seabirds during storms (Dick and Donaldson, 1978). Black (2005) reported a collision of about 900 birds, mostly a variety of petrel species and Antarctic prion, with a 75-m fishing trawler near South Georgia. The collisions took place over a 6-hour period at night, when visibility was <1 nautical mile (nmi), due to fog and rain. Of the 900 birds on deck, 215 were dead. Most of the remaining birds were released alive after being allowed to dry off in boxes stored in a protected area on deck. Waterfowl and shorebirds also have been documented as colliding with lighted structures and boats at sea (Schorger, 1952; Day, Prichard, and Rose, 2005).

Flight behavior over water by listed eiders, particularly during migration, places them at risk of colliding with human-built structures. Day, Pritchard, and Rose (2005) suggested that eider species may be particularly susceptible to collisions with offshore structures as they fly low and at relatively high speed (~ 45 mph) over water. Johnson and Richardson (1982), in their study of migratory behavior along the Beaufort Sea coast, reported that 88% of eiders flew below an altitude of 10 m and more than 50 % flew below 5 m.

New, site-specific data provides evidence that individual bird encounters with vessels are not rare events. BOEM and BSEE have required monitoring of bird encounters during certain OCS operations. In 2012, a lessee conducting an exploration drilling program in the Chukchi and Beaufort Seas (USDOI, BOEMRE, 2011) reported observations of at least 131 birds on their drilling units and support vessels, 83 (63%) of which were dead. From some detailed observations, it appeared that some birds sought refuge on a vessel in inclement weather and rested on the vessel until continuing migration. In other cases, exhausted birds appeared to have alighted on a vessel, but did not survive.

The injuries and mortalities, however, strongly indicated birds collided with vessel structures and died or succumbed to injuries later.

BOEM and BSEE calculated bird encounter rates for a typical, complete, open water operational period (season) based on the encounter reports from the 2012 partial-season exploration drilling program. Not all encounters are fatal and, in some cases, crew assistance likely helped some birds survive, at least to resume flying. Nonetheless, these rates almost certainly underestimate impacts, given the following assumptions: some birds 1) could have struck a vessel but landed overboard and been lost at sea undetected; 2) experienced such a costly level or time period of disorientation that they did not recover to resume flying but instead were also lost at sea; or 3) alighted, rested, and departed undetected. BOEM and BSEE estimated that birds would encounter drillships at a greater rate (53 birds per vessel per season) than smaller support vessels (11 birds per vessel per season).

Aircraft Strikes

Helicopter and fixed-wing aircraft operating at low altitudes have the potential to flush birds into the path of the aircraft, where a collision could occur. Approximately 90% of aircraft/bird collisions occur <1,500 ft above ground (Sodhi, 2002). Larned and Tiplady (1997) reported that flocks of wintering eiders often took flight during fixed-wing aircraft approaches of 150–200 m. While such strikes are relatively rare, aircraft/bird collisions could threaten the safety of aircraft and passengers and result in deaths of birds. Altitude restrictions have been used to separate birds and aircraft to reduce the potential harm to aircraft and birds (USDOI, MMS, 2006).

Habitat Loss and Alteration

Habitat loss occurs as facilities are developed, covering habitats used by birds. Both marine and terrestrial habitat loss could occur in the first incremental step. Marine habitats can be impacted when exploration and delineation wells are installed. Rock cuttings and other materials such as drilling muds from each well site would be discharged into the water and onto the ocean floor. Drilling muds would be reconditioned, and an estimated 80% would be re-used, including all the synthetic drilling fluids. The remaining 20%, typically composed of EPA Type 2 Lignosulfonate Mud, would likely be discharged at the drill site subject to federal (e.g., EPA) and State water quality regulations. The area of sea floor disturbance would depend upon multiple factors, including the water depth of the drilling and discharge sites and the currents. As an example, the Arctic MultiSale EIS (MMS 2008) reported detection of cuttings 50-500 m from the well site. Using a radius of 500 m and assuming the area of a circle, the maximum area disturbed by one well could be 785,000 m^2or 193.98 acres. Marine habitat loss could impact listed eiders or critical habitat by directly covering or indirectly silting over benthic beds of prey organisms where water is shallow enough to provide accessibility to diving birds.

Terrestrial habitat may be impacted in the first incremental step if land is filled/excavated for the construction of small exploration support facilities, or otherwise impacted as from dust/gravel spray from construction or facilities operations. Terrestrial habitat loss could impact listed eiders if tundra habitats used by nesting birds is covered, degraded, or made inaccessible. Other secondary impacts could occur from altered hydrology associated with these facilities, flooding areas and drying others. While some species may have or will benefit from wetter or drier habitats near these facilities, evidence suggests that many birds avoid using habitats near these developments and the human activities they support. For example, regular vehicle traffic on roads could result in the permanent displacement of nesting birds in a zone of influence around developments. In Alaska, Steller’s eider breeding is primarily concentrated in tundra wetlands near Barrow and occurs at much lower densities elsewhere on the Arctic Coastal Plain. If these habitat losses and alterations were to occur in the vicinity of important Steller’s eider nesting habitat around Barrow, impacts to this listed species could result.

5.1.1.2.6. Discharges

Discharges include those materials authorized for release into surrounding waters under specific permits and oil spills, which are accidental or unauthorized releases of oil into the marine environment.

Authorized Discharges

Discharge of Muds and Cuttings. Exploratory drilling could directly affect a very small area of benthic habitat with increased turbidity and discharge of drilling muds and cuttings. These discharges could make it more difficult for foraging birds to locate foods, especially benthic prey. Contamination may impact individual birds either through direct contact or indirectly as a result of effects on prey populations or important habitats. The EPA regulates the discharge of drilling muds (used to lubricate drill bits), cuttings (material removed from drill holes), and other materials to the marine environment. The Chuckchi Sea exploration NPDES general permit (AKG-28-8100) for oil and gas exploration facilities on the OCS is currently in effect and mandates certain discharge limits.

Discharge of Grey Water and Ballast Water. Vessel or platform operations could include the discharge of grey water and ballast water into the marine environment. The Chukchi Sea exploration NPDES general permit (AKG-28-8100) authorizes discharges from oil and gas exploration facilities. The EPA regulations at 40 CFR 125.122 require a determination that the permitted discharge will not cause unreasonable degradation to the marine environment.

Oil Spills

BOEM and BSEE estimate that approximately 20 small spills ranging in size from 1 bbl up to 55 bbl per spill could occur during the first incremental step. Sources of petroleum spills during the first incremental step activities include vessel accidents and equipment malfunctions during bulk fuel transfers. Spilled fuel/oil in the Action Area would be a serious threat to birds because it forms a thin liquid layer on the water surface. Sea ducks are highly vulnerable to oil spills, because they spend most of their time on the sea surface and aggregate in dense flocks. Large numbers of ESA-protected species could be affected anywhere a spill reaches an area of concentration. Exposure to oil can potentially affect waterbirds in several ways, depending on the extent and severity of the exposure. Beached-bird surveys have demonstrated that low-volume, chronic oil pollution is an ongoing source of mortality in coastal regions (Burger and Fry, 1993). Small volumes of oil may be released from leaking tanks and valves, accidents during loading and offloading, and flushing of tanks and bilges. In cold climates, an oil spot the size of a square inch is enough to compromise water repellency of plumage, possibly leading to the death of a bird. In some places, low-volume, chronic oiling is a major cause of seabird mortality.

Impacts to birds from fuel/oil spills may include fouling of feathers, ingestion, skin irritation and many others. For purposes of this BA, BOEM and BSEE conservatively estimates that all birds contacted by spilled fuel or oil will die. Details follow.

Covering of Skin or Feathers. Fouled plumage is the primary cause of mortality and stress in oiled birds (Burger and Fry, 1993). The hydrophobic nature of petroleum hydrocarbons makes them interactive with the hydrophobic properties of bird feathers. Oil causes marked loss of insulation, waterproofing, and buoyancy in the plumage. Oiled feathers lose their ability to keep body heat in and cold water out, and resultant hypothermia can kill birds. Waterlogging and loss of buoyancy can rapidly lead to drowning (Jenssen, 1994), particularly in cold environments (Piatt et al. 1990).

Inhaling Hydrocarbon Vapors. Birds have the most efficient respiratory system of all vertebrates (Welty, 1975) and could be more susceptible to harm from inhaling hydrocarbon vapors than mammals. Inhaled petroleum vapors are absorbed into the bloodstream and carried throughout the body (Geraci and St. Aubin, 1982). Inhalation of highly concentrated petroleum vapors can lead to inflammation and damage of the mucous membranes of the airways, lung congestion, emphysema, pneumonia, hemorrhage, and death. It is unlikely that vapor concentrations can reach critical levels for more than a few hours. If a bird were unable to leave the immediate area of the source of the spill or were confined to a contaminated lead or bay, it could inhale enough vapors to cause some damage. Birds away from the immediate spill area or exposed to weathered or residual oils would not be expected to suffer any adverse effects from vapor inhalation.

Ingesting Oil or Contaminated Prey. Petroleum oils contain many toxic compounds that can have fatal or debilitating effects on birds when ingested (Burger and Fry, 1993). Birds that ingest hydrocarbon-contaminated food could potentially 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 (Albers, 2003: Briggs et al., 1997; Epply, 1992; Fowler et al., 1995; Hartung and Hunt, 1966; Butlet and Peakall, 1982).). The major route by which birds would be expected to ingest oils is by preening it off their feathers after exposure. These same toxic compounds could be absorbed through the skin.

Reproductive Effects. Ingested oil causes short- and long-term reproductive failure in birds, indicative of severe physiological problems. These include delayed maturation of ovaries, altered hormone levels, thinning of eggshells, reduced egg productivity, reduced survival of embryos and chicks, reduced chick growth, and abandonment of nests by adults (Burger and Fry, 1993). Cassin's auklets experienced reduced reproduction after exposure to Prudhoe Bay crude oil (Ainley et al., 1981). It is unknown if exposed adults could become permanently sterilized.

Lightly oiled birds could bring oil contamination back to their nest where eggs and young could be contaminated. Mortality of embryos in incubating eggs and nestlings has been documented by exposure to small amounts of hydrocarbon contamination (light fuel oil, certain crude oil, and weathered oil) transferred by adults with lightly oiled plumage ((Parnell et al., 1984; Hoffman, 1990; Szaro et al., 1980; Stubblefield et al., 1995).). Heavily oiled birds would be prevented from returning to the nest resulting in the young dying of starvation. If adults engaged in a futile attempt to hatch a dead embryo, their reproductive effort for that year would be lost. Even if they were to attempt to renest later in the season, it is doubtful that their late-hatching young would survive.

Reduced Food Sources. Food resources used by birds could be displaced from important habitats or be reduced following a petroleum spill.

5.1.1.3. Potential Effects from the First Incremental Step on Listed Eiders

5.1.1.3.1. Disturbance and Displacement

Aircraft Traffic

BOEM and BSEE anticipate low numbers of aircraft operations during First Incremental Step activities. During exploration surveys, aircraft would be used only for search and rescue efforts. During open water exploratory drilling activities, BOEM and BSEE estimate 1-6 helicopter flights/day will occur. These aircraft will transport personnel and supplies between drill ships and land, likely Barrow and/or Wainwright. To minimize impacts to listed eiders and other avian species during sensitive life history periods, BOEM and BSEE require aircraft to avoid flying below an altitude of 1,500 feet over the LBCHU between 1 July and 15 November (the period when molting spectacled eiders are present), and over the spring lead system between 15 April and 10 June (when listed species may be present) unless it is unsafe to do so (Lease Stipulation No. 7; Appendix A).

Altitude restrictions can often be impractical in arctic coastal areas due to frequent inclement weather, however, and electronic tracking of actual flight altitudes would help to analyze how often weather conditions actually allow for compliance with the intent of the stipulation.

Evidence suggests that some birds may habituate to certain sources of disturbance or avoid impacts associated with certain areas (USFWS, 2005). For example, some spectacled eiders nest and rear broods near the Deadhorse airport, indicating that some individuals tolerate frequent aircraft noise. Individual tolerances are expected to vary, and the intensity of disturbance, in most cases, would be less than that experienced by birds at the Deadhorse airport. The use of designated flight paths could allow many birds, especially those in a specific area over several weeks or returning to a specific area year after year, to habituate to or use alternative areas to avoid aircraft impacts.

Disturbance to nesting spectacled and Steller's eiders during the First Incremental Step is probably further limited due to their extremely low densities across the North Slope. Spectacled eiders nest in loose aggregations in preferred habitat types (Bart and Earnst, 2005), but across the ACP of the North Slope breeding-season density has averaged approximately 0.165 spectacled eiders/km^2 (Larned, Stehn, and Platte, 2010). Steller's eiders are so rare in some years, that they are not detected at all by aerial-survey methods, and pair densities have ranged between 0 and 1 male/km^2 between 1999 and 2012 in their core nesting area near Barrow (USFWS, 2013). With the low number of anticipated flights, low nesting densities, and additional protection provided to these avian species through the flight altitude mitigation measures, we expect only infrequent, minor, short-term effects on listed eiders from aircraft disturbance.

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Vessel Traffic

There are a variety of vessel-based activities in the first incremental step. Two large vessels will be used for seismic surveys, one in open water and one in ice, and there will be two MODUs operating simultaneously in open water. These larger vessels will all have some smaller vessel support and/or ice breaking, and there will be one to two barge trips during each of two years of shorebase construction. Vessel traffic impacts on listed eiders include the periodic interruption of migrating, post-breeding and molting birds. Vessel operations may only affect listed eider species if the birds are present in the same area and at the same time as the vessels. For example, most spectacled eiders breeding on the ACP make regular use of the general lease-sale area, and each sex/age cohort could be affected differently, depending on time and location. In the most extreme case, 33,192 spectacled eiders have been counted in Ledyard Bay during the latter portion of the molting season (Petersen, Larned, and Douglas, 1999). While concentrations of molting eiders in the LBCHU have some ability to slowly move around in ice-free waters, this movement comes at an energetic cost, and they may be displaced to areas of lower productivity. Frequent vessel disturbance could result in energy expenditures that prolong the molt beyond the ice-free period or decrease the amount of stored energy reserves available for winter survival. As most of these eiders are believed to be successfully breeding females and their hatch-year broods, even a seemingly trivial incremental degree of adverse effect to individual fitness (caused by chronic vessel disturbance) applied to such a large number of birds could result in decreased winter survival with resultant decreased population size, productivity, and recruitment.

Large numbers of listed eiders are also likely present in the Chukchi Sea spring lead system in spring/early summer. Nearshore areas of the Chukchi Sea often are some of the first ice-free areas available to spring migrants. These open-water areas (sometimes referred to as polynyas or the spring lead system) can support dense concentrations of birds as migrants continue to arrive but cannot continue, because eastern destinations are still snow or ice covered. As these birds staging in the polynyas are returning to their breeding grounds, changes in their fitness or nutritional status could affect future reproductive efforts.

Regarding the LBCHU, no exploratory drilling can occur there because no leases exist there. However, some support vessels may occasionally transit through the area. From 16 November through 30 June, listed eiders are rarely present, and vessels would not contact them in large numbers. Between 1 July and 15 November, impacts of potential transit would be reduced by Lease Stipulation No. 7, which requires surface vessels associated with exploration and drilling operations to avoid travel in the LBCHU during this time period.

Regarding the spring leads, the vast majority of the spring lead system is closer to the coastline than the leased area, and only rarely do leads open up in the vicinity of the leased area (Mahoney, 2012). Furthermore, vessels transiting through the leads may cause short-term minor disturbance but the effects are likely to be limited due to the brief duration of a vessel transit, and the relatively low numbers of vessels that may transit the area (i.e., BOEM and BSEE estimate up to two drillships with up to 19 other vessels participating in a small support contingent and one ancillary activity annually (Shell Gulf of Mexico, Inc., 2014)).

Given the relatively low number of vessels and the restrictions on vessel activity in areas where large numbers of listed species occur (LBCHU and spring lead system), it is unlikely that vessels would encounter these species. A bird that does encounter deep-penetration survey, high-resolution survey, or exploratory drilling operations will likely only experience minor, short-term displacement to adjacent, undisturbed habitat.

Seismic Airgun Noise

Seismic work, exploratory/delineation drilling, and related support activities will be typically conducted from vessels during the ice-free, open-water period. The first incremental step includes two marine seismic survey/exploration/delineation surveys of up to 90 days duration and five smaller-scope ancillary acoustic surveys, whereby leaseholders and others investigate the potential for oil or gas production in the future. The in-ice survey is conducted when listed eiders will not be present.

The effects of open-water seismic survey operations are likely similar to those of transiting vessels. Seismic survey vessels typically move slowly through an area, and ramp up the airgun array when starting a survey or after a power down. Eiders will likely dive or move away from passing seismic vessels. Survey passes in any given area are generally one-time only events, and it is therefore anticipated that these activities will result in only negligible and temporary disturbances that do not rise to the level of adverse effects on eider populations.

Exploratory Drilling

Exploratory drilling may disturb and displace listed eiders from an immediate area. However, in the vast majority of the leased area, listed species may not be present and hence, may not be impacted. No exploratory drilling can occur in the LBCHU because there are no leases there. Further, exploratory drilling activities disturb a relatively small area and are stationary, allowing any birds that are present to either habituate to the activities or move away to an undisturbed area. In areas where large numbers of listed eiders may be present, BOEM imposes mitigation measures on operations. For example, Lease Stipulation No. 7 (Appendix A) will require that vessels associated with exploratory drilling operations in the leased area do not operate in or traverse the spring lead system between April 15 and June 10, to the maximum extent practicable. Additionally, during the spring, ice covers portions of the Action Area, making most surveys, and thus effects on birds, infrequent. Because few birds are likely to encounter exploratory drilling operations and those that do will likely be displaced only a short distance, and because measures imposed by BOEM will likely minimize impacts via mitigation measures, we expect disturbance from effects of drilling to have at most only temporary and minor effects on listed eiders. we discuss effects of mitigation measures for the LBCHU in the next section.

Collisions and Disorientation

Activities under the first incremental step could increase the total number of structures, particularly vessels, in the leased area and vicinity. Depending upon location and timing of operations, vessels and exploration structures pose a collision and disorientation risk to listed eiders, particularly when migrating to and from Alaska's North Slope (see USDOI, BOEM, 2012, page 77). Mitigation measures imposed on exploration activities will help minimize collision mortality to ESA-listed birds in the Action Area. Vessels and drillships, for example, are to operate their lights in such a way to minimize collisions. Lease Stipulation No. 7 requires that exterior lights 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 will be required to remain on for safety. Lessees are also required to implement lighting protocols aimed at minimizing the radiation of light outward from exploratory drilling structures.

At this time, however, BOEM and BSEE cannot guarantee that recommendations for the design and implementation of lighting of structures would result in no strikes by threatened eiders. BOEM and USFWS both acknowledge that estimating incidental take of listed eiders is extremely difficult. There were a variety of assumptions made to support the calculations, below, that were made based on the bird encounter data collected during the 2012 Shell exploratory drilling operation in the Chukchi. Eiders leaving the North Slope travel day or night. Movement rates (birds/hour) do not differ between night and day, but movement rates and velocities are higher on nights with good visibility (Day et al., 2004).

During the first incremental step no more than two marine seismic surveys would occur, with no more than one occurring in a given year. Marine seismic surveys could involve as many as three vessels during the open water season. Surveys conducted during other time periods would occur when birds are generally absent. The estimated level of impacts from each seismic survey is 33 bird: vessel encounters each open water season. For drilling operations during this time period, given that they may include 2 drilling rig operations and 19 support vessels (Shell Gulf of Mexico, Inc., 2014), 315 bird:vessel encounters are estimated to occur based on two independent drilling rig operations (i.e., 2 drilling vessels with 53 encounters each plus 19 support vessels with 11 encounters each during a full season). The distribution of these encounters would be distributed (percent, total for group) across seabirds (tubenoses, alcids, others) (21%, 67), seaducks (27%, 86), shorebirds (8%, 26), and passerines (44%, 139). The species distribution of the encounters within any group is diverse. A small percentage of the 86 seaducks could include listed species. The percentage of listed eiders possibly involved in these encounters cannot be estimated because listed eiders have not been reported to physically interact with vessels in the Chukchi Sea, but is assumed to be low. . Lease Stipulation No. 7 requires that all bird collisions that arise from exploration activities be documented and reported, and it is anticipated that this data will assist with mitigation efforts in future review and consultations.

The calculations presented above were derived from a drilling season when no large bird circulation events were reported. Such an event could impact large numbers of flock-mates at one time, but would be relatively rare and highly episodic in occurrence, and the chance that they would impact any given species, e.g., listed eiders, even more rare. The longer that the First Incremental Step would last, presumably the greater the risk that a large circulation event(s) could occur in that phase. It is not expected that exploration activities in search of an anchor field discovery would persist longer than 5 years, however, and so the risk of any multiple-eider strike event during this phase would be presumed to be negligible.

Habitat Alteration

Marine Habitat

Permanent structures in high-quality habitats can affect birds by rendering those habitats permanently unsuitable, thus relegating birds to lower quality habitats. The only permanent structures expected to result from deep-penetration and high-resolution surveys and exploratory drilling in the first incremental step are abandoned /capped exploratory wells and some other equipment (e.g., top of guide arms) on the sea floor. While listed eiders forage on the sea floor where water depth allows,these capped wells have an extremely small footprint. Therefore, it is expected that any permanent marine habitat loss for listed eiders from the first incremental step would likely be extremely minor.

Contamination of benthic and other food sources for avian species from disposal of drilling muds and cuttings can occur in some instances. Changes in species composition, abundance, or biomass of the benthic biota resulting from the release of synthetic-based mud cuttings generally has been 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 (USDOI, MMS 2008).

Areas affected by sedimentation or other degratdation, depending on substrate types, community composition, and ocean current speeds and directions, would begin the process of recolonization after deposition has completed following benthic disturbance (Conlan and Kvitek, 2005). Period of time for recolonization is dependent upon species, sediment classification (e.g. grain size and percentages of mud, sand, cobblestone, etc.), water current speeds and direction, water temperature, salinity, and areal coverage and depth of sediment plume (Trannum, et. al., 2010, 2011). Bivalves would likely reach sizes readily utilized by foraging mammals (and therefore certainly smaller foragers like seaducks) at approximately 7–9 or more years depending upon substrate classification, depth, and water temperature (MacDonald, et. al., 2010). Other benthic foragers such as crabs, fish, and pelagic bird species typically utilize smaller organisms such as amphipods, copepods, shrimp, nematodes, and polychaetes. These are among the first to recolonize taking generally less than a year for establishment in new locations (Trannum, et. al., 2011).

The EPA regulates the discharge of drilling muds (used to lubricate drill bits), cuttings (material removed from drill holes), and other materials to the marine environment. A NPDES permit for oil and gas exploration facilities on the OCS and contiguous State waters is currently in place. NPDES permits place limits on the location, volume, and materials that can be discharged to marine waters from exploratory drilling activities. Given the relatively small impact area from structures associated with exploratory drilling in relation to the size of the Action Area, the low number of wells that are likely to be drilled in the area (BOEM and BSEE estimate a maximum of 28 wells during the first incremental step), and the limits on the discharges enforced through the NPDES permit process, only minor impacts to listed eiders from toxic contamination resulting from discharges of drilling mud and cuttings.

Terrestrial Habitat

Some freshwater and coastal wetland habitat could also be lost in order to support the offshore exploration operations. About 27 acres (0.1 km^2) could be filled to provide development of an exploration camp, air support, and search and rescue base. Approximately 240 acres (1 km^2) could be excavated to provide borrow sources for the fill materials. Construction itself will occur in winter. The permanent loss of habitat would persist across seasons. Other habitat alterations and effects, including potentially 70 acres of gravel and dust spray and dust shadow, can be expected in the project vicinity. In future incremental steps, these exploration shore bases could be expanded to provide a full-sized production shorebase. If these habitat losses and alterations were to occur in the vicinity of important Steller's eider nesting habitat around Barrow, adverse impacts to this listed species could result. While there remains uncertainty about the location(s) of onshore development, protections, including avoidance and other forms of mitigation, of the important habitat in the Barrow vicinity are expected, however, from the multi-tiered decision making and review process in place for exploration and onshore development planning (see Section 2.2.1.1.5).

Discharges

Discharges include those materials authorized for release into surrounding waters under specific permits and oil spills, which are accidental or unauthorized releases of oil into the marine environment.

Authorized Discharges

Discharges from the Proposed Action would occur over relatively short periods of time (weeks to a few months at individual locations). Impacts to water quality from permitted discharges are expected to be localized and short term. Discharge of drilling muds and cuttings during exploration activities is not expected to cause population-level effects, either directly through contact or through affecting prey species. Adverse effects to benthic invertebrates that could be important to listed birds would be negligible when compared to their availability in the surrounding areas. Any effects would be localized primarily around the drill rig because of the rapid dilution or deposition of these materials. Because the discharges would be regulated through Section 402 of the CWA, typical discharge criteria and other mitigation measures, authorized discharges are expected to have a negligible level of effect on listed birds in the Action Area.

Oil Spills

Oil spills are accidental or unlawful events that are evaluated according to three different size categories: small, large, and very large ("VLOS"). While spills can occur on land or in the marine environment, spills to the marine environment have the greatest potential to affect large numbers of listed eiders, because of their ability to spread and persist in coastal environments. Assumptions about fuel spills in regard to the Proposed Action are discussed in Chapter 2. As these assumptions establish, small spills are likely (i.e., reasonably foreseeable) to occur during the first incremental step.Large spills (≥1,000 bbl) are not reasonably foreseeable during the first incremental step. The only type of large spill that could potentially occur during this increment is a VLOS (≥150,000 bbl) from a loss of well control resulting in a long duration flow. However, such an event would be extremely unlikely to occur because the frequency of a loss of well control incident is extremely low and therefore it is not reasonably foreseeable. As such, while the effects of a VLOS encountering listed eiders could be considerable, a VLOS is not considered to be a direct or indirect effect of the Proposed Action within the meaning of the ESA.

Exposure of spectacled and Steller's eiders is expected to result in the general effects reviewed below. For purpose of this analysis, BOEM and BSSEE assume that all birds contacted by oil would not survive and that secondary effects may cause impaired physiological function and production of fewer young.

Approximately 20 small refined spills (<1,000 bbl) could occur during first incremental step activities, but have little potential to affect listed eiders. Spill prevention and response measures would minimize effects to listed eider populations. Small spills are generally into containment, cleaned up immediately, and therefore do not reach the environment where they could contact birds.Should a fuel spill of this magnitude occur and escape containment, a small number of birds in the immediate vicinity of the vessel could be affected, depending on current and wind patterns. In the unlikely occurrence of a fuel spill in the presence of birds, there is some potential for a limited amount of individual bird mortality (and all birds contacted by spilled fuel are assumed to die), which could result in minor impacts; however, it is most likely that spill prevention and response measures would minimize effects to marine and coastal bird populations. Vessel and aircraft traffic, noise, and human activity associated with oil spill response and cleanup is anticipated to result in avoidance responses from listed birds and reduce the opportunity for them to contact these spills. A negligible level of effect on listed eiders is anticipated from small oil spills.

5.1.1.4. Potential Effects of the First Incremental Step on the Ledyard Bay Critical Habitat Unit

The Ledyard Bay Critical Habitat Unit (LBCHU) is important to migrating and molting spectacled eiders. The Primary Constituent Elements for the spectacled eider in this unit are: (1) marine waters greater than 5 m (16.4 ft) and less than or equal to 25 m (82.0 ft) in depth; (2) the associated marine aquatic flora and fauna in the water column; (3) and the underlying marine benthic community.

5.1.1.4.1. Small Oil Spills

A small oil spill in the Action Area during the first incremental step could reach the LBCHU and potentially affect PCEs and the ability of spectacled eider to use this area for the purposes for which the critical habitat area was designated. Although some oil from small spills could also contaminate the underlying benthic community, this is less likely than contamination within the water column. Small spills, however, are expected to be of very low volume and largely recoverable. Small spills would also have to occur directly adjacent to or within the LBCHU for these effects to occur, and very few activities are likely to occur in this area. Additionally, effects of such contamination would be minimized through oil evaporation, weathering, and recovery efforts. Because the likelihood of small spills occurring within the LBCHU is low, and if they did occur the area affected by small spills would be small, and most of the spilled oil would evaporate, weather, or would be recovered, we do not expect small spills to have long-term effects that would diminish the function and conservation value of the LBCHU for molting spectacled eiders.

5.1.1.4.2. Other Effects

BOEM expects some impacts to the LBCHU from activities that may occur during the first incremental step. No drilling can occur there, however, because no leases exist in the LBCHU and it is approximately 20 miles distant from the nearest lease block. (Very little of the LBCHU was offered for lease in LS 193 and, furthermore, much of it is in a deferral area.) This first step is not likely to impact the PCE of water depth, and it is unlikely that any appreciable volume ofdrilling muds and cuttings that could be discharged during exploratory drilling could reach to the LBCHU. Discharges could result in the deposition of sediment that could affect the PCEs of flora and fauna in the water column and the underlying benthic community through toxicity, or organic enrichment. These effects would be localized, however, to an area up to 277 acres total for the 28 wells, each of which will all be at least 20 miles from the LBCHU. Currents would likely carry discharged material mainly in one direction; some areas would be minimally affected by discharged material; and, recovery of an area around a well would minimize the level of disturbance with time. Any effects would be short-lived because benthic communities would likely be fully recovered one or two years after drilling ceases (USDOI MMS 2008). Given the nonexistent to negligible impact area from exploratory drilling discharges and their short-lived nature, significant adverse effects to the PCEs are not anticipated, and they are not expected to appreciably reduce the function and conservation value of the LBCHU for spectacled eiders.

5.1.2. Polar Bear

5.1.2.1. Impact-Producing Factors (IPFs)

5.1.2.1.1. Aircraft Traffic

Aircraft can affect polar bears due to presence and airborne noise. Two types of aircraft are evaluated, fixed wing and helicopter. Behavioral reactions of polar bears to aircraft depend on the lateral distance, flight altitude, and the type of aircraft. Reactions range from no detectable response to running away from aircraft traveling less than 660 feet agl at a lateral distance of less than 1,300 feet (Amstrup, 1993).

Fixed Wing

Exploration geophysical surveys and drilling operations may be supported by fixed wing aircraft. Fixed wing operations typically assess polar bear habitat use, distribution, movement, and behavior before, during, and after seismic surveys and drilling operations occur. Monitoring surveys are typically conducted with aircraft flying above 1,500 ft AGL unless safety due to weather or other factors becomes an issue. Greene and Moore (1995:102–105) explained fixed wing aircraft typically used in offshore activities were capable of producing tones mostly in the 68 to 102 Hz range and at noise levels up to 162 dB re 1 µPa-m at the source. Aircraft on a direct course usually produce audible noise for only tens of seconds, and the polar bears are likely to resume their normal activities within minutes (Richardson and Malme, 1993). Reaction frequency typically diminishes with increasing lateral distance and with increasing altitude. Individual responses appear to vary depending on flight altitude and received sound levels.

Helicopters

Exploration geophysical surveys and drilling operations may be supported by helicopters engaged in crew and equipment transport. Most helicopter use will be for ferrying personnel and equipment to offshore operations and involves turbine helicopters. Surveys and drilling operations may involve variable numbers of trips daily or weekly depending on the specific operation. The more independent surveys and drilling operations being conducted simultaneously the more aircraft effort and distribution of overflights occurs. Helicopter operations are conducted 1,000 to 1,500 feet AGL/ASL unless safety due to weather or other factors becomes an issue. Greene and Moore (1995:102–110) explained helicopters commonly used in offshore activities radiate more sound forward than backwards, and are capable of producing tones mostly in the 68 to 102 Hz range and at noise levels up to 151 dB re 1 µPa-m at the source. By radiating more noise forward of the helicopter, noise levels will be audible at greater distances ahead of the aircraft than to the aircraft's rear.

Polar bears are known to run from the sound and sight of aircraft, particularly helicopters (USFWS, 2013). The effects of displacement are temporary and polar bears are likely to resume normal activities within minutes (Richardson and malme, 1993).

5.1.2.1.2. Vessel Traffic

Vessel operations occur throughout the Chukchi Sea to conduct seasonal seismic surveys. These vessels operate primarily during open-water and early winter periods. Vessels and their operations produce effects through a visual presence; traffic frequency and speed; and operating noise of on-board equipment, engines, and in the case of icebreakers engine and ice breakage noise. Polar bears may be exposed to vessels when seasonal distribution and habitat selection overlaps in time and space with exploration vessel activities. Noise from seismic sources will be considered separately.

For offshore oil and gas exploration, operations vessels provide the primary platform for the various open-water season and in-ice (late fall/early winter during seasonal ice formation) seismic surveys and secondary support for these surveys such as monitoring; crew transfer; fuel, equipment and supplies delivery; and ice management. Vessels also provide similar support functions for the transport, placement, construction, and operation of exploration drilling platform facilities. In-ice seismic surveys and some late fall/early winter drilling facilities also require icebreaker operations.

Large Vessels

Large vessels employed for oil and gas exploration activities range from 75 m to 110+ m in length. Speeds range from 4.5 kn when towing seismic gear up to 16.5 kn when transiting. Operations historically were confined to the open-water period; however, technology to conduct in-ice seismic surveys during the late-fall/early winter period, when new ice is forming but not exceeding 1.6 m in thickness, is now feasible. Vessel activity occurs 24 hr a day including periods of poor visibility due to darkness and weather conditions. Vessels that perform as floating drilling platforms may be considered large vessels as well.

Medium and Small Vessels

Medium and small vessels are used to support refueling operations and equipment/personnel transport. These vessels are <75 m long and have the ability to slow down in relatively short distances and make rapid turns to avoid collisions with polar bears. These vessels may operate at speeds greater than 10 knots during supply missions and operate in periods of darkness and poor visibility. Collisions with polar bears could occur under such conditions, but have not been reported in the Arctic OCS.

Icebreakers

Some exploration activities require icebreaker support. Icebreaker support for ice breaking or ice management for in-ice seismic surveys and drilling operations can introduce loud noise episodes into the marine environment. When actively engaged in ice management or ice breaking, cavitation of the propellers occurs when higher power levels are required to move ice or ram/run up on ice for breakage. Davis and Malme (1997) noted "cavitation is a frequent occurrence during ice breaking if a ship has to reverse and repeatedly ram thick ice. Cavitation noise is created when the propeller is switched from astern to forward or when the ship has stalled in the ice after ramming, producing much higher noise levels than continuous forward progress through the ice." This noise is much greater than when in transit. Icebreaker noise may occur near habitats used by polar bears.

In order to address the potential for icebreaking to adversely affect the ice habitat itself or alter the mechanical behavior of the surrounding ice, BOEM supported a literature review and analysis by subject matter experts with an emphasis on Arctic expertise (Mahoney, 2010). This review and analysis suggested that icebreaker activity in fall/winter, when temperatures are cold and the ice is forming quickly, has very little impact on the availability of ice as habitat. Icebreaker track lines refreeze very quickly, within a matter of several hours in many cases. Icebreaker effects are overshadowed by the natural variations in land fast ice, which involves constant re-breaking, and even more so in pack ice. In spring, however, when the ice is melting and retreating further north the effects would be more prolonged and widespread. Any icebreaking activity in spring/summer could open new leads which could remain open and expand as the open water absorbed more light and further melting occurred.

5.1.2.1.3. Terrestrial and On-Ice Vehicle Traffic

Up to a mile of new roads could be constructed in the vicinity of onshore facilities in conjunction with the first incremental step. First incremental step activities are not likely to result in the use of terrestrial routes outside of villages or airports, or previously established sites in the vicinity of Wainwright or Barrow. Some equipment may be moved to the North Slope via the haul road. Terrestrial habitat use by polar bears in northern Alaska is primarily restricted to areas within a few miles of the coast. A small proportion of pregnant females may den on land. Non-denning bears of both sexes may travel and scavenge along the coast during fall, winter, and spring months. Terrestrial and on-ice vehicle traffic could temporarily disturb denning, traveling, or foraging polar bears. Impacts to polar bears from terrestrial vehicle traffic associated with first incremental step activities are not anticipated.

5.1.2.1.4. Shorebase Construction and Use

Up to three exploration support shorebases would be constructed during the First Incremental Step. Because polar bear dens may be found on land, coastal development and its associated disturbance could remove or make unavailable some polar bear denning habitat. First incremental step activities are likely to occur at previously established sites in the vicinity of Wainwright or Barrow. Given the relatively small footprint of the exploration support shorebases and the small proportion of polar bears that have historically denned on land, the onshore construction during first incremental step activities would likely have no effect on polar bears at the population level.

The attraction of polar bears to shorebases by food smells or human activities would increase the potential for human–polar bear interactions and would increase the probability of a bear being hazed or killed in defense of human life. Currently, offshore developments in the nearshore environment account for the majority of the polar bear observations. To illustrate, Endicott, Liberty, Northstar and Oooguruk in the Beaufort Sea accounted for 47% of the bear observations between 2005 and 2008 (182 of 390 sightings; 76 *FR* 47010). Because polar bears can be curious and permanent structures can provide habitat (e.g., resting), oil and gas activities and structures could serve as attractants. In some cases, bears may benefit from the presence of infrastructure. For example, the two man-made causeways on the North Slope (the STP/West Dock Causeway and the Endicott Causeway) have created resting, traveling, and other habitat (over approximately seven miles in length) for polar bears since their construction in the 1980s (USFWS, 2012a). However, such use of infrastructure by bears could result in increased human – bear encounters that could, in turn, result in unintentional harassment, intentional hazing, or possibly situations in which bears are killed because itposed an immediate threat to human life.

Most human-bear interactions involve transient polar bears and do not normally result in impacts to bears that affect their essential life functions (USFWS, 2012a). Through the MMPA LOA process, the USFWS typically requires that lessees develop human-polar bear interaction plans, and require that personnel participate in onsite polar bear training. Because human-bear interactions associated with oil and gas activities are typically brief in nature and rarely result in bear fatalities, activities related to onshore construction during the first incremental step are not expected to affect polar bears at the population level.

5.1.2.1.5. Seismic-Airgun Noise

Polar bear responses to oil and gas related sound have varied. Airguns can be of different sizes and can be combined into different array configurations. All seismic survey operations using airguns may be conducted 24 hr a day depending on weather, sea state, ice and operational considerations. To improve operational efficiency, seismic surveys stay active as many days as possible. Because of delays due to weather, equipment, and other reasons, not all seismic surveys are operated continuously, but rather will have periods when the airguns are silent.

The various types of seismic surveys using airguns include open-water surveys, in-ice seismic surveys using an icebreaker, and on-ice seismic surveys using rolligons on land fast ice. No on-ice seismic surveys are anticipated in the Leased Area. Seismic surveys may be 2D or 3D. The 2D and 3D surveys use similar survey methods but different operational configurations. Three-dimensional (3D) survey lines are spaced closer together and are concentrated in a specific area of interest. These surveys provide the resolution needed for detailed geological evaluation. A 2D survey provides less-detailed geological information because the survey lines are spaced farther apart. These surveys are used to cover wider areas and map geologic structures on a regional scale. However, one is not necessarily louder than the other. BOEM and BSEE requires that companies use the lowest possible airgun size to acquire the desired data. Ancillary activities may include the use of one or more airguns for shallow hazard clearance, typically at very low sound levels and over a small area as compared to deep-penetration 2D/3D surveys. The level of sound associated with the survey will be dependent upon the size of the airgun array. In addition to industry surveys, the military and research vessels also use seismic arrays. For example, military vessels conducted an area-wide survey in the Gulf of Alaska recently, and the National Science Foundation (NSF) sponsored an icebreaker (in-ice) oceanographic survey in the Arctic Ocean that included a seismic survey component.

In-ice surveys use an icebreaker to break newly formed ice ahead of the seismic source vessel. The source vessel tows an underwater airgun array. Depending on the timing and location of an in-ice survey, some polar bears could experience noise from both the icebreaking and airgun sound sources if they are in the vicinity of newly forming ice. Potential impacts include disturbance and displacement.

Drilling Operations

Exploration drilling operations are described in greater detail in the scenarios in chapter 2. Drilling units can be sources of noise and disturbance to polar bears. Potential adverse effects include displacing polar bears from the vicinity of drill sites. Drill sites could be located in feeding areas or migration paths. Drilling can be conducted from fixed or bottom-founded platforms or drillships. Drilling operations generate underwater sounds that are quite different than seismic surveys because the sounds are of a continuous nature and tend to be from a stationary source whereas seismic surveys are impulsive sounds from a constantly moving location.

Exploration drilling may be conducted using several types of fixed offshore drilling platforms in the Leased Area. The type of rig chosen is based on the characteristics of the well site's physical environment, water depth, expected drilling depth, and the mobility required based on weather and ice conditions. These mobile drill rigs travel at less than 10 kn; they are towed or self-propelled from one site to another.

The most likely rig types to be used in include dynamically positioned (DP) drillships and jack-up platforms. The existing shallow shelf leases in the Chukchi Sea are suitable for these types of platforms and are appropriate for water depths up to 500 ft.

The results of numerous acoustical studies at the Northstar production facility indicated that underwater sounds produced from construction and oil-production activities attenuate rapidly and reach background levels within a few kilometers of the sound source (Blackwell and Greene 2001, 2006). The distance over which construction sounds would remain above ambient sound levels would depend upon the depth of the water, sea state and other factors. Pile driving is potentially one of the loudest sounds associated with construction. Parvin and Nedwell (2006) found that the sound produced by pile driving dropped below ambient noise levels at between 5 and 10 km.

Drilling Sounds

Exploration drilling in the Leased Area would likely be conducted from a drillship, semisubmersible,or a jack-up rig. The level of sound propagation would depend upon a combination of factors including the precise drillship used, the water depth and location. Underwater sound propagation results from the use of generators, drilling machinery, and the rig itself. Sound levels during vessel-based operations may fluctuate depending on the specific type of activity at a given time. Underwater sound levels may also depend on the specific equipment in operation. Lower sound levels have been reported during well logging than during exploration drilling operations (Greene 1987b), and underwater sound appeared to be lower at the bow and stern aspects than at the beam (Greene 1987a). The following information is excerpted from EPs on file with BOEM and BSEE.

Most drilling sounds generated from vessel-based operations occur at relatively low frequencies below 600 Hz although tones up to 1,850 Hz were recorded by Greene (1987a) during exploration drilling operations in the Beaufort Sea. At a range of 0.11 mi (0.17 km) the 20–1,000 Hz band level was 122–125 dB for the drillship Explorer I. Underwater sound levels were slightly higher (134 dB) during drilling activity from the Explorer II at a range of 0.12 mi (0.20 km) although tones were only recorded below 600 Hz. Underwater sound measurements from the *Kulluk* at 0.61 mi (0.98 km) were higher (143 dB) than from the other two vessels.

Shell Gulf of Mexico, Inc. measured the sounds produced by the *Discoverer* while drilling on the Burger Prospect (within the Leased Area) in 2012. A broadband (10 Hz – 32 kHz) source level of 182 dB was calculated for the *Discoverer* based on the measurements recorded when drilling the 26-inch hole interval (Bisson et al., 2013). These estimates are considered representative of a typical industry-standard, ice-reinforced drillship that would be used for exploration drilling in the Arctic OCS.

Shell’s measurements showed source levels from drilling would fall below 160 dB (rms) within 10 m from the drillship. The 2012 measurement of the distance to the 120-dB (rms) threshold for normal drilling activity by the *Discoverer* was 0.93 mi (1.5 km) while the distance of the ≥120 dB (rms) radius during mudline cellar (MLC) construction was 5.1 mi (8.2 km) (Bisson et al., 2013).

Vertical Seismic Profile Sounds

Vertical seismic profiles are included in the first incremental step of the Proposed Action as part of the exploratory drilling; chapter 2 further describes VSP scenarios. For the purposes of this analysis, BOEM conservatively assumes that VSP would be conducted in association with each wellbore, resulting in a maximum of 28 VSP occurring during the first incremental step (Table 2–1).

Discharges

Authorized Discharges

The principal regulatory method for controlling pollutant discharges from vessels (grey water, black water, coolant, bilge water, ballast, deck wash, etc.) into waters of the Action Area is the Clean Water Act (CWA) of 1972. Section 402 establishes the NPDES. The EPA issued an NPDES Vessel General Permit (VGP) for “Discharges Incidental to the Normal Operation of a Vessel” for Alaska was finalized in December, 2013. The final VGP applies to owners and operators of non-recreational vessels that are 24 m (79 ft) and greater in length, as well as to owners and operators of commercial vessels of less than 79 ft which discharge ballast water.

The current NPDES General Permit for exploration discharges in the Chukchi Sea is the 2012–2017 NPDES General Permit for Oil and Gas Exploration Facilities on the Outer Continental Shelf in the Chukchi Sea (AK 28-8100) (EPA, 2012.) The Arctic general permit restricts the seasons of operation, discharge depths, and areas of operation, and has monitoring requirements and other conditions. The EPA regulations at 40 CFR 125.122 require a determination that the permitted discharge will not cause unreasonable degradation to the marine environment. The current NPDES General Permit for exploration discharges in the Chukchi Sea is the 2012–2017 NPDES General Permit for Oil and Gas Exploration Facilities on the Outer Continental Shelf in the Chukchi Sea (AK 28-8100) (EPA, 2012).

Oil Spills

Polar bears move north and south with the pack ice in the Chukchi Sea and are vulnerable to spills at any time of the year (USFWS, 2006). Spills during the fall or spring during the formation or breakup of ice present a greater risk because of difficulties associated with clean up during these periods and the presence of bears in the prime feeding areas over the continental shelf (USFWS, 2006). Oil would remain highly toxic to polar bears, even after the aromatic hydrocarbons have dissipated (St. Aubin, 1990). In general, polar bears can be encountered throughout the ice-covered waters of the Chukchi Sea. They are less likely to be found in open water, but they will swim considerable distances from ice to shore, or vice versa (USFWS, 2006). As sea ice breaks up in spring, polar bears follow the receding ice edge and may come ashore in late summer and fall, where they remain until the sea ice reforms in early winter. Large aggregations of polar bears may be vulnerable to a spill along the arctic coasts or on Wrangel or Herald islands in late summer and fall, when they congregate in these areas to feed on walrus and whale carcasses (USFWS, 2006). Indirect sources of mortality may occur when seals or other mammals die from oil exposure. Bears have an excellent sense of smell and will travel long distances to locate food sources. Polar bears may not avoid their usual prey items due to oiling (St. Aubin, 1990; Neff, 1990; Derocher and Stirling, 1991). Ingesting oiled prey would be likely to be a secondary source of mortality from a spill. Both adult and young bears that are hungry are likely to scavenge contaminated seals, as they have shown no aversion to eating and ingesting oil (St. Aubin, 1990; Neff, 1990; Derocher and Stirling, 1991).

Spills are unauthorized events. All operations require spill prevention and oil spill response plans, which outline equipment, personnel, and infrastructure associated with the required plans. Depending on the location, timing, duration, sea state, climatic conditions, and response to a spill, polar bears could be affected. Polar bears could be contacted by oil (direct contact, ingestion), inhale vapors, or forage on contaminated or diminished prey resources.

Polar bears could also be affected by spill response and cleanup activities. Cleanup activities following an oil spill could involve multiple marine vessels operating in the spill area for extended periods of time. After a large spill, there are typically helicopter and fixed wing aircraft overflights to track the spill and to monitor distributions of marine wildlife. Monitoring the location of specific marine animals helps guide response in an effort to prevent oil from contacting important animal concentrations or concentration areas.

5.1.2.2. Potential Direct and Indirect Effects of the First Incremental Step on Polar Bears

This section refers to the potential effects of the first incremental step of the Proposed Action on the AC stock of polar bears and the SBS stock of polar bears. There is a substantial area of overlap between the two stocks, and activities in the Chukchi Sea would have the potential to impact both populations. Since polar bears do not generally den along the coastal areas of the Chukchi Sea, disturbance of denning bears in the Leased Area is unlikely to occur. Therefore, the main focus of the analysis will be on non-denning polar bears occurring in the Leased Area.

5.1.2.2.1. Disturbance from Aircraft Traffic

Polar bears may be disturbed while resting or during foraging activities by low flying aircraft. Sight seeing flights, private pilots, industry related flights and regular commercial coastal flights all may come into contact with polar bears. Polar bears may be displaced temporarily by aircraft or may expend energy reserves avoiding aircraft. Requirements that are typical in the MMPA process that industry flights stay at 1,500 ft or above ground level and avoid overflights of important polar bear areas such as Cross Island help to reduce the potential for disturbance. Establishing flight corridors several miles inland for industry flights has also reduced the potential for impacts to polar bears from industry flights since most polar bears use the coastline and barrier islands to move between areas. Flight corridors established from shorebases to offshore industry operation sites reduce the potential for disturbances by limiting the spatial extent of the overflights. Flight routes are often designated through the LOA process, but typically are several kilometers inland or offshore. Some OCS operations involve a large number of fixed wing and helicopter flights, for example, there are 100–200 helicopter flights per open water season between Northstar and West Dock. Additional flights associated with OCS activities take place in conjunction with open water seismic operations and exploration drilling; these are primarily for crew changes, re-supply flights and marine mammal surveys. Flights are limited to the summer season due to weather constraints. Additionally, industry operations are usually limited to VFR flight and cannot operate in darkness, nor can they operate in temperatures below -30 – 40 degrees F (-34—40 degrees C) for safety reasons. Fixed wing and helicopter flights may result in short term disturbances of some polar bears. To date, OCS associated aircraft flights have had a negligible impact to some individual polar bears (76 *FR* 13454, 73 *FR* 33212).

5.1.2.2.2. Disturbance from Vessel Traffic

Most vessel traffic in the Alaskan Arctic occurs near shore and is associated with local subsistence fishing and hunting, travel between villages, and supply ships and barges serving local villages or the oil industry. Increasingly, cruise ships, icebreakers, USCG operations, and scientific research vessels (including icebreakers) operate in the Chukchi Sea. Open water traffic at present is limited primarily to summer and early autumn. Icebreakers may be active at any time of year; annual scientific research cruises typically take place in spring. BOEM-associated vessel traffic typically enters the Arctic after 15 July and departs before the end of December. Encounters between vessels and polar bears are less likely to occur in open water.

Vessels associated with lease exploration include open water seismic operations in summer and early fall, and scientific research operations associated with lease areas. Seismic operations typically include a single source vessel; several support vessels, and occasionally an icebreaker. Crew change outs typically occur by small boat or helicopter. Vessels are typically required to have marine mammal observers onboard and to shut down operations if marine mammals enter within the 180/190 dB range (180 for walrus and all cetaceans, 190 for polar bears and ice seals.) Vessels are also used during ancillary operations such as ice gouge and shallow hazard surveys which are used to identify possible pipeline routes and drilling sites, etc. While most industry associated vessel traffic occurs on or near the lease areas, ancillary activities may be near shore as well.

Vessel traffic which occurs in the open water is unlikely to affect polar bears simply because few polar bears will be present. Some vessels have occasionally reported seeing a swimming polar bear in open water. Vessel presence and noise may temporarily disturb small numbers of polar bears resting or foraging on marine mammal carcasses along the coast or on barrier islands. If an encounter between a polar bear and a vessel not engaged in seismic activities occurs, it would most likely result only in a minor disturbance as the vessel passes the bear. Potential impacts to polar bears from open water activities are expected to be limited to the short term disturbance of small numbers of individuals.

Icebreakers may support some lease activities such as drilling or in-ice seismic operations. In most cases, the icebreakers would primarily be used for ice management (e. g., pushing away large floes) or opening a path in first year ice. Polar bears may be drawn to or displaced by icebreaker traffic (Brueggeman et al., 1991), resulting in temporary disturbances while foraging or resting. Polar bears may expend energy to avoid ships in the lead systems, or conversely, may take advantage of leads opened by icebreakers. Ringed seals have been observed to take advantage of temporary leads opened by icebreakers, and polar bears could be drawn to the availability of ringed seals while foraging. Icebreakers may be stationed with drilling rigs (up to 2 per year) or associated with in-ice seismic operations. To date, one operator has proposed and completed one in-ice seismic survey. Given the few icebreakers that would operate in conjunction with first incremental step activities, such disturbances are anticipated to be infrequent and short term, and to have minimal energetic costs to a few individual polar bears.

In addition, icebreaker activity may alter habitat used by polar bears. To address the potential for icebreaking to adversely affect the ice habitat itself or alter the mechanical behavior of the surrounding ice, BOEM supported a literature review and analysis by subject matter experts with an emphasis on Arctic expertise. This review and analysis suggested that icebreaker activity in fall/winter, when temperatures are cold and the ice is forming quickly, have very little impact on the availability of ice as habitat. Icebreaker track lines refreeze very quickly, within a matter of several hours in calm weather. Icebreaker effects are overshadowed by the natural variation in land fast ice, which involves constant re-breaking. Icebreaker effects are even less evident in pack ice, which is constantly moving, fracturing and re-forming (Mahoney, 2010).

In spring when the ice is melting and retreating further north the effects would be more prolonged and widespread. Any icebreaking activity in spring/summer could open new leads which could remain open and expand as the open water absorbed more light and further melting occurred. Impacts from icebreaker track lines in fall/winter would be very short term (Mahoney, 2010). First incremental step activities involving icebreakers in the Chukchi Sea would take place in summer through fall (approximately July–December). During this time period, sea ice would readily refreeze. Icebreaking of multi-year ice is not anticipated in association with OCS activities.

Icebreaking activity associated with first incremental step activities would include ice management around a stationary drillship or rig. In this case, the icebreaker would be stationed “up wind” of the rig and would be used to push large ice floes away from the rig, or to break up smaller sheets of ice before they piled up onto the rig and became a safety hazard. The icebreaker may be 1–5 km from the rig, depending upon the rate of flow of the ice. An area of a few square km would be kept clear of ice while the rig remained on site. Ice typically closes in behind the rig within a similar distance since the flow of the ice determines both how far ahead of the rig the icebreaker must be and how quickly the ice moves back in after it is past the rig. Icebreakers may also be used to accompany a seismic ship or other vessels while traversing through the Arctic. In most cases this would primarily be a safety precaution, and vessels that are in transit would avoid ice as much as possible for safety and fuel efficiency reasons. Icebreakers that were conducting in-ice seismic operations would operate primarily in open water and newly forming first year ice (gray ice). In this case, the track lines could cover 100’s or 1000’s of kilometers, but the ice would typically refreeze behind the vessels within a few hours. They would not be able to conduct in-ice seismic surveys in ice that was thicker than ~1.5 m due to limitations of the equipment. Sea-ice habitat used by SBS and A-C polar bears exists in the U.S. Chukchi Sea as well as the Canadian Beaufort Sea and in the Russian Chukchi Sea. Given the transitory nature of the effects on ice from icebreaking, and the wide extent of sea ice available relative to the small footprint of OCS activities in any given year, OCS activities would not appreciably diminish the availability of sea ice for polar bears for breeding, foraging or denning.

5.1.2.2.3. Disturbance from Terrestrial and On-Ice Vehicle Traffic

Sources of motorized travel on the North Slope include local transit from village to village, subsistence activities, industry activities, scientific research, and some guiding and tourism. Polar bears may be displaced or disturbed by ground transportation, such as snow machines, heavy industrial vehicles, or rolligons. On average, polar bears react to avoid snowmobiles at a distance of approximately 1 km and may be displaced by as much as 3 km. Females with cubs react at greater distances and with more intense and persistent responses, thus expending more energy, than adult males or lone adult females. Polar bears may take flight to avoid snow machines before having been detected by the rider (Andersen and Aars, 2008). Although it is very difficult to assess population-level effects from repeated short-term disturbance of individual animals, bears that already are nutritionally stressed may be impacted by repeated disturbances over time (Evans, 2008, pers. comm.). In addition, polar bears are vulnerable to heat stress (Best, 1982; Stirling, 1988), and they may become overheated if forced to run to evade vehicles in warm weather. Impacts, if any, are likely to occur near shore, as very little motorized vehicle activity takes place more than 20 km offshore. The SBS polar bears may form aggregations of 20–60 bears at Cross Island and/or near Kaktovik and Barrow in the late summer/early fall while waiting for sea ice to form. Large aggregations of polar bears do not seem to occur as regularly along the U.S. side of the Chukchi Sea as they do along the Russian coastline of the Chukchi Sea or the Beaufort Sea coastline, however, this may change as changing sea-ice conditions continue to affect polar bear distribution. As bears spend more time onshore, they may be at increased risk of overheating or stress reactions due to disturbance events. The SBS population of polar bears commonly den along the northeastern coast of the Beaufort Sea in Alaska. The A-C population of polar bears den on Wrangell and Herald islands, along the Russian coast of the Chukchi Sea, and to a lesser extent along the U.S. coast of the Chukchi Sea. Denning polar bears are more sensitive to disturbance in the fall, but the energetic costs of disturbance may be higher in the spring. Polar bear cubs forced to leave dens early due to motorized vehicle disturbances are at increased risk of predation and mortality from other causes. There is some evidence that some bears may habituate to noise. Smithet al., (2007) found that polar bears using dens between 1 and 2 km from ice roads were less vigilant than polar bears not exposed to industry activities, indicating that the bears may have become acclimatized to the activity and no longer perceived it as a risk (Smith, et al., 2007; Amstrup, 1993). In other instances, polar bears have abandoned dens due to human activities in the vicinity (Perham, 2008, pers. comm.). Identifying denning habitat and monitoring changes in habitat use is critical when evaluating the effects of activities on the polar bear population. Protecting core maternity denning areas from disturbance is of critical importance to the long-term conservation of polar bears.

5.1.2.2.4. Disturbance from Shorebase Construction and Use

Construction of and routine operation activities at the exploration support shorebases are a potential source of disturbance for polar bears. Female polar bears denning within approximately 1 mi of the construction activity could be disturbed by vehicular traffic or construction noise. Disturbance of females in maternity dens could result in either abandonment of the cubs or premature exposure of cubs to the elements, resulting in mortality (Amstrup, 1993). Regulations require that road and other construction activities maintain a 1-mi buffer around known or suspected polar bear dens. MacGillivray et al. (2003, in USDOI, BLM, 2004) measured noise from industrial activities in artificial dens at varying distances from the activity. Noise in the dens from vehicular traffic was generally at background levels when vehicles were approximately 500 m away. However, one vehicle was detectable above background levels at a distance of 2,000 m. Thus, current regulations should prevent disturbance to polar bears in natal dens that have been identified. Bears in unidentified dens could be disturbed by the construction. The number of bears affected would depend on the number of dens that are undetected but within a 1-mi buffer around construction activity. The severity of the effect would depend on the reaction of individual bears, whether the den is abandoned, and the age of the cubs when the disturbance occurs.

Non-denning polar bears may avoid the immediate vicinity of construction activities or they may be attracted to it, depending on the circumstances and temperament of individual bears. Avoidance of the area would reduce the potential number of human-bear interactions, thereby reducing the potential for injury to people or the need to kill bears.

5.1.2.2.5. Disturbance from Seismic-Airgun Noise

Open-Water Seismic Operations

Polar bears are closely tied to the presence of the sea-ice platform for the majority of their life functions, including hunting (Amstrup, 2003). It is unlikely that open-water seismic activities will impact polar bears or the abundance and availability of ringed and bearded seals, which are the primary prey of polar bears. Seismic operations typically are not concentrated in any one area for extended periods; therefore any impacts to polar bears would be limited to short term disturbances. Polar bears normally keep their heads above or at the water's surface when swimming, where underwater noise is weak or undetectable (Richardson, 1995b). Direct impacts potentially causing injury from open-water seismic surveys are possible if animals entered the 190 dB zone immediately surrounding the sound source. The Chukchi Sea ITR issued under the MMPA requires mitigation measures for seismic survey operations. Protect Species Observers (PSOs) are required on seismic vessels, and they are responsible for instructing the vessel's captain to power-down or shut-down airgun arrays if a polar bear enters the 190 dB ensonification zone (USFWS, 2012a, also see Section 2.3.2).

There also is the possibility that bears could be struck by seismic vessels or exposed to small-scale fuel spills, although these risks are considered unlikely to occur. Vessel traffic associated with seismic survey activity is not expected to cause impacts to polar bears, because polar bears show little reaction to vessels and generally do not linger in open-water. Brueggeman et al. (1991) observed polar bears in the Chukchi Sea during oil and gas activities and recorded their response to an icebreaker. While bears did respond (walking toward, stopping and watching, walking/swimming away) to the vessel, their responses were brief. Seismic surveys have the potential to disturb polar bears that are swimming between ice floes or between the pack ice and shore. Swimming can be energetically expensive for polar bears, particularly for bears that engage in long-distance travel between the leading ice edge and land. Bears that encounter seismic operations may be temporarily deflected from their chosen path, and some may choose to return to where they came from. However, bears swimming to shore are most likely heading for reliable food sources (e.g., areas where ringed seal concentrations are high or Native-harvested marine mammal carcasses on shore), for which they have a strong incentive to continue their chosen course. Therefore, although some bears may be temporarily deflected and/or inhibited from continuing toward land due to seismic operations, this interruption likely would be brief in duration. Ultimately, few bears are likely to be substantially affected by seismic operations during the open water period. For most of the year, polar bears are not very sensitive to noise or other human disturbances (Amstrup, 1993).

In-Ice Seismic Operations

One in-ice seismic survey is included in the first incremental step. In-ice seismic operations use an icebreaker in conjunction with a seismic vessel to extend the seismic survey season later into the fall when new ice is beginning to form. Polar bears may be impacted by noise and disturbance from seismic and icebreaker activities or from changes to their sea-ice habitat from icebreaking. Polar bears that are encountered while on the ice are unlikely to be physically impacted by airgun effects. Polar bears in the water are usually swimming near the surface. Received sound levels near the surface are substantially reduced due to the pressure release effects near the water surface (Amstrup, 2003; Amstrup and DeMaster, 1988). The most likely impacts to polar bears from an in-ice seismic survey and associated activities would be disturbance and possible impacts to bears' food resources. Reactions to vessel noise, icebreaking, or seismic sound would be similar. Polar bears on ice may move into the water to avoid the area that the vessels are operating in. Polar bears may be stressed by energy expenditures related to avoiding ships or traffic in the lead systems. Polar bears may move away from the icebreaker and seismic ship at distances of several kilometers. Anderson and Aars (2008) found that on average, polar bears react to avoid snowmobiles at a distance of approximately 1 km and may be displaced by as much as 3 km. Females with cubs react at greater distances and with more intense and persistent responses, thus expending more energy, than adult males or lone adult females. Any impacts of seismic activity to polar bear food resources will probably be minor, local and brief in nature. Bearded and ringed seals are the primary prey of polar bears in the action area, and abundance and availability of these seals are not expected to be significantly altered by the proposed seismic survey and associated activities. Polar bears may be drawn to icebreaker and seismic vessels by curiosity or may avoid them. Reactions vary by individual bear, with females with cubs being the most cautious. If ringed seals are drawn to the open leads created by the icebreaker, polar bears may be drawn to the area as well. The location of leads influences the distribution of foraging polar bears (Stirling, 1997), and they may take advantage of leads created by icebreakers, however leads created by icebreakers tend to refreeze quickly. Polar bears have been observed to take advantage of the leads that form downstream of drilling platforms, which are routinely used by seals (Stirling, 1988).

Winter ice-breaking activity has some potential to affect polar bears denning in sea-ice habitats <300 m water depth. The distribution of maternal dens appears to have changed in recent years; from 62% offshore dens (1985–1994) to 37% offshore dens (1998–2004) (Fischbach, Amstrup, and Douglas, 2007). Fischbach, Amstrup, and Douglas (2007) concluded that the changes in the den distribution were in response to delays in ice formation and reduced availability and quality of the more stable pack ice suitable for denning, due to increasingly thinner and less stable ice in the fall. Amstrup and Gardner (1994) noted that only a small proportion (4%) of the southern Beaufort Sea polar bear population den on the shore-fast ice adjacent to the mainland coast of Alaska. The overall occurrence of dens on sea ice in the Arctic is thought to be relatively low based on current studies using radio-telemetry (Amstrup, 1995; Amstrup, et al., 2006) and is decreasing as more polar bears den on land (Schleibe, et al., 2008).

Females typically den in November (Amstrup, 2003). Polar bears denning on sea ice usually select deep snow drifts adjacent to pressure ridges or jumbles of multi-year ice (Durner, Amstrup, Nielson et al., 2004). The seismic survey vessel cannot operate in this kind of ice, but it is possible that the icebreaker and survey vessel may transit through or near some multi-year ice or pressure ridges during the survey. Bears that are disturbed from their dens early in the season, before they have given birth, are believed to move to a new den site fairly readily, as other bear species do (Amstrup, 1993). Bears that are disturbed from their dens early in the spring after they have given birth may lose their cubs; however, polar bears give birth in late December or early January. It is likely that bears are sometimes forced to locate new den sites early in the year due to storms that cause the ice to break up and re-form. Some bears may be disturbed from their dens by the icebreaker and seismic survey vessel. These bears would be likely to move to another den site. Most impacts to polar bears are likely to be limited to disturbance. Icebreaking has been shown to result in short term openings in the pack ice. As the ice is typically subject to large scale pressure from currents, winds, or neighboring ice, in fall and winter the openings typically close quickly, most frequently within hours of icebreaker passage. If seawater temperatures fall below -1.8 degrees C (28.8 degrees F), new ice will form in the openings. Under certain wind, current, and water temperature situations, the openings could persist for longer periods. Icebreaking activities associated with the proposed action would take place in fall when the sea ice is forming.

Disturbance from Exploration Drilling

Exploration drilling typically occurs from a drillship or jackup rigin open-water. Up to two drillshipsare anticipated to be operating simultaneously in the first incremental step. These may drill at more than a single location in a given year. Each rig could drill up to two wells per open-water season. Exploration drilling would occur during the open-water season in the Chukchi Sea (> 3 mi from shore or barrier islands).

Impacts to polar bears are limited because polar bears typically remain on the sea ice during the summer open-water season when drilling occurs. Some polar bears may be in the vicinity of exploration drilling activities while swimming from the sea ice to shore late in the season, but sightings of polar bears in open-water areas are rare. Two active drill rigs in the Chukchi Sea Leased Area during the open-water season would have a relatively small footprint. Impacts to polar bears would be limited to short term disturbance of a few individuals.

Discharges

Authorized Discharges

Operators must acquire and adhere to the terms of an NPDES permit, received from the EPA. The Arctic general permit restricts the seasons of operation, discharge depths, and areas of operation, and has monitoring requirements and other conditions. The EPA regulations at 40 CFR 125.122 require a determination that the permitted discharge will not cause unreasonable degradation to the marine environment.

Discharges from the Proposed Action would occur during various operations, each for a period of weeks up to several months. Discharges would be in the open-water where cuttings would settle out on the seafloor. Discharge of drilling muds and cuttings during exploration activities are expected to have only negligible effects on polar bears, either directly through contact or indirectly through affecting prey species.

Oil Spills

Oil spills are accidental or unlawful events that are evaluated in NEPA documents according to three different size categories: small, large, and very large (VLOS). Assumptions about fuel spills in regard to the Proposed Action are discussed in Chapter 2. As these assumptions establish, small spills are reasonably foreseeable during the first incremental step. Therefore, small spills are considered to be a potential indirect effect of the Proposed Action in that they may be reasonably foreseeable. Large spills (≥1,000 bbl) are not reasonable likely to occur during the first incremental step. The only type of large spill that could potentially occur during this step is a VLOS (≥150,000 bbl) from a loss of well control resulting in a long duration flow. However, such an event would be extremely unlikely to occur because the frequency of a loss of well control incident is extremely low and is therefore not reasonably foreseeable as a result of the Proposed Action. Therefore, while the effects of a VLOS could likely be considerable, a VLOS is not considered to be an effect of the Proposed Action within the meaning of the ESA.

Approximately 20 small refined spills (<1,000 bbl) could occur during first incremental step activities, but would have little potential to affect polar bears. Small spills could occur during exploration drilling operations and refueling. Polar bears are not likely to be in open-water where G&G activities and exploration drilling occurs. Small spills offshore would dissipate quickly (a few hours to a few days). Small spills onshore from activities in the Proposed Action would likely be cleaned up completely, with oiled soil or tundra removed from the location. Polar bears would be hazed away from active cleanup efforts for the safety of personnel and bears. Some disturbance of polar bears could occur during cleanup efforts for small spills. The level of disturbance is likely to be limited to a few bears and/or a small area. However, the effects of small-volume spills on polar bear would depend upon the location and timing of each spill, as well as the speed and success rate of cleanup efforts, and of efforts to haze bears away from the spill area.

5.2. Future Incremental Steps

This section assesses the impact of future exploration and development activities, including development and production of the anchor field; the exploration, development, and production of the satellite field; and decommissioning of both fields. Considerable uncertainty exists as to whether further exploration (i.e, beyond an anchor field) or new development will actually occur in the Leased Area, and the location, scale, and type of any such new development if it does occur. However, as described in the Proposed Action, although development may not be probably it is possible and BOEM and BSEE have developed a reasonable development scenario. This scenario was used to provide an evaluation of potential impacts to listed species and designated critical habitat if development were to occur. Activities associated with further exploration and development and production would take place in marine and terrestrial environments, and could include construction of permanent facilities (including central production shorebase and subsea and terrestrial pipelines), associated aircraft and vessel traffic, operation of those facilities over the life of the field, and removal and/or abandonment in place of facilities. The impacts associated with development activities include: Noise, Physical Presence, Discharges, Habitat Alteration, and Accidental Oil Spills. Under the Proposed Action, Future Incremental Steps could also include up to two large oil spills as reasonably foreseeable effects we describe potential effects that may be reasonably expected in future increments to listed eiders, the LBCHU and polar bear below. For each, we first describe new impact-producing factors that may arise in Future Incremental Steps, and then analyze the potential effects and level of effects the IPFs can have on the species and LBCHU under the assumptions of the Proposed Action.

5.2.1. Listed Eiders

5.2.1.1. Impact-Producing Factors (IPFs)

This section identifies the IPFs resulting from oil and gas activities associated with Future Incremental Steps. It discusses the general ways that oil and gas activities can impact Steller's Eider and spectacled eider. IPFs that also occurred in the First Incremental Step are not presented again in this section.

5.2.1.1.1. Factors Causing Disturbance and Displacement

Physical Presence

With the construction of onshore production and distribution facilities would come the expansion of terrestrial human activities such as the movement of personnel and equipment for the shore base, storage pads, along the access road and pipeline ROW. This could result in the repeated disturbance of listed eiders on the nesting grounds. If disturbance were to occur during the nesting period, it could adversely affect individuals by: 1) flushing females from nests or shelter in brood-rearing habitats, exposing eggs or ducklings to inclement weather and predators; and 2) displacing adults and or broods from preferred habitats during pre-nesting, nesting, and brood rearing, leading to reduced foraging efficiency and higher energetic costs.

Other Factors

Other factors that can cause disturbance and displacement during Future Incremental Steps include aircraft and vessel traffic, seismic airgun noise, and exploratory drilling. These were previously discussed in the IPF section of the First Incremental Step. The potential effects of noise from drilling wells for oil and gas production would be similar to that previously described for drilling exploration wells.

5.2.1.1.2. Habitat Loss and Alteration

Habitat loss occurs as facilities are developed, covering habitats used by birds. Both marine and terrestrial habitat loss would occur in Future Incremental Steps. Marine habitats can be impacted in Future Incremental Steps when satellite exploration and delineation wells and production platforms are installed, with associated production and service wells and connected via subsea utility cables, flowlines, and pipelines. Rock cuttings and other materials such as drilling muds from each well site would be discharged into the water and onto the ocean floor. Drilling muds would be reconditioned, and an estimated 80% would be re-used, including all the synthetic drilling fluids. The remaining 20%, typically composed of EPA Type 2 Lignosulfonate Mud, would likely be discharged at the drill site subject to federal (e.g., EPA) and State water quality regulations. The area of sea floor disturbance would depend upon multiple factors, including the water depth of the drilling and discharge sites and the currents. As an example, the Arctic MultiSale EIS (MMS 2008) reported detection of cuttings 50–500 m from the well site. Using a radius of 500 m and assuming the area of a circle, the maximum area disturbed by one well could be 785,000 m^2or 193.98 acres. Marine habitat loss could impact listed eiders or critical habitat by directly covering or indirectly silting over benthic beds of prey organisms, should the water be shallow enough to provide accessibility to diving birds. Installation of undersea pipelines likely would involve trenching/seafloor excavation which could not only disturb/degrade seafloor habitats, but could suspend fine materials in the water column. These potential effects would be similar to those described for exploration drilling, but the affected sites would be larger and the effects would be distributed across a more extensive area.

Terrestrial habitat may be impacted in Future Incremental Steps when land is filled/excavated for the construction of a production shorebase and pipeline corridor, or otherwise impacted as from dust/gravel spray from construction or facilities operations. Terrestrial habitat loss could impact listed eiders if tundra habitats used by nesting birds is covered, degraded, or made inaccessible. Other secondary impacts could occur from altered hydrology associated with these facilities, flooding areas and drying others. While some species may have or will benefit from wetter or drier habitats near these facilities, evidence suggests that many birds avoid using habitats near these developments and the human activities they support. For example, regular vehicle traffic on roads could result in the permanent displacement of nesting birds in a zone of influence around developments. In Alaska, Steller's eider breeding is primarily concentrated in tundra wetlands near Barrow and occurs at much lower densities elsewhere on the Arctic Coastal Plain. If these habitat losses and alterations were to occur in the vicinity of important Steller's eider nesting habitat around Barrow, impacts to this listed species could result.

Increased Subsistence Hunting

The development of an onshore pipeline corridor linking the new production shorebase to the Trans Alaska Pipeline System would likely entail the construction of a parallel access road into previously undeveloped areas. The Proposed Action envisions a new 300-mile long pipeline corridor with adjacent access road. This could provide access for hunters to previously inaccessible areas. Besides direct mortality, hunting can impact eiders via lead poisoning from ingested spent shotgun pellets.

Increased Bird Predator Populations

Increased predation can result from anthropogenic influences on predator population size or distribution. The construction of a permanent production shorebase and associated infrastructure could potentially contribute to increases in numbers or advancement of ranges of bird predators, by indirectly providing new nest or den sites, or prey or scavenged food sources. Potential predators of listed eiders along the Chukchi Sea include snowy owl *Nyctea scandiaca*), peregrine falcon *(Falco peregrinus)*, gyrfalcon *(Falco rusticolus)*, jaegers (*Stercorarius* spp.), common raven (*Corvus corax*), glaucous gull(*Larus hyperboreus)*, short-tailed weasel (*Mustela erminea*), red (*Vulpes vulpes*) and arctic fox (*Alopex lagopus*), and even polar bear *(Ursos maritimus)* (USDOI, USFWS, 2014; USDOI, USFWS 2013). The current distribution and abundance of these predators have received some research attention, but ravens, for example, have existed commensally with small communities or structures across the North Slope for decades (see Day, 1998). Other species, especially raptors, are young, dispersing birds transiting the area after the breeding season.

Several of these bird predators concentrate in areas where human-use foods and garbage are available. Examples include gulls, ravens, and arctic foxes that are abundant near camps, roads, oilfields and villages. For ravens and foxes, there is evidence indicating population increases and range expansion due to increased availability of nesting or denning sites on these developments where they did not previously exist.

The predation pressure that foxes, gulls, and ravens exert on nesting birds, especially waterfowl, is well documented and, in some areas, predation is the predominant factor affecting nest success (Pearce, Esler and Degtyarev, 1998). Nest survival of Steller's eider is negatively correlated with predation levels and averaged 0.23 (±0.09, standard error [SE]) from 1991–2004 before fox control was implemented near Barrow, but 0.47 (±0.08 SE) from 2005–2012 during years with fox control USDOI, USFWS. 2013). For spectacled eider, nest success is highly variable and thought to be primarily influenced by predators, including gulls (*Larus* spp.), jaegers, and red and arctic foxes (USDOI, USFWS, 2014).

The greatest direct impact on listed eider bird populations could occur when certain predator densities, such as ravens and foxes, are high and densities of nesting birds are low. However, Quakenbush, Suydam, Obritschkewitsch and Deering, 2004, reported that Steller's eider nest survival may be positively influenced by nearby jaeger and snowy owl nests in years when lemming populations are high, suggesting that the predators' aggressive nest defense indirectly protects the eiders' nests.

5.2.1.1.3. Discharges

Discharges include those materials authorized for release into surrounding waters under specific permits, and oil spills, which are accidental or unauthorized releases of oil into the marine environment. The general impacts to birds from authorized discharges and oil spills remain the same as described in the IPFs of the First Incremental Step.

Oil Spills

Development activities carry the additional risk of large (≥1,000 bbl) refined or crude oil spills. BOEM and BSEE estimate that approximately 757 small spills (<1000 bbl) and up to two large spills (>1,000 bbl) could occur during Future Incremental Steps. Sources of small petroleum spills during the Future Incremental Steps activities include vessel accidents, equipment malfunctions during bulk fuel transfers, and a variety of onshore accidents and malfunctions. For purposes of analysis, BOEM and BSEE assume that the one large spill of 5,100 bbl would be from a production platform and one large spill of 1,700 bbl would be from a large offshore pipeline. No large spills are assumed to occur onshore. Assumptions and outcomes of oil spill movement are explained in chapter 2.

Kasegaluk Lagoon, Peard Bay, colonies at Cape Thompson and Cape Lisburne, the open-water Spring-Lead System, Ledyard Bay, and barrier islands provide important nesting, molting, and migration habitat to a variety of waterfowl and shorebirds. Spills during periods of peak use could affect large numbers of birds. A large oil spill contacting the Ledyard Bay Critical Habitat Unit (LBCHU) during the open water period could contact as many as 33,000 spectacled eiders, including the entire cohort of successfully breeding females and their young, using the Ledyard Bay molting area at one time. The loss of many of the breeding female spectacled eiders of the Arctic Coastal Plain would be anticipated to result in large-scale population-level effects. A similar impact could be experienced by Steller's eiders using the spring lead system for staging prior to moving to the breeding grounds. A large spill contacting the spring lead system at such a time could affect a relatively large proportion of the Steller's eider population. Such contact could produce a population-level effect on this species.

5.2.1.2. Potential Effects to Listed Eiders from Future Incremental Steps

Exploration beyond anchor field discovery, and developmet and production comprise the future incremental steps. Should such exploration, development and production be proposed, the activities that could affect listed birds include vessel and aircraft traffic, collisions, seismic airgun noise, increased bird predator populations, increased hunting mortality, facility construction and operation, and discharges.

5.2.1.2.1. Disturbance and Displacement

As noted in our analysis of the effects of the first incremental step, the severity of disturbance and the effects of displacement would depend upon the duration, frequency, and timing of the activity causing the disturbance. Such activities would likely increase with development and production.

Aircraft Traffic

BOEM and BSEE anticipate low to moderate levels of aircraft operations during future incremental Steps. Besides a similar level (to the First Incremental Step) of 1–6 helicopter flights per day in support of continued exploratory drilling, 1–3 additional helicopter flights per day would now service each production platform. Fixed wing and helicopter flights can also be anticipated to provide year-round support of onshore facilities construction and on- and off-shore maintenance activities (see Table 2–4).

While an increase in flights comes with Future Incremental Steps, the additional flights are to service platforms and new onshore facilities. Platforms will not be built in sensitive eider concentration areas (i.e., the spring lead system, which is almost always outside the leased area, or the LBCHU which is 20 miles distant from the nearest portion of the leased area), onshore facilities will likely not be in areas of concentrated nesting habitat, and Lease Stipulation No. 7 restricts flights below an altitude of 1,500 feet over the LBCHU between July 1 and November 15 (when listed eiders may be present).

As for aircraft traffic in the vicinity of new onshore facilities, disturbance to nesting spectacled and Steller's eiders from the Proposed Action would be limited by their extremely low densities across the North Slope. Breeding season density is variable (none to 1.531 birds/km^2 (Larned et al. 2010), but averages 0.165 spectacled eiders/km^2. Steller's eiders are so rare in some years that they are not detected at all by aerial-survey methods. In the core of the Steller's eider breeding area near Barrow, densities have ranged from 0 to 1 males/km2. In 2012, researchers estimated 0.41 males/km^2 (USDOI, USFWS. 2013). Densities elsewhere on the ACP are much lower.

The uncertainty regarding production shorebase development siting, and protections in place to avoid and minimize impacts of any facilities development that may be proposed in the vicinity of the Barrow nesting area are discussed elsewhere in this document (see Habitat Loss and Alteration, below).

The number of nesting Steller's or spectacled eiders that would be exposed annually to low-level flights associated with future incremental steps is low, because the potential direct flight from an air base to offshore work sites within the leased areas would be primarily over coastal waters. Mitigation measures imposed on existing and future exploration activities avoid or minimize adverse effects to ESA-listed birds rearing or staging in the Chukchi Sea. Given the relatively rare likelihood of encountering groups of eiders during sensitive periods, we expect, as with the first incremental step, only infrequent, minor, short-term effects on listed eiders from aircraft disturbance.

Vessel Traffic

Future Incremental Steps will involve a continuation of exploratory drilling vessel operations at similar levels to the First Incremental Step, plus vessel operations associated with multiple open-water season (July–November) development and production activities, including the barging in to place, installation, and servicing of 8 platforms (no more than 1 installed at a time); transport, reeling, trenching, and laying of flowlines and pipe (spread out over more than 40 years); installation of 15 templates and drilling of subsea wells (spread out over many years); and the presence of up to 4 MODUs operating at one time. Additionally, new year-round vessel activities include platform personnel, supply, and waste transport (1–3 vessel trips per platform per week and 1–2 barge trips to/from platforms total per open water season), and barge support for construction of the onshore facilities (likely no more than 2 trips per summer per facility).

As with the First Incremental Step, vessel traffic can impact individual or groups of listed eiders only if birds are present in the same area and time. Lease Stipulation No. 7 requires surface vessels associated with exploratory activities to avoid travel in the LBCHU between July 1 and November 15 when the greatest numbers of eiders may be present. When a development plan is proposed, any vessel travel anticipated at that time for the LBCHU will be subject to future review including NEPA analysis, and avoidance and minimization mitigation measures. While vessel traffic may at times be increased over first incremental step levels during future incremental steps, the level of vessel encounters with swimming listed eiders is anticipated to remain unremarkable, occasional, and not be chronic.

Seismic Airgun Noise

Seismic airgun noise levels will likely continue similarly to that of the First Incremental Step. It is therefore anticipated that these activities will result in only negligible and temporary disturbances that do not rise to the level of adverse effects on eider populations.

Drilling

Noise and disturbance from drilling operations could include both exploratory drilling similar to that experienced in the First Incremental Step, and the drilling of wells for oil and gas production: a one-time high of 32 on-platform production and service wells may be drilled per year, while more typically 16–25 could be drilled annually. A total of 90 subsea production wells could be drilled at a rate of 6–9 annually.

Drilling may disturb and displace listed eiders from the immediate area. However, in the vast majority of the leased area, listed species may not be present and hence, may not be impacted. Further, exploratory drilling activities disturb a relatively small area and are stationary, allowing any birds that are present to either habituate to the activities or move away to an undisturbed area. In areas where large numbers of listed eiders may be present, BOEM and BSEE impose mitigation measures on operations. For example, Lease Stipulation No. 7 will require that vessels associated with exploratory drilling operations in the leased area do not operate in or traverse the spring lead system between April 15 and June 10, to the maximum extent practicable. Additionally, during the spring, ice covers portions of the Action Area, making most surveys, and thus effects on birds, infrequent. Because few birds are likely to encounter exploratory drilling operations and those that do will likely be displaced only a short distance, and because measures imposed by BOEM and BSEE will likely minimize impacts via mitigation measures, we expect disturbance from effects of drilling to have at most only temporary and minor effects on listed eiders. we discuss effects of mitigation measures for the LBCHU in the next section.

Physical Presence

Future Incremental Steps could see an increase in onshore human activities, including the movement of personnel and equipment for the shorebase, storage areas, and along the pipeline corridor and access road. These human activities would likely occur year-round, and likely often regularly, including during the nesting period. The individual tolerance and behavioral response (i.e., habituation) of listed eiders to disturbance would likely vary. There does not appear to be a clear relationship between the movements of spectacled eiders and oil infrastructure (Troy 1995), but it is possible that females could choose to avoid nesting in habitats near repeated human activities (essentially, habitat loss). If this occurred in areas supporting high densities of listed eiders, such as near Barrow, the resulting disturbance during the nesting season could lead to significant impacts to the species. It is difficult to estimate how much habitat would be rendered less suitable for nesting as a result of disturbance, but the USFWS has assumed that nesting behavior may be disrupted by human activities within 200 m of nests (USFWS 2008). If so, the potential for the habitat to support nesting would be compromised.

BOEM and BSEE anticipate it is unlikely that the pipeline corridor would deviate from more likely "straight-line" (to TAPS) delineations northward towards Barrow, and any shorebase construction proposed for the Barrow vicinity would probably only arise as an expansion of some existing footprint and be limited to supporting uses rather than the main production shorebase. The uncertainties regarding production shorebase development siting, and protections in place to avoid and minimize impacts of any facilities development that may be proposed in the vicinity of the Barrow nesting area are discussed elsewhere in this document (see section 2.2.1.1.5 and Habitat Loss and Alteration, below). For example, any new fill in this important wetland habitat area will require additional scrutiny and mitigation under the Section 404 permit program managed by the USACE. Therefore it is not anticipated that disturbance from increased physical presence will rise to the level of population effects for these species.

Collisions and Disorientation

Activities under the future incremental steps would be expected to increase the total number of structures, including platforms, MODUs and other vessels in the Action Area. Depending upon location and timing of operations, vessels and drilling structures pose a collision and disorientation risk to listed eiders, particularly when migrating to and from Alaska's North Slope. Onshore structures may increase as well but both numbers and presence in the path of migration of lighted structures would be less than offshore structures because spectacled eiders appear to migrate on direct over-water routes or along coastlines (USDOI, BOEM, 2014). Mitigation measures imposed on exploration activities will help minimize collision mortality to ESA-listed birds in the Action Area. Vessels and drillships, for example, must operate their lights in such a way to minimize collisions whenever weather conditions and safety allows. Lease Stipulation No. 7 requires that exterior lights only be used as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather; otherwise they are to be turned off. Interior and navigation lights would remain on for safety. Lessees are also required to implement lighting protocols aimed at minimizing the radiation of light outward from exploratory drilling structures.

At this time, however, it cannot be assumed that recommendations for the design and implementation of lighting of structures would result in no encounters, or strikes, by threatened eiders. BOEM and USFWS both acknowledge that estimating incidental take of listed eiders is extremely difficult. There were a variety of assumptions made to support the calculations, below, that were made based on data collected during the 2012 Shell exploratory drilling operation in the Chukchi. Eiders leaving the North Slope travel day or night. Movement rates (birds/hour) do not differ between night and day, but movement rates and velocities are higher on nights with good visibility (Day et al., 2004).

The maximum number of encounters per year may be expected to occur during those years when the most vessels and platforms are present. In initial phases of the future incremental steps, this could occur in a given year when up to 4 geohazard and geotechnical surveys are occurring, 4 MODUs are drilling, and flowlines are being installed, although the BOEM and BSEE scenario does not envision more than 5 platforms present when MODUs are present drilling, and only 4 platforms in the year that the maximum number of 4 surveys occur. At a presumed encounter rate of 53 birds per season per MODU or platform and 11 birds per season for survey, support, and other vessels, a strike rate for these initial most active years could be 1,062 birds/year (4 surveys x 1 vessel each, plus 4 MODUs, plus 19MODU support vessels x 2, plus 4 platforms, plus up to 3 platform supply vessels x 4, plus 1 platform maintenance vessel x 4). Because MODUs and platforms are presumed to have more encounters per season than smaller vessels, and they also require support vessels themselves, adding even one platform does raise the potential overall strike rate, even with no exploratory surveys going on.

The maximum number of encounters per year may actually be anticipated to occur in the initial years of decommissioning, when up to 8 platforms plus up to 3 MODUs (which conduct the decommissioning of subsea wells) may be present. Conservatively estimating that 29 support vessels support 3 MODUs (based on the Shell, 2014, rate of 19 support vessels supporting 2 MODUs), a total estimate of 1,254 encounters may be anticipated (i.e., 3 MODUs, plus 29 support vessels, plus 8 platforms, plus up to 3 platform supply vessels x 8, plus 1 platform maintenance vessel x 8). Using the 2012 Chukchi rate of 27%, 339 of the total encounters could be seaducks. Out of that 339, a small percentage could presumably be listed eiders, although the percentage of listed eiders possibly involved in these encounters cannot be estimated because listed eiders have not been reported to physically interact with vessels in the Chukchi Sea.

While the above encounter rates were calculated from data gathered during actual oil and gas activities in the Project Area, precision is considered limited because only <1 year of data was available, and bird circulation events, when large numbers of birds may be affected at once, are episodic and dependent on a variety of factors such as weather, visibility and the presence of large numbers of flying birds, e.g., during migration. Furthermore, monitoring for bird encounters is notoriously difficult and an unknown percentage of encounters are likely never recorded due to inadequate observations, often probably excacerbated by the same local visibility and weather conditions that may be co-incident with increased attraction by birds (Ronconi, Allard, and Taylor, 2015). Encounters that are caused by attraction and take the form of circulation events are particularly episodic and may not lead to actual vessel landings but reduced energy levels and fitness that can have indirect or delayed consequences.

Operation of a gas production facility includes the unlikely effects from flaring, including a loss of control. As with the small amounts of natural gas periodically flared during oil production operations, the release and flaring of 10 million ft3 of natural gas during a one day loss of gas well control would affect few birds in the immediate vicinity. Some migrating birds may become disoriented by the flare, especially during periods of darkness or inclement weather and could increase their potential for colliding with the platform structure. No adverse effects on listed species are anticipated from a sudden release of natural gas from a pipeline rupture because the gas would typically dissipate into the atmosphere instead of lingering in a localized area where birds could be present.

It would appear reasonable that at least 339 seaduck:vessel encounters, at minimum, could occur annually, that a large percentage of them would be directly or indirectly fatal, and that some of those could be listed eiders. Fatal strike numbers could perhaps number tens of spectacled eiders, and fewer Steller’s eiders because their population is smaller; but again, there are no records of listed eider vessel strikes as a basis for calculations. Additional strikes or circulation events could potentially occur with onshore structures as well, and the presence of both structures and vessels will persist for many years. A persistent loss of breeding individuals could potentially have an impact on populations. Overall, the collisions and disorientation that can result from activities conducted during the future incremental steps are anticipated to adversely impact listed eiders.

Habitat Loss and Alteration

Long-term or permanent habitat loss would only arise from the construction of development and productions facilities (offshore platform(s), undersea pipeline(s), pipeline landfall(s) to an onshore base, and pipeline(s) linking to existing infrastructure), which is considered possible, if not probable. Temporary and indirect habitat loss could also potentially occur via well drilling and bird-displacement effects. Temporary and indirect habitat loss via displacement during facility construction and operation could occur if production facilities (offshore platform, an undersea pipeline) are located in areas used by Steller's and spectacled eiders. Indirect habitat losses could result from eiders not using habitats near sites of industrial activity.

Marine Habitat

Regarding marine habitats in particular, long-term habitat loss could occur from the installation of 8 production platforms, 160 miles of 2 parallel subsea pipelines (oil and gas) from the hub platform to the shorebase, and 30 miles of subsea flowlines (see Table 2-4). The drilling of 12 additional exploration and 549 production and service wells (up to 35 a year from platforms and MODUs combined) would be regarded as temporary impacts because surrounding discharged sediment would recolonize and the wells themselves are such small footprints. While a theoretical circle of sedimentation of 500 m radius has been used to calculate of a maximum of 194 acres (0.79 km^2) of temporary impacts per well, in reality discharged material, given currents and other factors, would not likely take the shape of a circle due to the influence of currents and other physical factor and there would not be an even distribution of material, and the zone of impact would likely be closer to 9 acres (0.04 km^2) per well (USDOI, BOEM, 2014). Additionally, the area around wells would begin to recover after the disturbance ceased. Thus, the area affected by discharges would likely be much less than the maximum described above because: currents would likely carry discharged material mainly in one direction; some areas would be minimally affected by discharged material; and, recovery of an area around a well would minimize the level of disturbance with time.

Terrestrial Habitat

In the terrestrial environment, direct loss of habitat could occur by placement of gravel fill onto the tundra or by excavation of materials at gravel mine sites. BOEM and BSEE can only speculate about the size and location of permanent onshore developments associated with a future phase of oil production in the Chukchi Sea. If development occurs in the Chukchi Sea Program Area, BOEM and BSEE would anticipate construction of a new shorebase on the coast between Icy Cape and Point Belcher with oil/gas pipeline(s), communications lines, and a road stretching from the shorebase approximately 300-320 miles to link with the TAPS. BOEM and BSEE estimate an additional staging area and four pump stations would also be constructed along the route.

Terrestrial habitat loss would occur in future incremental steps if 14,163 acres (57.3 km^2) of freshwater wetland and upland habitat is filled/excavated (1,535 acres/6.2 km^2) or otherwise impacted as from dust/gravel spray (12,628 acres/51.1 km^2 km^2) for the construction of a production base, and 300 to 320-mile long oil/gas pipeline corridor with access road (see Table 2-5). Construction itself will occur in winter. The permanent loss of habitat would persist across seasons.

The location of development would determine the impacts of breeding habitat loss on listed eiders, because density varies considerably across the North Slope. Assuming the gradient in observed density reflects a gradient in habitat quality, and displacing birds from preferred habitat reduces their reproductive potential, placing fill in areas used by nesting eiders may compromise their reproductive potential. To estimate the number of pairs affected, the footprint size can be multiplied by the density of birds. If the infrastructure and associated fill were placed in areas of average spectacled eider density (0.165 spectacled eiders/km^2; Larned et al. 2010), a few pairs would be affected each year. However, given the variation in density (none to 1.531 birds/km^2; Larned et al. 2010) the total number of pairs that could be potentially affected could range higher depending on location of facilities.

Impacts of terrestrial habitat loss on Steller's eiders are even more dependent on location. Aerial surveys optimized to detect eiders since 1992 (Larned et al. 2006) indicate Steller's eiders occur at very low densities across the ACP, with the highest density in the vicinity of Barrow. Steller's eiders are so rare in some years that they are not detected at all by aerial-survey methods. In the core of the Steller's eider breeding area near Barrow, densities have ranged from 0 - 1 males/km^2. In 2012, researchers estimated 0.41 males/km^2 (USDOI, FWS. 2013). Densities elsewhere on the ACP are much lower. The potential for significant impacts to nesting habitat is particularly acute for the Steller's eider because its numbers appear to be very low, and its density varies substantially within its breeding range on the North Slope. Thus, the proportion of the breeding population affected would vary significantly beginning with close to none, up to a population-level response depending on how much habitat loss may occurs near Barrow.

While development activities, such as construction of the pipeline corridor or main production shorebase, are not anticipated to occur at Barrow, if such an activity actually occurred, significant impacts to Steller's eiders could result. Before any onshore construction activities were to occur, however, plans and detailed information, including location(s) and size(s) of facilities and borrow sources, will be subject to a multi-tiered decision-making and review process. First, OCSLA staged decision-making will provide for review of the Exploration Plan(s) and Development Plan(s). Compliance with the conditions of the Biological Opinion that results from the current ESA consultation will be required. Other mitigation may be required as well, including but not limited to site characterization or alternative siting. The lessee would also be obligated to coordinate with the land owner(s) in order to obtain necessary authorizations and permits for all onshore activities, including construction and gravel mining. Construction activities that impact wetlands will also be reviewed by the USACE, and permit(s) required under the Section 404 process which will include measures to avoid, minimize, and otherwise mitigate habitat losses. This coordination could require additional ESA consultation(s) to ensure listed species are protected and additional mitigation measures to reduce construction and operation activity impacts to natural resources. Typical mitigation measures for onshore activities are presented in section 2.3.

Other secondary or indirect effects to nesting eiders would arise from terrestrial habitat modifications (drainage, flooding, dust impacts to vegetation, changes in thermokarst) and disturbances from traffic and human activities. A "zone of influence" may measure out to a distance of 200 m from developments (BLM 2003, FWS 2005). Many long-term disturbing activities could have fewer impacts to spectacled and Steller's eiders if they were to occur during the winter, when eiders are not present. Material extraction activities were assumed to occur during the winter, when eiders would not be present, and a secondary zone of influence from these areas is not considered applicable.

If production eventually is proposed, mitigation measures imposed on future facilities would likely minimize adverse effects to ESA-listed birds in the Alaskan Arctic. While there likely would be an incremental increase in the total number of acres of eider habitat eliminated, nesting habitat has not been identified as a factor limiting eider populations. Indirect habitat losses could result from eiders not using habitats near sites of industrial activity.

In summary, habitat loss and disturbance in/displacement from, preferred habitats may adversely affect listed eiders. In the terrestrial environments, some habitat could be completely and permanently lost when structures or fill render the habitat unusable. Significant impacts could occur if landfall, storage pads, pipelines, pump stations, and roads are placed in important nesting habitat.

Additionally, the capability of immediately adjacent habitat to support eiders may be completely or partially compromised by nearby structures and the associated human activity. The extent of this zone of influence remains unknown, and it is also unknown whether eiders are simply displaced from this zone (presumably at compromised fitness) or continue to use it but possibly at reduced fitness. The impact of habitat loss and disturbance/displacement on listed eiders could vary substantially, but is not likely to have population-level effects as significant construction in the Barrow area is not expected to occur.

Increased Subsistence Hunting

Increased subsistence-hunting activity could arise only from the construction of development and production facilitieswhich is not considered probable but is possible. . Prior to the listing of Steller's and spectacled eiders under the ESA, some level of subsistence harvest of these species occurred across the North Slope (Braund et al. 1993). Recent harvest data indicate that listed eiders continue to be taken during subsistence hunting on the North Slope. Although estimates of the number taken are imprecise, concern remains about the scale of impacts, particularly for Steller's eiders. Continued efforts to eliminate harvest are being implemented in North Slope villages, however, and particularly at Barrow, where the greatest known concentrations of listed Steller's eiders occur. Intra-service consultations for the Migratory Bird Subsistence Hunting Regulations are conducted annually and harvest of all species, included listed eiders, is being monitored.

The Future Incremental Steps envision a new 300 to 320-mile road into previously undeveloped areas, which could provide access to previously inaccessible areas for hunters. Waterfowl hunters may be able to access pipeline roads during the period immediately following spring breakup to hunt geese and eiders, but it is unknown whether increased access would result in an increased harvest of spectacled or Steller's eidersPlacement of a new pipeline corridor, including the access road, is not anticipated to be in the Barrow Triangle, and this avoidance of the high-density nesting habitat, combined with existing regulations and ongoing education efforts, is expected to minimize any impacts to listed eiders caused by a potential in increased subsistence hunting activity.

Increased Predation

Increased predator populations populations could only arise from the construction of development and production facilities in the future incremental steps, which is considered possible, though not probable... There is some evidence that predator and scavenger populations may be increasing on the North Slope near sites of human habitation, such as villages and industrial infrastructure (Eberhardt, Garrott, and Hanson, 1983, Day 1998, Powell and Bakensto 2009). Researchers have proposed that reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting/denning sites on human-built structures have resulted in increased fox, gull, and raven numbers (USDOI, USFWS, 2014). These anthropogenic influences on predator populations and predation rates may have affected listed eider populations, but this has not been substantiated. However, increasing predator populations are a concern, and Steller's eider studies at Barrow have attributed poor breeding success to high predation rates (Obritschkewitsch, Martin, and Suydam, 2001), and in years where arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased significantly (Rojek 2008, USDOI, USFWS, 2013).

If development and production eventually is proposed, mitigation measures imposed on future facilities could avoid or minimize adverse effects to ESA-listed birds in the Action Area. While there likely would be an increase in the total number of structures or facilities that could be used by bird predators, such as ravens or foxes, these facilities would likely be constructed or operated in a manner that would discourage support of bird predators. For example, a lease stipulation (requiring that new infrastructure would avoid the artificial enhancement of predator populations) was implemented for the Liberty project. Implementation and enforcement of a leasing stipulation could be expected to reduce effects of increased predator populations resulting from BOEM and BSEE actions, although it is possible that increased levels of predators and predation over time could still eventually lead to long-term adverse impacts to listed eiders.

Discharges

Authorized Discharges

Installation of platforms and pipelines in Future Incremental Steps would likely increase the number of vessels/barges operating in the marine environment. Discharges of gray water and ballast water from these vessels would remain regulated by the same EPA NPDES permit structure as previously described under the First Incremental Step and effects to marine and coastal birds, including listed species, are not anticipated.

Discharges from production drilling would occur over relatively short periods of time. Impacts to water quality from permitted discharges are expected to be localized and short term discharge of drilling muds and cuttings during the initial drilling activities is not expected to cause population-level effects, either directly through contact or through affecting prey species. Subsequent drilling wastes would likely be reinjected into a disposal well. Adverse effects to benthic invertebrates that could be important to listed birds would be negligible when compared to their availability in the surrounding areas. Any effects would be localized primarily around the drill rig because of the rapid dilution or deposition of these materials. Because the discharges would be regulated through Section 402 of the CWA, typical discharge criteria and other mitigation measures, authorized discharges are expected to have a negligible level of effect on listed eiders.

Oil Spills

Small Spills

For the purposes of analysis under the Scenario, BOEM and BSEE estimate that approximately 777 small spills (<1,000 bbl) could occur over the life of the Scenario (20 during the First Incremental Step and 757 during future incremental steps) (Table 2–6). Small spills are generally contained prior to reaching the marine environment. If a small spill escaped containment, the volumes are small and dissipate/weather quickly. Small spills would not travel very far, which limits the potential for contact with listed eiders. Vessel and aircraft traffic, noise, and human activity associated with oil spill response and cleanup is anticipated to result in minor avoidance response from listed eiders and reduce the opportunity for them to contact these spills. Accidental small oil spills are considered reasonably foreseeable events that are anticipated to have minimal impacts to listed eiders.

Large Spills

Development activities carry the additional risk of large (≥1,000 bbl) refined or crude oil spills. BOEM and BSEE’s estimate of the likelihood of one or more large spills occurring assumes that there is a 100% chance that development(s) will occur and 4.3 Bbbl of crude oil and natural gas liquid condensate will be produced (see Chapter 2). Two large oil spills reasonably foreseeable during Future Incremental Steps (see Chapter 2). One large spill of 5,100 bbl is assumed to occur from a production platform and one 1,700 bbl spill is assumed to originate from a subsea pipeline. The potential for large oil spills to contct listed eiders in the Chukchi Sea was described in the DSSEIS for LS193 (USDOI, BOEM, 2014). A detailed description of the OSRA model for large spills and results are also presentaed in Appendix A of the DSSEIS. Kasegaluk Lagoon, Peard Bay, colonies at Cape Thompson and Cape Lisburne, the open-water Spring-Lead System, Ledyard Bay, and barrier islands provide important nesting, molting, and migration habitat to a variety of waterfowl and shorebirds. Large spills during periods of peak use could affect large numbers of birds.

As stated previously, large oil spills during future incremental steps, including VLOS, could originate from loss of well control incidents followed by a long-duration flow, or spills from pipelines and platforms. However, if a large spill were to occur it could adversely affect listed species, and in rare circumstances could possibly cause population-level effects. Critical habitat in the Action Area could also be adversely affected.

Conditional Probabilities. This section discusses the chance that a large oil spill from the Leased Area could contact specific ERAs that are important to listed eiders, assuming a hypothetical large spill occurs. The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting bird habitats, assuming a spill occurs. The locations of the ERAs used in this analysis are shown in Figures 5.1 and 5.2. Conditional probabilities are based on the assumption that a large spill occurred. The following analysis assesses impacts to threatened Steller's and spectacled eiders.

BOEM models large spills to estimate the percent chance that a large spill could contact important resources, and then analyzes the potential effects from oil spills to determine which areas might have the highest chance of contact. In the following sections, BOEM evaluates the vulnerability of marine and coastal birds to oil spills (oil-spill analysis), and then describes the effect of disturbance from oil-cleanup activities, the effects of prey reduction or contamination, and the anticipated effects of that mortality on marine and coastal birds.

Summer Spill. The following discussion summarizes the results for all hypothetical launch areas (LAs) and pipeline sources (PLs) during summer, unless otherwise specified. These are shown in the DSSEIS Appendix, Map A-5. The OSRA model estimates a <0.5–29% chance that a large spill starting at LAs will contact ERAs important to listed eiders within 180 days, and a <0.5–59% chance from a PL (Table A.2–29). The LA10 has the highest chance (29%) of contact to ERA10 (Ledyard Bay Critical Habitat Unit, LBCHU). The chance of contact in this resource area is highest because that LA and the ERA are in proximity to or overlap each other (maps, Appendix A). For PLs, the highest chance of contact to ERA10 is from PL6, which has a 59% chance of contact. As with the LAs, the chance of contact in this ERA is highest because the OSRA model's PLs and the ERA are in proximity to or overlap each other.

Spectacled eiders must stage offshore in the spring if their breeding habitats are unavailable. The ERA19 represents the spring lead system used by spectacled eiders during spring (April–June), and the highest percent chance of contacting ERA19 is 8% from any LA within 180 days (Table A.2–29). Similarly, a spill originating from PLs 6 or 9 has a 12–15% chance of contacting ERA19 within 180 days (Table A.2–29).

Most postbreeding spectacled eiders move offshore and then migrate west to the LBCHU (ERA10). A large spill from LAs 10 and 11 has a 14–29% chance of contacting the critical habitat area, which spectacled eiders use during the May–November open-water period (Table A.2–29).

Winter Spill. The following discussion summarizes the results for LAs 1, 4–6, and 10–11 and PLs 2–6 and 8–9 during winter, unless otherwise specified. The OSRA model estimates a <0.5–12% chance that a large spill starting at a LA contacts ERAs important to ESA-listed eiders within 180 days, and a <0.5–23% from a PL (Table A.2–53 and maps). A 180-day period is used in this analysis, because it allows an adequate time period for most winter spills to overlap with summer open-water period. If a large spill occurs during the winter season, it is assumed that at least part of the spill would not be cleaned up prior to ice breakup and, thus, it could contact one or more important habitat areas after ice breakup. The highest percent chance of contact from a LA occurs at ERA19, the spring lead system (April–June), which has a 26% chance of contact from LA11 and 23% from P6. The chance of contact in this ERA is highest because the OSRA model's LAs or PLs and the ERA are in proximity to or overlap each other (Table A.2–53 and maps).

Most postbreeding spectacled eiders move offshore and then migrate west to the LBCHU (ERA10). The OSRA model estimates a spill from LA10 or PL6 has a 3% or 10% chance of contacting ERA10 during winter, melting out in the spring. On an annual basis, a large spill from LA10 or PL6 has a 14% and 30% chance, respectively, of contacting ERA10 within 180 days (Table A.2–53).

Combined Probabilities. Combined probabilities differ from conditional probabilities in that they do not assume that a spill has occurred and consolidate nonuniform weighting of launch probabilities into one unit probability. The chance of one or more large spills occurring is multiplied by the area-wide probability that spilled oil would reach a particular ERA to estimate a combined probability that both would occur simultaneously. The highest chance of contact during the assumed life of the project is 14% to ERA 10, the LBCHU.

Anticipated Mortality. The number of birds oiled, and thus the severity of population-level effects, would depend on many factors, including season of the spill, distance from congregations of birds, and oil spill volume. Thus, the impacts of a large spill could range from 0 birds affected to large numbers affected. ESA-listed birds returning to the breeding grounds in spring often encounter sea ice in offshore areas and must stage in the Chukchi Sea before heading overland to nest sites. An excellent map depicting spectacled eider nesting areas is in Larned, Stehn, and Platte (2006: Figure 17). After breeding, the males often return overland to open waters in the Chukchi Sea spending little, if any, time in the Beaufort Sea. Late-departing males and failed-nesting females may head north to open waters of the Beaufort Sea as spring progresses and coastal ice has receded. A few satellite-tagged males were relocated in Simpson Lagoon and Harrison Bay. In late August, once all the chicks in a nest hatch, the hen moves the brood to coastal areas for rearing. An increasing number of female and juvenile eiders move to these nearshore areas as the broodrearing season progresses. Once the chicks are flight capable, the broods move west out of the Beaufort Sea to molting areas in the Chukchi Sea, particularly Ledyard Bay. Bird mortality associated with an oil spill is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus nonmolting).

BOEM's modeling suggests that a large spill some distance away from these ERAs would likely not reach these areas and oil large numbers of listed and candidate birds. However, if oil reached these ERAs when significant numbers of listed or candidate birds were present (e.g., during spring or fall molt), numerous birds could be poisoned or killed from contact with oil. A large oil spill contacting the LBCHU (ERA10) late in the open-water period could contact tens of thousands of molting spectacled eiders. As many as 33,000 eiders, including the entire cohort of successfully breeding females and their young, use the Ledyard Bay molting area at one time. The loss of all or part of the breeding female spectacled eiders of the ACP would result in a major impact to this species. For many of the same reasons, a spill contacting the spring lead system could affect a relatively large proportion of the Steller's eider population staging enroute to the breeding grounds. A spill of this magnitude would have long-lasting effects on this species because they are clear, long-lasting and change the resource's function in the ecosystem. Nevertheless, a spill of up to 5,200 barrels would likely not be large enough to contaminate or kill a large enough portion of listed avian species to cause population-level effects. For spills larger than 5,200 barrels, the nature and severity of effects, including the potential for population-level effects to listed species would be expected to increase with increasing spill volume, depending on the location and timing of the spill.

Spill-Response Activities. None of the conditional or combined probabilities factor in the effectiveness of oil-spill response activities to large spills, which range from highly effective under ideal conditions to largely ineffective during unfavorable or broken-ice conditions. An OSRP would be required prior to oil exploration, development, and production (30 CFR 254).

Activities such as hazing and other human activities (vessel and aircraft traffic) could impact marine and coastal birds, including ESA-listed birds. Hazing may have limited success during spring when migrants occupy open-water ice leads. The hazing effect of cleanup activity or actively hazing birds out of ice leads that oil is expected to enter may be counterproductive because there are few alternative habitats that flushed birds can occupy. Cleanup activities in leads during May and open water in June through September are likely to affect marine and coastal birds, but may be unavoidable in responding to the spill.

The presence of large numbers of cleanup workers, boats, and additional aircraft would be likely to displace marine and coastal birds from affected offshore, nearshore, and/or coastal habitats during open-water periods for one to several seasons. Although little direct mortality from cleanup activity is likely, predators may take some eggs or young while females are displaced off their nests if located near a site of operation. Disturbance during the initial season, possibly lasting six months, is expected to be frequent in some areas. Cleanup in coastal areas late in the breeding season may disturb small flocks of flightless broods and some may be displaced from favored habitats, expending energy stores accumulated for molt/migration. Survival and fitness of individuals may be affected to some extent, but this disturbance likely would not result in more than a minor effect. Again, this assumes that a spill occurs and that an area important to these birds is affected when they are there.

Oil-spill response could originate from as far away as Goodhope Bay or Kotzebue Sound. Specific animal-deterrence activities would be employed as the situation requires and would be modified as needed to meet the current needs. The response contractor would be expected to work with USFWS and State officials on wildlife-management activities in the event of a spill. In an actual spill, the two aforementioned groups most likely would have a presence at the Incident Command Post to review and approve proposed hazing activities and monitor their impact on birds. As a member of the team, USFWS personnel would be largely responsible for providing critical information affecting response activities to birds in the event of a spill.

Oil-spill-response plans typically do not spell out specific wildlife-response actions. Oil-spill-response plans typically identify the resources at risk and refer to the appropriate tactics. The response contractor also can contract with other response organizations to augment animal hazing and response activities. The response contractor would be expected to have an inventory of bird-scare devices in addition to the Breco buoys (air cannons, guns, vessels, pyrotechnics, and visual devices) to deter birds from entering the spill area, and they would be assumed to cycle their use to ensure that the birds do not habituate to their effect.

As analyzed previously, cleanup activities could disturb listed eider species, could include capturing oiled birds, and could further stress birds already stressed from contact with oil. It is possible that hazing birds away from an oil impacted area may reduce the numbers of individuals that contact spilled oil. While a few individuals could experience disturbance, we would not expect population-level effects to occur from cleanup activities. we would expect that the potential effects to avian species from cleanup activities would increase with increasing spill volume, depending on the location and timing of the spill.For purposes of evaluating the potential impact of a large spill on listed eiders, oil-spill response in the Chukchi Sea is assumed to be ineffective due to the unpredictability of response time, proximity of the launch site(s) to bird habitats, certain environmental conditions (e.g., broken ice), and the large number of birds that could be impacted in a brief time period (<36 hr).

Prey Reduction or Contamination. Local reduction or contamination of food sources could reduce survival or reproductive success of the portion of populations occupying or nesting in the local area affected. This generally is not likely to affect a large proportion of any marine and coastal bird population because most species exhibit a dispersed breeding distribution. However, it could be more serious if these populations are experiencing a population decline or were restricted to specific foraging habitats. Lowered food intake may slow the completion of growth in young birds, the replacement of female energy reserves used during nesting, and energy storage for migration of all individuals. However, the contamination of some local habitat areas is not likely to affect a large proportion of the population because they are likely to have access to alternative foraging habitat similar in appearance and with similar prey organisms present that is widely distributed in the region.

The analysis for a large spill affecting ESA-listed birds was updated in the Biological Evaluation (USDOI, BOEMRE 2011b, page 120). That analysis concluded that a large oil spill contacting the LBCHU during the open water period could contact as many as 33,000 spectacled eiders, including the entire cohort of successfully breeding females and their young, using the Ledyard Bay molting area at one time. The loss of all or part of the breeding female spectacled eiders of the Arctic Coastal Plain would be anticipated to result in large-scale population-level effects. A similar impact could be experienced by Steller's eiders using the spring lead system for staging prior to moving to the breeding grounds. A large spill contacting the spring lead system could affect a relatively large proportion of the Steller's eider population. This would be considered a large-scale population-level effect on this species.

Considering the low incidence of a large oil spill, however, coupled with a variety of other factors that would need to be satisfied to result in mortality, BOEM anticipates that it is improbable that listed eider mortality would result from oil spills associated with the Proposed Action and a minor level of effect is anticipated.

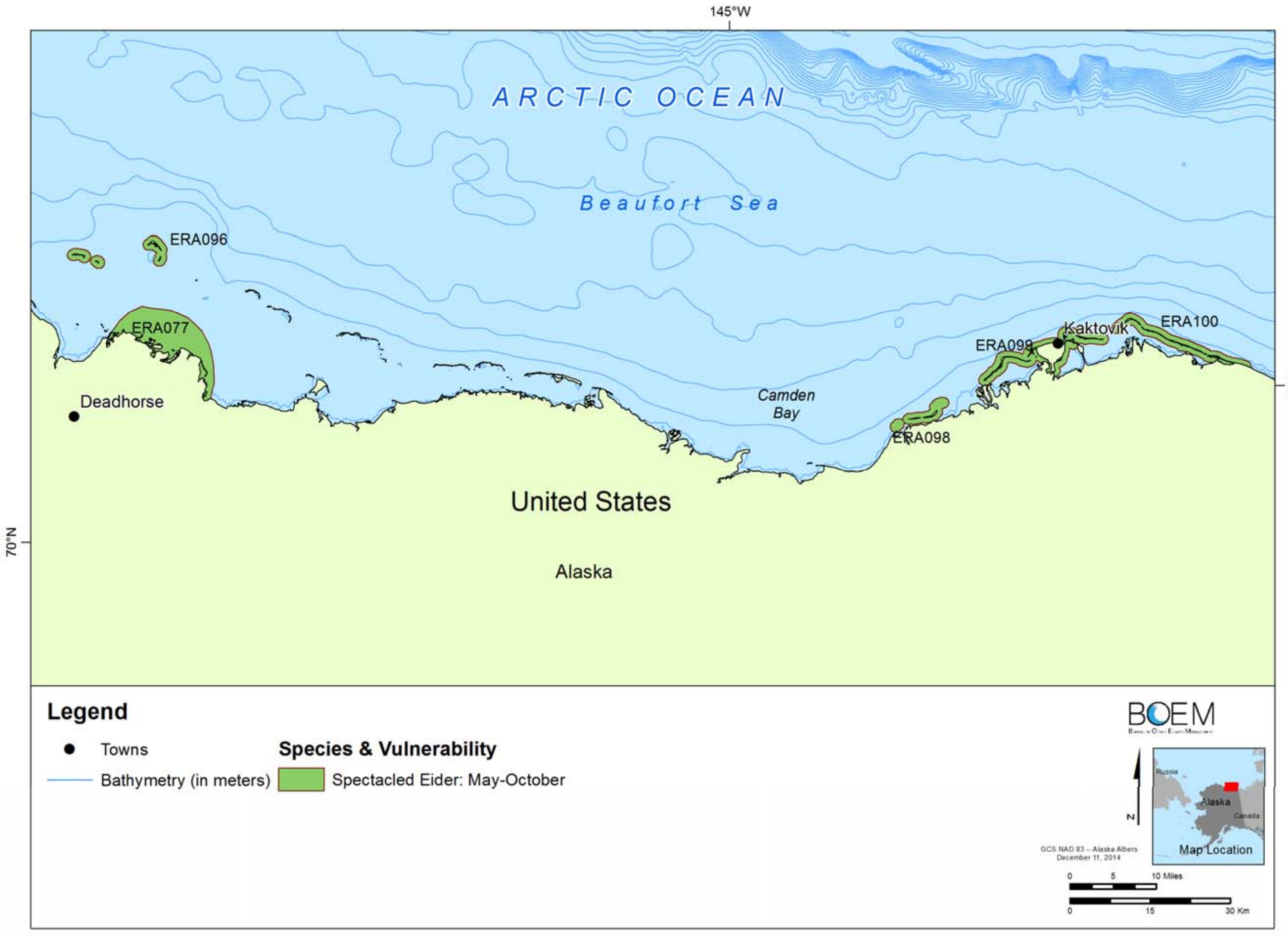

Figure 5-1. Locations of Eastern-most ERAs for Listed Eiders as used in LS 193 OSRA analyses.

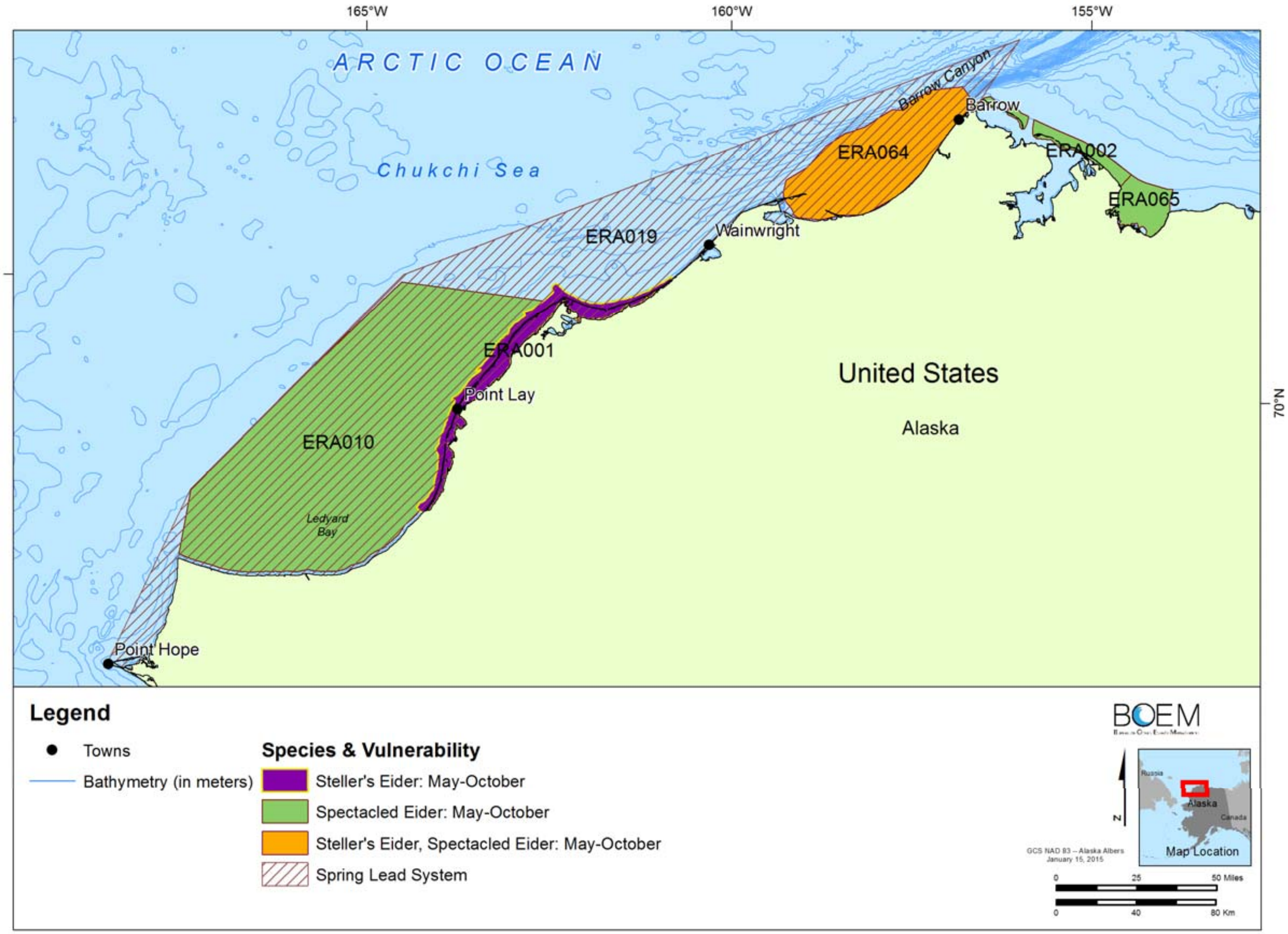

Figure 5-2. Locations of western ERAs for Listed Eider as used in LS 193 OSRA analyses.

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5.2.1.3. Potential Effects to LBCHU from Future Incremental Steps

The Ledyard Bay Critical Habitat Unit (LBCHU) is important to migrating and molting spectacled eiders. The Primary Constituent Elements for the spectacled eider in this unit are: (1) marine waters greater than 5 m (16.4 ft) and less than or equal to 25 m (82.0 ft) in depth; (2) the associated marine aquatic flora and fauna in the water column; (3) and the underlying marine benthic community.

5.2.1.3.1. Discharges

Drilling muds and cuttings would leave a footprint around the well site and would impact the PCE of the benthos. Recovery of this area is not likely to occur until a few years after oil and gas extraction ceases because sediments would be greatly altered; however, the footprint of these sites would likely occupy a very small portion of the LBCHU or not reach it at all, because the nearest leased block is approximately 20 miles distant.

Large oil spills during future incremental steps could originate from loss of well control incidents followed by a long-duration flow, or spills from pipelines and platforms. If a large spill were to occur it could reach the LBCHU. For example, the OSRA model combined probabilities analysis estimates that there is a 14% chance that a large spill could contact the LBCHU during the life of the project. This could potentially affect PCEs and the ability of spectacled eider to use this area for the purposes for which the critical habitat area was designated.

Small spills, however, are expected to be of very low volume and largely recoverable. Small spills would also have to occur directly adjacent to or within the LBCHU for these effects to occur, and very few activities are likely to occur in this area. 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 the LBCHU, their effects on the marine flora and fauna PCEs would be short-term and localized and would not diminish the function and conservation value of the LBCHU for molting spectacled eiders.

Because the likelihood of small spills occurring within the LBCHU is low, and if they did occur the area affected by small spills would be small, and most of the spilled oil would evaporate, weather, or would be recovered, we do not expect small spills to have long-term effects that would diminish the function and conservation value of the LBCHU for molting spectacled eiders. Regarding large spills, their incidence is low, but it is possible that one or more could reach the LBCHU during the life of the project and diminish the function and conservation value of the LBCHU for molting spectacled eiders.

5.2.1.3.2. Other Effects

No production platforms or wells would be needed within the Ledyard Bay Critical Habitat Unit, because no leases occur there Some drilling muds and cuttings could be discharged outside of the LBCHU during exploratory drilling, Discharges could result in the deposition of sediment that could affect the PCEs of flora and fauna in the water column and the underlying benthic community through toxicity, or organic enrichment. However, these effects, at a level of 9 acres per well, would be localized to an area up to approximately 277 acres total for the 28 wells and would be therefore very unlikely to reach the LBCHU. Burying pipelines across the LBCHU would disturb the benthos and the PCE of the marine benthic community but this is likely a short term effect as benthos will likely recolonize the area.

Given the negligible impact area from exploratory drilling discharges and their short-lived nature, significant adverse effects to the PCEs are not anticipated, and they are not expected to appreciably reduce the function and conservation value of the LBCHU for spectacled eiders.

5.2.2. Polar Bear

5.2.2.1. Impact-Producing Factors (IPFs)

Because polar bears occur in the Leased Area, industry may also encounter them during the future incremental steps of the Proposed Action. Following the first incremental step, additional activities could occur that may have potential adverse effects on polar bears. Activities associated with development and production, if it does occur, would take place in marine and terrestrial environments, and could include construction of permanent facilities (central production facility, satellite facilities, subsea and terrestrial pipelines, pump stations), associated aircraft and vessel traffic, operation of those facilities over the life of the field, and removal and/or abandonment in place of facilities.

Development and production logically follow if a leaseholder finds an economically developable field. Development activities include the construction or installation of a production facility and necessary pipelines that would convey oil or gas to existing infrastructure. Vessel and aircraft traffic, seismic surveys, drilling activities, and discharges have been discussed previously in Sections 5.2.1 and 5.2.2. Production activities are those that make use of the developments; the drilling of production wells and the operation of pump stations and other facilities that move the oil/gas to existing infrastructure.

If development and production proceed after exploration, the operator must submit a Development and Production Plan, which would be evaluated to ensure compliance with NEPA; additional consultation under the ESA would be required. The purpose of this section is to describe the potential effects of a “single and complete project” that could arise from the activities in the Leased Area. Subsequent evaluations would be based on site-specific information and additional details provided through the Development and Production Plan process.

5.2.2.1.1. Effects from Facility Construction

A production facility and new subsea and terrestrial pipelines are the largest components that would need to be constructed to support getting product to existing infrastructure. Platform construction would produce lower-energy localized noise from equipment operation, generators, etc. The sounds from these activities would not be likely to travel as far as sound from 2D/3D or site clearance seismic surveys. Similarly, pipeline construction would involve a slow-moving sound source that would have a localized, low energy noise footprint that is smaller than 2D/3D or site clearance seismic surveys. . IPFs associated with onshore construction were described in first incremental step IPFs and are not repeated here.

5.2.2.1.2. Effects of Facility Operations

Once a development facility is constructed, routine production operations would begin. The location, timing, and specific actions have not been determined and would be evaluated as development plans are submitted. The specific potential effects would depend on the type of facility being proposed, its location, and the equipment being used (i.e., pumps, motors, etc.). The types of impacts from development and production activities are similar to those from exploration. The primary impacts would be disturbance from vessel traffic, aircraft traffic, and the platform or production facility site itself. During construction, activities such as pile driving could occur. The footprint of the facility would exclude that area as habitat for foraging in the foreseeable future. Typical activities that might occur include: weekly or bi-weekly aerial surveys to inspect onshore pipelines for leaks or spills, and helicopter traffic to transport crew and materials to and from the facility. Recommended flight corridors and altitude restrictions would be maintained. Some small spills would be likely to occur. Material spilled could include drilling mud, corrosion inhibitor, sewage, methanol, motor oil, diesel fuel, hydraulic fluid, lube oil, and propylene glycol. An oil spill that occurred during production would have the same impacts as a spill that occurred during exploration.

5.2.2.2. Potential Effects to Polar Bear from Future Incremental Steps

If development occurs, polar bears would experience disturbance and possibly other impacts from activities associated with offshore and onshore facilities; the magnitude of impacts would likely vary by project location. Many of the effects from development would be similar to those described in the first incremental step, although the scale of effects in the offshore environment and the frequency of disturbance and human-polar bear encounters could increase. The types and scale of effects would depend on the location of facilities. As described in the analysis for the first incremental step, polar bears do not generally den along the coastal areas of the Chukchi Sea and disturbance of denning bears in the Leased Area is unlikely to occur. Therefore, the main focus of the analysis will be on non-denning polar bears occurring in the Leased Area but impacts to denning polar bears will also be discussed.

5.2.2.1.3. Effects on Non-denning Polar Bears

Construction of and routine operation activities associated with the main production shorebase and terrestrial pipeline are a potential source of disturbance for polar bears. Non-denning polar bears may avoid the immediate vicinity of construction activities or they may be attracted to it, depending on the circumstances and temperament of individual bears. Avoidance of the area would reduce the potential number of human-bear interactions, thereby reducing the potential for injury to people or the need to kill bears. Effects of disturbance and human-polar bear interactions would be similar to those described for activities occurring in the first incremental step, although more interactions and an increase in disturbance could be expected as the number of development and production facilities increased if new facilities are built in areas frequented by polar bears (e.g., near the coast). Industry would likely use existing infrastructure and would construct new infrastructure. Non-denning polar bears could be temporarily displaced, or their behavior could be modified (e.g., by changing direction or speed of travel), however, the majority of the construction footprint during future incremental steps would be inland (e.g., onshore pipeline installation to connect the coastal processing facility) from the coast, in habitat where polar bears infrequently occur. Potential for disturbance would be greatest during construction and would decrease after construction was complete, when noise from proposed activities, the number of personnel on-site, and the frequency of vehicle traffic would decrease. Polar bears may be attracted by food smells to vessels and platforms and will swim long distances in the pursuit of food. If a polar bear swims out of its way in open water to a vessel or platform, which then turns out to provide neither food nor resting habitat, it could result in a big energetic cost with real impacts to the bear.

Possible habituation or conditioning to noise – Polar bears near routine industrial noise may habituate to these stimuli and show less vigilance than bears not exposed to such stimuli. For example, during the ice-covered seasons of 2000–2001 and 2001–2002, active dens were found 0.4 km and 0.8 km (0.25 mi and 0.5 mi) of remediation activities on Flaxman Island in the Beaufort Sea with no observed impact to the polar bears (Smith et al. 2007). Habituation to stimulus such as noise is generally considered to be positive because polar bears could experience less stress from industrial activity; however, it could also increase the risk of human-bear encounters.

Industry activities as attractants – Offshore/nearshore oil and gas activities during future incremental steps could lead to construction of permanent structures. Currently, offshore developments in the nearshore environment of the Beaufort Sea account for the majority of the polar bear observations. To illustrate, Endicott, Liberty, Northstar and Oooguruk in the Beaufort Sea accounted for 47% of the bear observations between 2005 and 2008 (182 of 390 sightings; 76 FR 47010). Because polar bears can be curious and permanent structures can provide habitat (e.g., resting), oil and gas activities and structures could serve as attractants. However, far fewer bears occur along the Chukchi Sea coast than the Beaufort Sea coast therefore onshore and near shore facilities located along the Chukchi Sea coastline are unlikely to disturb very many bears. In some cases, bears may benefit from the presence of infrastructure. For example, the two man-made causeways on the North Slope (the STP/West Dock Causeway and the Endicott Causeway) have created resting, traveling, and other habitat (over approximately seven miles in length) for polar bears since their construction in the 1980s. However, such use of infrastructure by bears could result in increased human-bear encounters that could, in turn, result in unintentional harassment, intentional hazing (see *Interrelated and Interdependent Effects* section below), or possibly situations in which bears are killed because it posed an immediate threat to human life.

Mitigation measures – Most human-bear interactions involve transient polar bears and do not normally result in impacts to bears that affect their essential life functions. Under the Proposed Action, lessees would be required to develop human-polar bear interaction plans, and personnel would participate in onsite polar bear training. This training would educate field personnel about the dangers of bear encounters and how to implement safety procedures in the event of a bear sighting. It would allow on-site personnel to detect bears and respond safely and appropriately. In the past, this response often included leaving an area where bears are seen until the bear leaves the area. Occasionally, and when appropriate, the response may involve deterring the bear from the site (76 FR 13454: 13470). Effects of deterrence activities are described in more detail in the *Interrelated and Interdependent Effects* section below.

5.2.2.1.4. Effects on Denning Polar Bears

Polar bears can den on land and on sea ice; and development and production activities could occur in these two habitat types. Thus, some potential for disturbance of denning bears is possible, however, the majority of Bering/Chukchi Sea polar bears den in Chukotka or on Wrangell Island. As the potential impacts to polar bears from oil and gas activities in these two habitats would be similar, the effects described in this section are relevant to bears denning in either habitat.

Female polar bears denning within approximately 1 mi of the construction activity could be disturbed by vehicular traffic or construction noise. Disturbance of females in maternity dens could result in either abandonment of the cubs or premature exposure of cubs to the elements, resulting in mortality (Amstrup, 1993). Regulations require that road and other construction activities maintain a 1-mi buffer around known or suspected polar bear dens. MacGillivray et al. (2003, in USDOI, BLM, 2004) measured noise from industrial activities in artificial dens at varying distances from the activity. Noise in the dens from vehicular traffic was generally at background levels when vehicles were approximately 500 m away. However, one vehicle was detectable above background levels at a distance of 2,000 m. Thus, current regulations should prevent disturbance to polar bears in natal dens that have been identified. Bears in unidentified dens could be disturbed by the construction. The number of bears affected would depend on the number of dens that are undetected but within a 1-mi buffer around construction activity. The severity of the effect would depend on the reaction of individual bears, whether the den is abandoned, and the age of the cubs when the disturbance occurs. Potential for disturbance would be greatest during construction and would lessen after construction was complete, when noise from proposed activities, the number of personnel on-site, and the frequency of vehicle traffic would decrease.

Industry infrastructure as attractants – As mentioned previously, permanent structures could provide polar bears habitat; abandoned structures could provide relatively disturbance-free habitat. For example, the Staging Pad, an isolated, abandoned gravel pad isolated approximately 7 km northeast of the Milne Point Central Processing Facility, is the most consistent location of polar bear denning on the North Slope; eight maternal dens have occurred on this man-made pad in the last nine years. Bears have also successfully denned on a decommissioned exploration gravel pad on Cross Island and on the runway ramp at the Bullen Point LRRS. These sites are on the Beaufort Sea, and few bears are believed to den along the US side of the Chukchi Sea.

Effect of noise disturbance on denning bears – Female polar bears entering dens and those in dens with cubs are more sensitive than other bears to industry activities. Noise from oil and gas activities (stationary or mobile and on ice or on land) could disturb bears at den sites, and depending on the timing in the denning cycle, could have varying effects on the female bear and family group. During the early stages of denning when the pregnant female has limited investment at the site, disturbance could cause her to abandon the site in search of another one. At emergence, cubs are acclimating to their 'new environment' and the female bear is vigilant to protect her offspring. As a result, females with cubs of the year may be more sensitive than other bears, and visual, acoustic, and olfactory stimuli may disturb the female to the point of abandoning the den site before the cubs are physiologically ready to move.

For example, in 2006, a female and two cubs emerged from a den 400 meters from an active river crossing construction site. The female abandoned the den site within hours of the cub emergence three days later. In 2009, a female and two cubs emerged from a den site within 100 meters of an active ice road with heavy traffic and abandoned the site within three days. Females with cubs generally remain near the den site for three days to three weeks (C. Perham 2011, MMM, *pers. comm.*) prior to abandoning a den site. Such occurrences, however, are infrequent and isolated. Reactions of bears to human activity are highly variable, as some bears are more tolerant of stimuli than others. For example, in the spring of 2011, a female bear emerged from a maternal den she had constructed in the bagged island armor of ENI's Spy Island Development. The island was not in use when she initiated denning, but the den was discovered when industry returned in the spring. In coordination with the USFWS (Service), personnel temporarily left the island until the female emerged naturally with a cub and abandoned the den site (i.e., did not abandon early due to human disturbance). Thus, this female and cubs tolerated oil and gas activities for some time prior to emergence; implementation of an interaction plan most likely also minimized effects on these denning bears.

The oil and gas industry develops interaction plans and receives training in association with LOAs, and known polar bear dens around oil and gas activities, discovered opportunistically or from planned surveys, are monitored by the Service. These sites are only a small percentage of the total active polar bear dens for the SBS in any given year, and LOAs issued to the oil and gas industry and polar bear interaction plans specify procedures to be followed when a bear or a bear with cubs are encountered. At that time, mitigation, such as activity shutdowns near the den and 24-hour monitoring of the den site may be implemented limiting human-bear interactions, thereby allowing the female bear to naturally abandon the den and minimize impacts to the animals. The expectation is that these interaction plans and training would minimize disturbance to denning bears. For example, in the spring of 2010, an active den site was observed approximately 60 meters from a heavily used ice road. A one-mile exclusion zone was established around the den, closing a 2-mile portion of the road. Monitors were assigned to observe bear activity and monitor human activity to minimize any other impacts to the bear group. These mitigation efforts minimized disturbance to the bears and allowed them to naturally abandon the den site. Similar mitigation methods are expected to be used during the future incremental steps, and similar effectiveness at minimizing disturbance is expected, however, interactions with denning bears are far less likely in the Chukchi Sea.

Impacts of mobile sources of disturbance on denning bears – Mobile sources include vessel and aircraft traffic, ice road construction and associated vehicle traffic, including tracked vehicles and snowmobiles. Additionally, if development occurs in the Leased Area, BOEM and BSEE anticipates construction of a road and oil pipeline to connect with existing infrastructure. Because disturbance from traffic on the road is frequent and on-going, and confined to the road corridor, the assumption is denning females will either avoid the area or become habituated (Smith et al. 2007) to this source of disturbance and not suffer adverse effects from road disturbance during denning. Although vehicles on ice or land could hypothetically travel over dens causing them to collapse, this is unlikely to occur because few bears den in the US Chukchi Sea area and oil and gas personnel routinely coordinate with the Service to determine where their activities are relative to known dens and denning habitat. LOA provisions require oil and gas personnel to avoid known polar bear dens by one mile and often require personnel to search for potential denning habitat using den detection techniques, such as Forward-looking Infrared (FLIR) technology. Similar provisions would likely be enacted during the future incremental steps to minimize the chance that oil and gas activities cause the destruction of dens or early den abandonment.

Occasionally, oil and gas personnel encounter an unknown den. From 2002 through 2010, six previously unknown maternal polar bear dens were encountered by industry near the Beaufort Sea coast. Once a previously unknown den is identified, industry must report its location to the Service, and mitigation measures described in polar bear interaction and response plans are implemented. These may include a one-mile exclusion area around the den and 24-hour monitoring of the site. Denning bears may also abandon or depart their dens early in response to repetitive noise produced by extensive aircraft over flights. Mitigation measures, such as minimum flight elevations over polar bears or areas of concern and flight restrictions around known polar bear dens, will be likely be required in LOAs or other MMPA authorizations, as appropriate, to reduce the likelihood that bears are disturbed by aircraft.

5.2.2.1.5. Interrelated and Interdependent Effects

Deterrence activities are not part of the Proposed Action, but polar bears could ultimately be subject to intentional deterrence; thus, deterrence activities are considered to be an interrelated action to the Proposed Action. Deterrence activities are most likely to occur on the mainland, production islands, and on the ice. Production islands are not anticipated to be built in the Chukchi Sea. Polar bears could experience temporary disturbance and stress from some deterrence activities (e.g., from acoustical devices, moving vehicles, spotlights) and could walk, run or swim away. For healthy bears, any stress they experience from this activity would likely be short term; bears that have walked or swam long distances could experience longer periods of stress and could need to rest elsewhere prior to resuming normal activities such as feeding. Bears that are deterred using more aggressive methods (e.g., projectiles such as bean bags and rubber bullets), would likely experience stress, short-term pain and could be bruised. In August 2011, one polar bear was accidentally killed during a deterrence event due to mistaking a firecracker round with a bean bag round. Such outcomes are extremely rare (no bears were killed during oil and gas activities from 1993 until this event).

From 2006 through 2010, the oil and gas industry working in the Beaufort Sea or coastal areas adjacent to it reported the sightings of 1,414 polar bears, of which 209 (15%) were intentionally harassed or deterred (C. Perham, *pers. comm*., email, July 12, 2011). Annually, the percent of total bears sighted that were deterred ranged from 9% in 2010 to 43% in 2006, with an average of 15%. For the purposes of this BE, we expect that with increased development, the number of bears deterred annually during the DS would increase. If polar bears become stranded in the nearshore/coastal environment due to melting sea ice from climate change, the number of deterrence events could increase further. For the majority of deterrence events, no contact with the bear is anticipated, and we expect that most of these deterrence events would cause only minor, temporary behavioral changes (e.g., a bear runs or swims away).

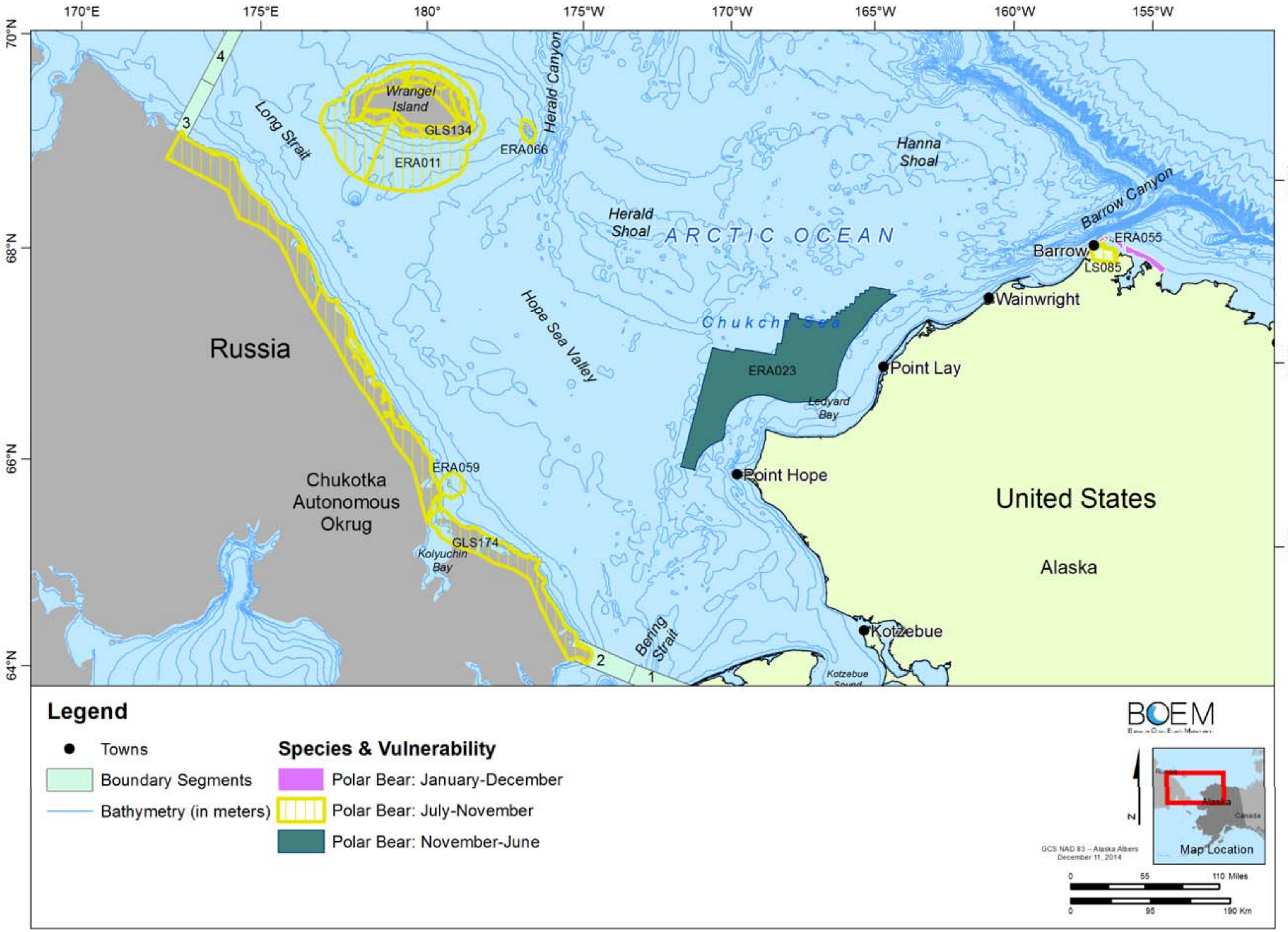

Figure 5-3. Location of western Chukchi Sea Polar Bear ERAs.

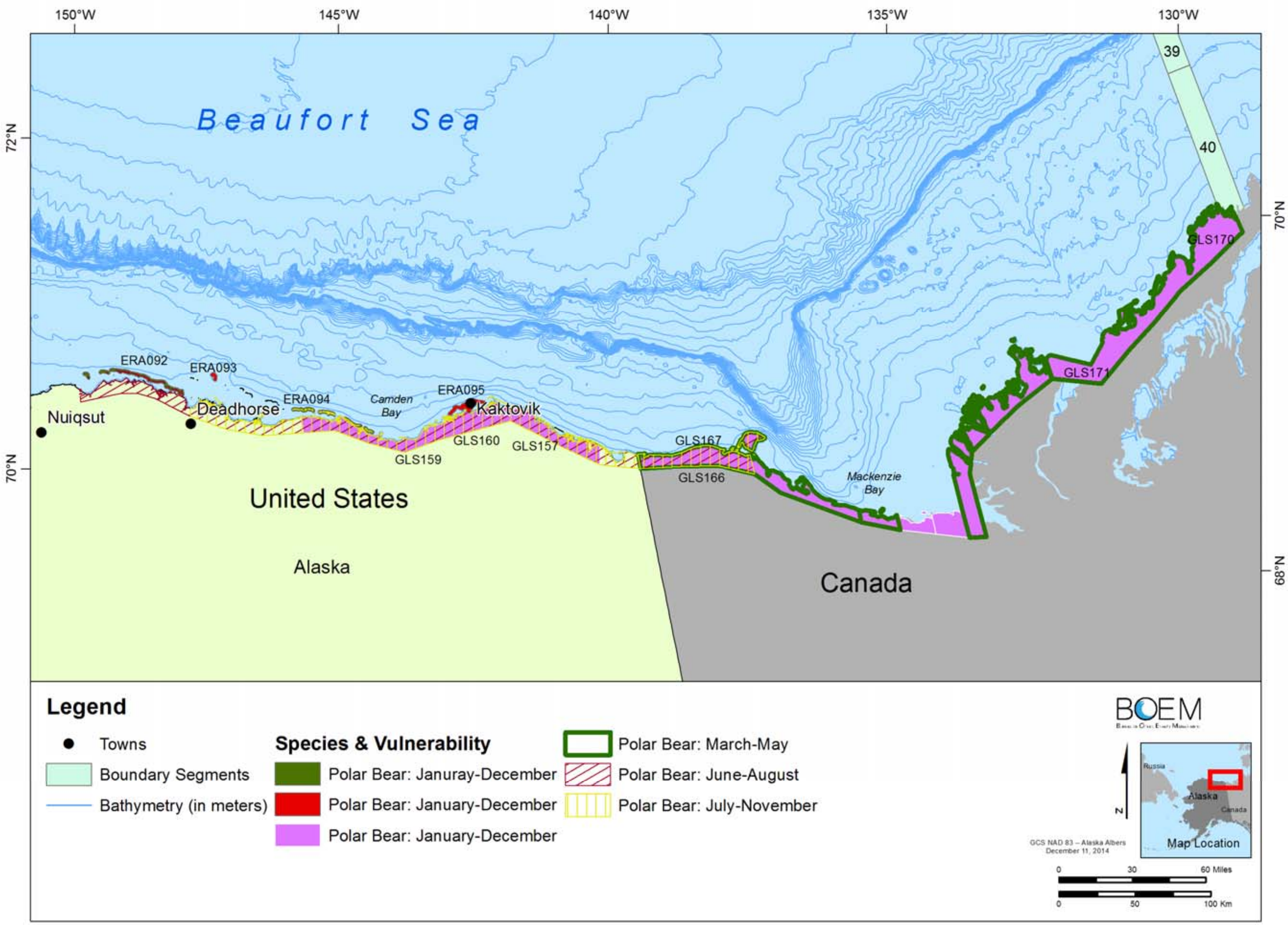

Figure 5-4. Location of eastern Chukchi Sea Polar Bear ERAs..

5.3. Cumulative Effects

5.3.1. Cumulative Effects on Listed Eiders and LBCHU

5.3.1.1. Community Growth

Hundreds of acres of North Slope bird habitats have been filled by oil and gas infrastructure (fill pads, pipelines, roads, gravel pits, etc.), as well as community development (residences, schools, airports, roads, landfills, etc.).Community growth is anticipated to continue across the North Slope. The footprints of North Slope villages will likely increase, through expansion of roads, powerlines, communication towers, landfills, and gravel pits and these activities may adversely affect listed species. The scale of impacts will depend not only on the amount of growth, but the location as it relates to eider habitat. For example, community development projects at Barrow may potentially impact Steller's eiders to a much higher degree than developments at Point Lay. Because over 97% of the Action Area is wetlands or open water (USGS National Land CoverDatabase), and listed eiders breed near and use wetland areas, a section 404 permit from the U.S.Army Corps of Engineers would likely be necessary for all large scale community development projects that may impact eiders. The issuance of these permits would also trigger consultation under the ESA.

5.3.1.2. Projected Growth in Hunter Numbers

United States 2000 Census data indicate the estimated village size in the Wade-Hampton and Bethel census areas, where subsistence hunters on the Y-K Delta might encounter spectacled or Steller's eiders, is increasing. Census data is also provided for the North Slope, which encompasses the ACP breeding area for these two species. At current rates of population growth, increases in the numbers of households and projected population numbers can be approximated (Table 6.1). Predicting future levels of take of either listed eider species as a result of population growth is problematic. However, the Service anticipates that the potential number of subsistence hunters will grow in Alaska, indicating a continuing and growing need for careful management of the subsistence hunt and a need for long-term education, outreach, and law enforcement activities to protect listed species during the hunt.

5.3.1.3. Oil and Gas Development

Oil and gas development, whether in Federal or State waters or in the terrestrial environment on State, private, Native-owned, or Federal lands, would require Federal permits (such as section 404 of the Clean Water Act authorization from the U.S. Army Corps of Engineers, and National Pollution Discharge Elimination System permits from the Environmental Protection Agency) and, therefore, are not considered cumulative effects. Regarding a proposed gas line, the BLM now considers the development and export of North Slope natural gas from the Action Area via pipeline to be reasonably foreseeable. While much of this line is likely to be on State lands, a project of this magnitude would require Federal permits and section 7 consultation. It is therefore, not a cumulative effect under the ESA.

5.3.1.4. Increased Scientific Research

Scientific research across the North Slope is increasing as concern about effects of climate change in the arctic grows. There are a number of long-term study plots near Barrow and NPRA providing baseline data, further increasing interest in the area. While much research is conducted by universities and private institutions, all activities in NPR-A require land use authorization by BLM and therefore, require section 7 consultation. The Service is consulting on the major long-term research near

Barrow. Any research on listed species requires a Section 10 recovery permit and therefore, also requires section 7 consultation. Researchers are currently conducting activities in ways that minimize impacts to listed eiders.

5.3.1.5. Summary of Cumulative Effects

In summary, we anticipate community growth, a gradual increase in subsistence hunter numbers (with community growth), terrestrial and offshore oil and gas development, scientific activities, and other activities will continue in the Action Area in coming decades. Most notably activities with potential to affect significant numbers of individuals of listed species (such as oil and gas development, community growth, and large-scale science projects) are expected to require consultation under the ESA, whereas those that may not require consultation (such as non-Federal research) will likely have minor impacts to only a few individuals.

5.3.2. Cumulative Effects on Polar Bears

Cumulative effects are the combination of past, existing and future activities that are reasonably certain to occur in the Leased Area. These may be dynamic or stable, and localized or widespread. The following are the primary factors contributing to cumulative effects in the Leased Area.

5.3.2.1. Climate Change

The primary factor of concern for the continued existence of healthy polar bear populations throughout their range is decreasing sea ice due to climatic changes. SBS and A-C polar bears spend most of their time on the pack ice during the open water season. As pack ice decreases, the seasonal ice edge moves further north off of the continental shelf over waters that are less productive and less inhabited by ringed or bearded seals (the polar bear's principle prey items). Polar bears may spend longer time periods fasting on shore or on ice. Polar bears may also be forced to swim longer distances between shore and the retreating ice edge, increasing energy expenditures and decreasing both fitness and survival rates. Impacts to polar bear habitat include erosion of barrier islands and shorelines due to an increase in the open water season that results in more large storms. Sea ice is also in decline with primary effects on multi-year ice.

5.3.2.2. Subsistence hunting

The primary source of direct mortality to polar bears is by humans. Polar bears are harvested for subsistence purposes and killed in defense of human life when they enter villages or otherwise come into contact with humans. The current level of subsistence harvest is believed to be at or above the current estimates of PBR for the SBS and A-C sub-populations. Available evidence indicates that subsistence hunting can cause disturbance, changes in behavior, and temporary effects on habitat use, including migration paths.

5.3.2.3. Research Activities

There are several active ongoing research programs studying the SBS and/or A-C sub populations of polar bears, which include the darting and handling of polar bears. Effects from research are generally limited to temporary disturbance of individual bears. This may cause some limited energy expenditures for individual bears and possibly increase their avoidance reactions to aircraft over time. Additional research programs using icebreakers to access study sites (particularly in spring) may have some short-term impact to sea-ice habitat. The spatial extent of these effects is limited to relatively small areas when compared to the available habitat.

5.3.2.4. Offshore oil and gas exploration

Noise and disturbance from oil and gas exploration and development activities on shore or near shore may have localized, short-term adverse effects, but no lasting population-level adverse effects on polar bears have been identified. There is no indication that human activities have caused long-term displacement of polar bears. Offshore exploration primarily occurs during the open water season and is not likely to impact polar bears, which tend not to use open water habitats.

5.3.2.5. Discharges

Accidental fuel spills have occurred historically in the Arctic Region OCS without apparent impacts to polar bears. Due primarily to increased concentrations of bears on parts of the coast, the relative oil spill risk to the population may be increasing. Fuel spills and discharges of other contaminants may occur from vessels transiting the Arctic (cargo ships, barges, USCG vessels, industry vessels, and research vessels). Polar bears may avoid the noise and disturbance of vessels engaged in response and cleanup activities, or be drawn to the area by curiosity. To date, impacts to polar bears from spills or discharges have been negligible.

5.3.2.6. Summary

The Proposed Action is likely to contribute to cumulative effects on polar bears in the Leased Area through short-term disturbances of a few individual bears. When considered collectively with other activities, the amount of disturbance or “take” is small. The SBS polar bear population is already in decline and decreasing in fitness due to the impacts of a changing climate. Polar bear habitat, particularly sea ice, is also declining. The Proposed Action neither adds to nor diminishes these ongoing trends. Hunting pressure, loss of sea ice and climate change, and the expansion of commercial activities have potential to impact polar bears. Combined, these factors present challenges for management of polar bears in Alaska. The success of future management efforts will rely in part on continued investments in research investigating population status and trends and habitat use patterns. The effectiveness of various mitigation measures and management actions will need to be continually evaluated through monitoring programs.

5.4. Determination of Effects

5.4.1. Conclusion for the First Incremental Step

This portion of the BA considers impacts to listed Steller’s and spectacled eiders, polar bears, and critical habitat that may result from the first incremental step of the proposed Action. The potential effects of these activities, taken together with cumulative effects, were considered in the aggregate and in the context of information on the current status of spectacled eiders, Steller’s eiders, polar bears, the LBCHU, and the environmental baseline for the Action Area. In our analysis of impacts to critical habitat, we rely upon the statutory provisions of the ESA.

5.4.1.1. Listed Eiders

5.4.1.1.1. Disturbance, Displacement, and Habitat Alteration.

As detailed in the *Potential Effects* sections above, few significant adverse effects to listed species from habitat loss and disturbance or displacement (i.e., aircraft and vessel traffic, seismic airgun noise, and exploratory drilling) are anticipated to result from activities proposed in the first incremental step.

5.4.1.1.2. Collisions and Disorientation.

Activities taking place during the first incremental step may result in collisions between vessels/exploratory drilling rigs and spectacled and Alaska-breeding Steller's eiders. Collisions between birds and human-built structures are episodic in nature, and it is difficult to quantify the collision risk for listed eiders from vessels and drilling rigs using the short-term datasets that are currently available. It is also not anticipated that lessees would persist in exploration activities in search of an anchor field discovery for longer than 5 years, so during the First Incremental Step the risk of a large circulation event that could cause take(s) of multiple eiders is negligible to low. Our estimate is based on the best local data available at this time, and we believe it is unlikely that we have underestimated potential effects to any significant degree. BOEM and BSEE's requirements regarding lighting protocols for vessels operating in the Beaufort and Chukchi Seas may reduce collision risk, but the ultimate effectiveness of this mitigation is currently unknown.

5.4.1.1.3. Small Spills.

Although small spills are reasonably foreseeable in the first incremental step, it is highly unlikely that listed eiders will be significantly affected because these spills will likely be of such low occurrences and volume that oil is likely to evaporate, weather, or be mostly recovered prior to contacting listed eiders or their habitat. Moreover, the density of these species is very low in most of the Action Area so only very few are likely to encounter oil from small spills, and disturbance from oil spill response activities will likely displace individuals away from spill sites before they come into contact with oil.

5.4.1.1.4. Ledyard Bay Critical Habitat Unit

Impacts to the LBCHU from activities authorized in the first incremental step of the proposed Action are anticipated to have only minor, short-term impacts, and are not likely to diminish the function and conservation value of critical habitat. The leased areas are not in the LBCHU so no drilling will take place there. No shorebases are planned for the vicinity. It is possible that sedimentation from distant drilling and small spills from traversing or nearby vessels could reach the LBCHU, but impacts would be rare and negligible. Small spills, by definition, are limited in size, and as such have small areal extents, are less likely to persist long enough to reach specific areas of interest, such as the LBCHU, and in the unlikely event that one did, its effects on the marine flora and fauna PCEs would be short-term and localized and would not diminish the function and conservation value of the LBCHU for molting spectacled eiders.

5.4.1.2. Polar Bears

Disturbance. Non-denning (mobile) bears may be affected by human presence and activities such that they change their behavior and move away from the source of disturbance, or in rare cases may be attracted, which can occasionally result in the need to haze the individual(s) involved. Based on records reported from previous operations, we estimate that up to 5 polar bears may be seen from each marine deep-penetration and high-resolution survey activity, and an estimated 22 polar bears may be seen from each exploratory drilling operation annually. Based on successful management of human-bear interactions in recent decades, we do not anticipate lethal take will occur, and if lessees, permittees, or their agents implement the mitigations and conditions of any required take authorizations under the MMPA, effects will be minimized by implementation of the conditions of authorizations.

Small Spills. As noted above, small spills are reasonably foreseeable in the first incremental step. However, it is highly unlikely that polar bears will be significantly affected because these spills will likely be of a very low volume such that the oil is likely to evaporate, weather, or be almost entirely recovered prior to contacting individuals or their habitat. Moreover, the density of polar bears is low in most of the Action Area so that only very small numbers of individuals are likely to encounter oil from a small spill. Further, oil spill response activities would cause a significant local disturbance which would likely displace individuals away from the spill site before they come into contact with oil.

5.4.1.3. Summary of First Incremental Step Effects

Considering the aggregate effects on the species and critical habitat, BOEM determines that one or more species are likely to be adversely impacted by activities in the First Incremental Step: listed eiders (spectacled eider, and to a lesser degree, Steller’s eider) have increased risk of mortality from collisions. It is possible, although unlikely given the short duration of this phase, that this level of take could have population-level effects. Likewise, habitat loss or disturbance is considered unlikely to have population-level effects because construction in the important nesting habitat near Barrow is expected to be avoided or mitigated through the multi-tiered decision-making and review process. No significant adverse impacts are anticipated for polar bear or the LBCHU as a result of the First Incremental Step. As discussed above, no large spills are anticipated and VLOS is extremely rare and the effects that may result from it cannot be said to be reasonably certain to occur and are therefore not considered a dir4ect or indirect effect of the proposed Action.

5.4.2. Conclusion for Entire Proposed Action

The purpose of this Biological Evaluation is to determine the effects of the Proposed Action. The effects of the action on threatened or endangered species and critical habitat under Section 7 of the Endangered Species Act species are considered along with the environmental baseline (Section 4.0) and predicted cumulative effects (Section 5.4). This section considers the following categories:

- The proposed actions would have no effect on the listed species.
- The proposed actions may affect the listed species. Two categories:
    - The proposed action is likely to adversely affect the listed species.
    - The proposed action is not likely to adversely affect the listed species.
- The proposed actions are *likely to adversely modify* critical habitat for a listed species.
- The proposed actions are *not likely to adversely modify* critical habitat for a listed species.

In addition to considering the effects of activities proposed in the first incremental step, we analyzed the effects of the entire Proposed Action, including exploration beyond the anchor field and production, as envisioned in BOEM and BSEE’s hypothetical development scenario, and cumulative effects to determine if there is a reasonable likelihood that the entire proposed Action would adversely impact listed species or adversely modify the LBCHU.

It should be noted, however, that at this time, considerable uncertainty exists regarding what specific activities the entire action may ultimately entail and, therefore, estimating potential impacts of future activities with precision is not possible at this time. Some of the uncertainties are as follows:

- ***How much development would occur and where it would occur*** – BOEM and BSEE have provided a development scenario for the leased area, and the current estimation of potential impacts of development is necessarily based on these scenarios. The scenario includes one 4.3 Bbbl field with eight offshore facilities and satellite wells with subsea pipelines transporting product to a shorebase at an unknown location with a terrestrial pipeline moving the product to the TAPS and/or a gas line. If and when a discovery is made and development occurs in frontier areas, such as the Chukchi Sea, more projects are likely to follow. . Plans and detailed information, including location(s) and size(s) of facilities and borrow sources, will be subject to a multi-tiered decision making and review process. First, OCSLA-staged decision-making will provide for review of EPs and DPs. Compliance will be required with the conditions of the BO that results from the current ESA consultation, and other mitigation may be required, including, but not limited to, alternative siting. The lessee would also be obligated to coordinate with the land owner(s) in order to obtain necessary authorizations and permits for all onshore activities, including construction and gravel mining. Construction activities that impact wetlands will also be reviewed by the USACE and permit(s) required under the CWA Section 404 process which will include measures to avoid, minimize, and otherwise mitigate habitat losses. This coordination could require additional ESA consultation(s) to ensure listed species are protected and additional mitigation measures to reduce construction and operation activity impacts to natural resources. At this time, however, it is difficult to precisely estimate the amount or location(s) of development that will actually occur.

- ***The likelihood of one or more large marine oil spills*** – The greatest identified population-level risk to listed species and critical habitat from development and production is from a large marine oil spill. Large (≥ 1,000 barrels) spills could originate from wells, production platforms, and production pipelines. According to BOEM and BSEE, a large OCS oil spill from a loss of well control incident followed by an uncontrolled flow event is extremely rare (2.39 x 10^5/well), and such spills rarely reach large spill volumes. On the other hand, for platforms and pipelines, BOEM and BSEE estimate a 75% chance of one or more large spills occurring over the 77 years of the Scenario, and 25% chance of no spills occurring. Therefore, although it is not part of the proposed action, BOEM and BSEE cannot discount that up to two large spills could potentially occur in a future increment. Therefore, adverse impacts to listed species could result.
- ***Effectiveness of oil spill response and cleanup efforts*** – Were an oil spill to occur a response effort would immediately be implemented and cleanup efforts would begin. Because there have been no large marine oil spills in the Chukchi Sea, the effectiveness of these efforts is unknown. However, efficacy would likely be affected by timing (i.e., presence of ice, broken ice, or open water), location (i.e., proximity to infrastructure, spill response equipment, and ease of logistics), weather and current conditions, and volume of oil spilled. Given these variables, in some cases spill response and cleanup activities may be effective at reducing oil spill impacts to listed species and critical habitat units and in others they may have little beneficial effect to these resources.
- ***The likelihood that a spill would encounter listed species or designated critical habitat*** – In the event that oil is spilled in the marine environment, a number of factors would influence whether listed species or critical habitat would be affected. First, effects would depend in part by the amount of oil spilled, and this would be influenced by the location of infrastructure, technology used to transport oil, the length of pipelines, and other factors. Further, the location of a spill would have a great bearing on the likelihood that listed species would be exposed. For example, the probability of spills reaching concentrations of listed eiders in the LBCHU varies considerably depending on spill location and source. Finally, the seasonal timing of spills would influence the number of individuals present in the region and their location, the efficacy of spill response, and the likelihood that oil would persist long enough in important habitats to cause lasting impacts to the primary constituent elements of critical habitat.

As specific projects are proposed at future incremental steps in this multi-step oil and gas program, additional consultation that closely examines the specific details of the particular projects, (including their scale, location and proposed technology) and carefully evaluates their likely effects will be essential in order to determine the full extent of potential impacts to listed species and critical habitat. It is determined through this analysis that the Proposed Action likely would have the following effects, as described by the ESA, on spectacled and Steller's eiders, designated critical habitat, and polar bear.

Spectacled and Steller's Eiders

There are several impact-producing factors that could affect listed eiders. Some of these (vessel/drilling/aircraft noise, physical presence, and authorized discharges and small spills) would have minimal effects because birds typically avoid areas of industrial activity. Industrial activities are not anticipated to occur in critical habitats, such as the LBCHU or the spring lead system. There are brief periods of construction activity that have localized, short-term effects. The greatest amount of direct harm could come from listed eiders striking drilling rigs, offshore platforms, and support or construction vessels. While the marine and coastal bird:vessel encounters are estimated to exceed a thousand marine and coastal birds during several periods, only a portion of these are seaducks and an even smaller proportion of these are anticipated to be listed eiders. Platforms are obstacles to birds in the marine environment and are a long-term source of bird mortality. A major impact is anticipated to occur where exploration drilling coincides with a large number of offshore production platforms. Once exploration drilling ceases, impacts are reduced, with lower levels of effects.

Toxics contamination, and small oil spills may adversely affect listed eiders at the individual level. Increased collisions, increased predation as a result of anthropogenic influences on predator population size or distribution, increased subsistence hunting as a result of new roads, and large spills and toxic constamination, should they occur, could potentially lead to population-level effects although based on the best available data at this time, this is unlikely.

Habitat loss and disturbance in, and displacement from, preferred habitats may also adversely affect listed eiders. In both the marine and terrestrial environments, some habitat could be completely and permanently lost when structures, excavation, or fill render the habitat unusable. Additionally, the capability of immediately adjacent habitat to support eiders may be completely or partially compromised by nearby structures and the associated human activity. Long term operation of pipelines necessitates access along the route, and this access brings disturbance that could displace nesting birds away from the pipeline corridor. The width of this zone of influence remains unknown, and it is also unknown whether eiders are simply displaced from this zone (presumably at compromised fitness) or continue to use it but possibly at reduced fitness. The impact of habitat loss and disturbance/displacement on listed eiders could vary substantially, from virtually none to potentially significant at the population level, depending on location and nature of the infrastructure and activity. Disturbance and displacement in the marine environment could have significant impacts if there is repeated or prolonged vessel and aircraft traffic in the spring lead system while birds occupy this area (prior to 10 June), in the central LBCHU, or in the western LBCHU, but this is unlikely. In the terrestrial environment, significant impacts could occur if landfall, storage pads, pipelines, pump stations, and roads are placed in important nesting habitat. Because we do not anticipate significant construction in relatively dense nesting habitat near Barrow, Steller's eider would have relatively lower anticipated impacts because of their nesting habitats and population size.

The level of potential mortality to listed eiders, combined with habitat loss and long-term disturbances from pipeline corridor maintenance for the entire Scenario are likely to adversely affect listed eiders. The impacts are expected to have long-lasting changes in the resource's function in the ecosystem. Spectacled eiders could be the most impacted of the listed species, with direct and indirect effects to nesting habitats as well as likely direct and indirect mortality to adult and subadult birds from vessel and other structure encounters.

The potential level of mortality to these species, combined with habitat loss and long-term disturbances from pipeline corridor maintenance for the entire Scenario may affect, and are anticipated to adversely affect, threatened and endangered birds, especially the spectacled eider, but not likely to threaten the continued existence of the species. Further incremental consultation would be necessary at the time development and production plans are proposed.

5.4.2.1. Ledyard Bay Critical Habitat Unit

No LS 193 leases exist in the LBCHU and therefore no direct impacts are expected; the only impacts anticipated may be those associated with traversing vessels and/or oil spills. Should burying pipelines through the LBCHU be proposed, it would disturb the benthos and the PCEs of the marine benthic community but this is likely a short term effect, as benthos will likely recolonize the area. Activities would have neglible to low anticipated impacts and are not expected to result in a permanent adverse modification or diminish the function and conservation value of the LBCHU for molting spectacled eiders.

5.4.2.2. Polar Bears

Based on current exploration activities and a hypothetical development and production scenario and the current status of the polar bear, the Proposed Action may affect, and is likely to adversely affect polar bears, but is not likely to threaten the continued existence of the species.Activities associated with development and production would likely occur at lower levels than those for exploration. Duration of development activity is likely to span a period of several years, if production occurs, a production site may be active for several decades. However, only a small proportion of the worldwide population is likely to be impacted. Also, based on the successful management of human-polar bear interactions in existing industrial areas in recent years, largely through mitigation measures in LOAs issued under the MMPA, it is expected that there would be few effects to polar bears from such interactions. There is a reasonable likelihood that the entire action would not violate Section 7(a)(2). Further incremental consultation would be necessary at the time development and production plans are proposed, and more site-specific information is available.

5.4.2.3. Possible Effects from Oil Spills

As noted previously, the factor thought to have the greatest potential to cause population-level impacts to listed species and/or significant impacts to designated critical habitat is a substantial oil spill in the marine environment. In order for spilled oil to actually impact listed species or designated critical habitat, a series of events would have to occur: oil would need to be spilled; oil would need to be spilled in, or transported to, critical habitat or areas where species are present; and spilled oil would have to contact the species of interest or impact the PCEs of designated critical habitat. These impacts range from virtually no impacts where few or no individuals are oiled significant if large volumes of oil reach the LBCHU or areas where large concentrations of listed species are present.

5.4.3. Range of All Possible Effects Collectively

BOEM and BSEE determine that the **possible** effects of the Proposed Action range from negligible to significant. Specifically, the impacts on listed species and designated critical habitat would range from (1) negligible, if exploration and development occur in areas or are managed in ways that minimize oil spill risk and the juxtaposition of infrastructure and activities and important habitats, to (2) potentially problematic if development is proposed in areas that would compromise the ability of the marine or terrestrial environment to support listed species; to (3) potentially significant if development is proposed that produces unmitigated interference to life history requirements of a large number of listed species (e.g., produces a long-term risk of bird:vessel strikes or increased predation), or in the possible, but unlikely, event that one or more oil spills contacts a large number or large proportion of North Slope breeding spectacled or Steller's eiders, results in long-term impacts to the LBCHU, or contacts a significant number of polar bears.

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Leasing Activities Information

MMS

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

Final
Lease Stipulations
Oil and Gas Lease Sale 193
Chukchi Sea
February 6, 2008

Stipulation No. 1. Protection of Biological Resources. If previously unidentified biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

(1) Relocate the site of operations;
(2) Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;
(3) Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or

(4) Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such finding to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

Stipulation No. 2. Orientation Program. The lessee shall include in any exploration plan (EP) or development and production plan (DPP) submitted under 30 CFR 250.211 and 250.241 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the RS/FO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence activities and pertinent mitigation.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Stipulation No. 3. Transportation of Hydrocarbons. Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any Federal, State, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RS/FO.

Stipulation No. 4. Industry Site-Specific Monitoring Program for Marine Mammal Subsistence Resources. A lessee proposing to conduct exploration operations, including ancillary seismic surveys, on a lease within the blocks identified below during periods of subsistence use related to bowhead whales, beluga whales, ice seals, walruses, and polar bears will be required to conduct a site-specific monitoring program approved by the RS/FO, unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with appropriate agencies and co-management organizations, determines that a monitoring program is not necessary. Organizations currently recognized by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) for the co-management of the marine mammals resources are the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Nanuk Commission. The RS/FO will provide the appropriate agencies and co-management organizations a minimum of 30 calendar days, but no longer than 60 calendar days, to review and comment on a proposed monitoring program prior to Minerals Management Service (MMS) approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead and beluga whales, ice seals, walruses, and polar bears are present in the vicinity of lease operations and the extent of behavioral effects on these marine mammals due to these operations. In designing the program, the lessee must consider the potential scope and extent of effects that the type of operation could have on these marine mammals. Experiences relayed by subsistence hunters indicate that, depending on the type of operations, some whales demonstrate avoidance behavior at distances of up to 35 miles. The program must also provide for the following:

(1) Recording and reporting information on sighting of the marine mammals of concern and the extent of behavioral effects due to operations;
(2) Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project and other mandated aerial monitoring programs;
(3) Inviting a local representative, to be determined by consensus of the appropriate co-management organizations, to participate as an observer in the monitoring program;
(4) Submitting daily monitoring results to the RS/FO;
(5) Submitting a draft report on the results of the monitoring program to the RS/FO within 90 days following the completion of the operation. The RS/FO will distribute this draft report to the appropriate agencies and co-management organizations;
(6) Allowing 30 days for independent peer review of the draft monitoring report; and
(7) Submitting a final report on the results of the monitoring program to the RS/FO within 30 days after the completion of the independent peer review. The final report will include a discussion of the results of the peer review of the draft report. The RS/FO will distribute this report to the appropriate agencies and co-management organizations.

The RS/FO may extend the report review and submittal timelines if the RS/FO determines such an extension is warranted to accommodate extenuating circumstances.

The lessee will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for bowhead whales. The lessee may be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for other co-managed marine mammal resources. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the appropriate agencies and co-management resource organizations. The results of these peer reviews will be provided to the RS/FO for consideration in final MMS approval of the monitoring program and the final report, with copies to the appropriate agencies and co-management organizations.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from NMFS and/or FWS, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. The lessee must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and must provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NMFS and/or FWS and will advise the lessee if the LOA or IHA will meet these requirements.

The MMS, NMFS, and FWS will establish procedures to coordinate results from site-specific surveys required by this stipulation and the LOA's or IHA's to determine if further modification to lease operations are necessary.

This stipulation applies to the following blocks:

NR02-06, Chukchi Sea:
6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey:
6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert
6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island
6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West
6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal
6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow
6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright
6002-6006, 6052, 6053

NS04-08, (Unnamed)
6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

This stipulation applies during the time periods for subsistence-harvesting described below for each community.

Subsistence Whaling and Marine Mammal Hunting Activities by Community

Barrow: Spring bowhead whaling occurs from April to June; Barrow hunters hunt from ice leads from Point Barrow southwestward along the Chukchi Sea coast to the Skull Cliff area. Fall whaling occurs from August to October in an area extending from approximately 10 miles west of Barrow to the east side of Dease Inlet. Beluga whaling occurs from April to June in the spring leads between Point Barrow and Skull Cliff; later in the season, belugas are hunted in open water around the barrier islands off Elson Lagoon. Walrus are harvested from June to September from west of Barrow southwestward to Peard Bay. Polar bear are hunted from October to June generally in the same vicinity used to hunt walrus. Seal hunting occurs mostly in winter, but some open-water sealing is done from the Chukchi coastline east as far as Dease Inlet and Admiralty Bay in the Beaufort Sea.

Wainwright: Bowhead whaling occurs from April to June in the spring leads offshore of Wainwright, with whaling camps sometimes as far as 10 to 15 miles from shore. Wainwright hunters hunt beluga whales in the spring lead system from April to June but only if no bowheads are in the area. Later in the summer, from July to August, belugas can be hunted along the coastal lagoon systems. Walrus hunting occurs from July to August at the southern edge of the retreating pack ice. From August to September, walrus can be hunted at local haulouts with the focal area from Milliktagvik north to Point Franklin. Polar bear hunting occurs primarily in the fall and winter around Icy Cape, at the headland from Point Belcher to Point Franklin, and at Seahorse Island.

Point Lay: Because Point Lay's location renders it unsuitable for bowhead whaling, beluga whaling is the primary whaling pursuit. Beluga whales are harvested from the middle of June to the middle of July. The hunt is concentrated in Naokak and Kukpowruk Passes south of Point Lay where hunters use boats to herd the whales into the shallow waters of Kasegaluk Lagoon where they are hunted. If the July hunt is unsuccessful, hunters can travel as far north as Utukok Pass and as far south as Cape Beaufort in search of whales. When ice conditions are favorable, Point Lay residents hunt walrus from June to August along the entire length of Kasegaluk Lagoon, south of Icy Cape, and as far as 20 miles offshore. Polar bear are hunted from September to April along the coast, rarely more than 2 miles offshore.

Point Hope: Bowhead whales are hunted from March to June from whaling camps along the ice edge south and southeast of the point. The pack-ice lead is rarely more than 6 to 7 miles offshore. Beluga whales are harvested from March to June in the same area used for the bowhead whale hunt. Beluga whales can also be hunted in the open water later in the summer from July to August near the southern shore of Point Hope close to the beaches, as well as areas north of the point as far as Cape Dyer. Walruses are harvested from May to July along the southern shore of the point from Point Hope to Akoviknak Lagoon. Point Hope residents hunt polar bears primarily from January to April and occasionally from October to January in the area south of the point and as far out as 10 miles from shore.

This stipulation will remain in effect until termination or modification by the Department of the Interior after consultation with appropriate agencies.

Stipulation No. 5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Marine Mammal Subsistence-Harvesting Activities. Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities. This stipulation applies to exploration, development, and production operations on a lease within the blocks identified below during periods of subsistence use related to bowhead whales, beluga whales, ice seals, walruses, and polar bears. The stipulation also applies to support activities, such as vessel and aircraft traffic, that traverse the blocks listed below or Federal waters landward of the sale during periods of subsistence use regardless of lease location. Transit for human safety emergency situations shall not require adherence to this stipulation.

This stipulation applies to the following blocks:

NR02-06, Chukchi Sea:
6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey:
6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert
6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island
6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West
6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal
6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow
6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright
6002-6006, 6052, 6053

NS04-08, (Unnamed)
6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

Prior to submitting an exploration plan or development and production plan (including associated oil-spill response plans) to the MMS for activities proposed during subsistence-use critical times and locations described below for bowhead whale and other marine mammals, the lessee shall consult with the North Slope Borough, and with directly affected subsistence communities (Barrow, Point Lay, Point Hope, or Wainwright) and co-management organizations to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures that could be implemented by the operator to prevent unreasonable conflicts. Organizations currently recognized by the NMFS and the FWS for the co-management of the marine mammals resources are the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Nanuk Commission. Through this consultation, the lessee shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement, to assure that exploration, development, and production activities are compatible with whaling and other marine mammal subsistence hunting activities and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The lessee shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative affects. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The RS/FO shall send a copy of the exploration plan or development and production plan (including associated oil-spill response plans) to the directly affected communities and the appropriate co-management organizations at the time the plans are submitted to the MMS to allow concurrent review and comment as part of the plan approval process.

In the event no agreement is reached between the parties, the lessee, NMFS, FWS, the appropriate co-management organizations, and any communities that could be directly affected by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the parties to specifically address the conflict and attempt to resolve the issues. The RS/FO will invite appropriate parties to a meeting if the RS/FO determines such a meeting is warranted and relevant before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Activities on a lease may be restricted if the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities.

In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts.

Subsistence-harvesting activities occur generally in the areas and time periods listed below.

<u>Subsistence Whaling and Marine Mammal Hunting Activities by Community</u>

Barrow: Spring bowhead whaling occurs from April to June; Barrow hunters hunt from ice leads from Point Barrow southwestward along the Chukchi Sea coast to the Skull Cliff area; fall whaling occurs from August to October in an area extending from approximately 10 miles west of Barrow to the east side of Dease Inlet. Beluga whaling occurs from April to June in the spring leads between Point Barrow and Skull Cliff; later in the season, belugas are hunted in open water around the barrier islands off Elson Lagoon. Walrus are harvested from June to September from west of Barrow southwestward to Peard Bay. Polar bear are hunted from October to June generally in the same vicinity used to hunt walruses. Seal hunting occurs mostly in winter, but some open-water sealing is done from the Chukchi coastline east as far as Dease Inlet and Admiralty Bay in the Beaufort Sea.

Wainwright: Bowhead whaling occurs from April to June in the spring leads offshore of Wainwright, with whaling camps sometimes as far as 10 to 15 miles from shore. Wainwright hunters hunt beluga whales in the spring lead system from April to June but only if no bowheads are in the area. Later in the summer, from July to August, belugas can be hunted along the coastal lagoon systems. Walrus hunting occurs from July to August at the southern edge of the retreating pack ice. From August to September, walruses can be hunted at local haulouts with the focal area from Milliktagvik north to Point Franklin. Polar bear hunting occurs primarily in the fall and winter around Icy Cape, at the headland from Point Belcher to Point Franklin, and at Seahorse Island.

Point Lay: Because Point Lay’s location renders it unsuitable for bowhead whaling, beluga whaling is the primary whaling pursuit. Beluga whales are harvested from the middle of June to the middle of July. The hunt is concentrated in Naokak and Kukpowruk Passes south of Point Lay where hunters use boats to herd the whales into the shallow waters of Kasegaluk Lagoon where they are hunted. If the July hunt is unsuccessful, hunters can travel as far north as Utukok Pass and as far south as Cape Beaufort in search of whales. When ice conditions are favorable, Point Lay residents hunt walruses from June to August along the entire length of Kasegaluk Lagoon, south of Icy Cape, and as far as 20 miles offshore. Polar bears are hunted from September to April along the coast, rarely more than 2 miles offshore.

Point Hope: Bowhead whales are hunted from March to June from whaling camps along the ice edge south and southeast of the point. The pack-ice lead is rarely more than 6 to 7 miles offshore. Beluga whales are harvested from March to June in the same area used for the bowhead whale hunt. Beluga whales can also be hunted in the open water later in the summer from July to August near the southern shore of Point Hope close to the beaches, as well as areas north of the point as far as Cape Dyer. Walruses are harvested from May to July along the southern shore of the point from Point Hope to Akoviknak Lagoon. Point Hope residents hunt polar bears primarily from January to April and occasionally from October to January in the area south of the point and as far out as 10 miles from shore.

Stipulation No. 6. Pre-Booming Requirements for Fuel Transfers. Fuel transfers (excluding gasoline transfers) of 100 barrels or more will require pre-booming of the fuel barge(s). The fuel barge must be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a fuel spill. The lessee's oil spill response plans must include procedures for the pre-transfer booming of the fuel barge(s)**.**

Stipulation No. 7. Measures to Minimize Effects to Spectacled and Steller's Eiders During Exploration Activities. This stipulation will minimize the likelihood that spectacled and Steller's eiders will strike drilling structures or vessels. The stipulation also provides additional protection to eiders within the blocks listed below and Federal waters landward of the sale area, including the Ledyard Bay Critical Habitat Area, during times when eiders are present.

(A) General conditions: The following conditions apply to all exploration activities.

(1) An EP must include a plan for recording and reporting bird strikes. All bird collisions (with vessels, aircraft, or drilling structures) shall be documented and reported within 3 days to MMS. Minimum information will include species, date/time, location, weather, identification of the vessel, and aircraft or drilling structure involved and its operational status when the strike occurred. Bird photographs are not required, but would be helpful in verifying species. Lessees are advised that the FWS does not recommend recovery or transport of dead or injured birds due to avian influenza concerns.

(2) The following conditions apply to operations conducted in support of exploratory and delineation drilling.

(a) Surface vessels (e.g., boats, barges) associated with exploration and delineation drilling operations should avoid operating within or traversing the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, to the maximum extent practicable. If surface vessels must traverse this area during this period, the surface vessel operator will have ready access to wildlife hazing equipment (including at least three *Breco* buoys or similar devices) and personnel trained in its use; hazing equipment may located onboard the vessel or on a nearby oil spill response vessel, or in Point Lay or Wainwright. Lessees are required to provide information regarding their operations within the area upon request of MMS. The MMS may request information regarding number of vessels and their dates of operation within the area.

(b) Except for emergencies or human/navigation safety, surface vessels associated with exploration and delineation drilling operations will avoid travel within the Ledyard Bay Critical Habitat Area between July 1 and November 15. Vessel travel within the Ledyard Bay Critical Habitat Area for emergencies or human/navigation safety shall be reported within 24 hours to MMS.

(c) Aircraft supporting drilling operations will avoid operating below 1,500 feet above sea level over the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, or the Ledyard Bay Critical Habitat Area between July 1 and November 15, to the maximum extent practicable. If weather prevents attaining this altitude, aircraft will use pre-designated flight routes. Pre-designated flight routes will be established by the lessee and MMS, in collaboration with the FWS, during review of the EP. Route or altitude deviations for emergencies or human safety shall be reported within 24 hours to MMS.

(B) Lighting Protocols. The following lighting requirements apply to activities conducted between April 15 and November 15 of each year.

(1) Drilling Structures: Lessees must adhere to lighting requirements for all exploration or delineation drilling structures so as to minimize the likelihood that migrating marine and coastal birds will strike these structures. Lessees are required to implement lighting requirements aimed at minimizing the radiation of light outward from exploration or delineation drilling structures to minimize the likelihood that birds will strike those structures. These requirements establish a coordinated process for a performance-based objective rather than pre-determined prescriptive requirements. The performance-based objective is to minimize the radiation of light outward from exploration/delineation structures while operating on a lease or if staged within nearshore Federal waters pending lease deployment.

Measures to be considered include but need not be limited to the following:

- Shading and/or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;
- Types of lights;
- Adjustment of the number and intensity of lights as needed during specific activities;
- Dark paint colors for selected surfaces;
- Low-reflecting finishes or coverings for selected surfaces; and
- Facility or equipment configuration.

Lessees are encouraged to consider other technical, operational, and management approaches that could be applied to their specific facilities and operations to reduce outward light radiation. Lessees must provide MMS with a written statement of measures that will be or have been taken to meet the lighting objective, and must submit this information with an EP when it is submitted for regulatory review and approval pursuant to 30 CFR 250.203.

(2) Support Vessels: Surface support vessels will minimize the use of high-intensity work lights, especially when traversing the listed blocks and federal waters between the listed blocks and the coastline. Exterior lights will be used only as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather (such as rain or fog), otherwise they will be turned off. Interior lights and lights used during navigation could remain on for safety.

For the purpose of this stipulation, the listed blocks are as follows:

NR02-06, Chukchi Sea:
6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey:
6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert
6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island
6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West
6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal
6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow
6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright
6002-6006, 6052, 6053

NS04-08, (Unnamed)
6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

Nothing in this stipulation is intended to reduce personnel safety or prevent compliance with other regulatory requirements (e.g., U.S. Coast Guard or Occupational Safety and Health Administration) for marking or lighting of equipment and work areas.

Existing Geological and Geophysical Permit Stipulations for Oil and Gas Activities in Alaska OCS Waters

Programmatic Environmental Assessment (2006)
Arctic Ocean Outer Continental Shelf Seismic Surveys
Appendix A

Minerals Management Service
Alaska OCS Region
OCS/EIS/EA MMS 2006-038

STIPULATIONS

From http://www.mms.gov/alaska/re/permits/stips1-5/htm

In the performance of any operations under the Permit and Agreement for Outer Continental Shelf Exploration, the Permittee shall comply with the following Stipulations:

1. As part of the requirements of 30 CFR 251.7-3, the Permittee shall submit to the Regional Supervisor, Resource Evaluation (hereinafter referred to as the Supervisor) within 30 days after the completion of the survey authorized under this Permit and Agreement a map at the same scale as that used ordinarily for such maps and showing the coordinates of latitude and longitude. In addition, each Permittee shall submit one (1) one-half inch, nine-track, final edited navigation tape of all locations in latitude and longitude degrees. The tape is to be in an ASCII or EBCDIC 1600 BPI format with fixed record length and fixed block size. Record length, block size, density and whether the tape is ASCII or EBCDIC must be on a label affixed to the tape. The label must also specify the geodetic reference system (NAD27 or NAD83) used. A printed tape listing and format statement are to be included with the tape.

2. As part of the requirements of 30 CFR 251.3-5, if any operation under this Permit and Agreement is to be conducted in a leased area, the Permittee shall take all necessary precautions to avoid interference with operations on the lease and damage to existing structures and facilities. The lessee (or operator) of the leased area will be notified by letter before the Permittee enters the leased area or commences operations, and a copy of the letter will be sent to the Supervisor executing this Permit and Agreement.

3. (a) Solid or liquid explosives shall not be used except pursuant to written authorization from the Supervisor. Requests for the use of such explosives must be made in writing, giving the size of charges to be used, the depth at which they are to be suspended or buried, and the specific precautionary methods proposed for the protection of fish, oysters, shrimp, and other aquatic life, wildlife, or other natural resources.

   (b) The following provisions are made applicable when geophysical exploration on the Outer Continental Shelf using explosives is approved:

      (i) Each explosive charge will be permanently identified by markings so that unexploded charges may be positively traced to the Permittee and to the specific field party of the Permittee responsible for the explosive charge.

      (ii) The placing of explosive charges on the seafloor is prohibited. No explosive charges shall be detonated nearer to the seafloor than five (5) feet.

      (iii) No explosives shall be discharged within one thousand (1000) feet of any boat not involved in the survey.

4. Any serious accident, personal injury, or loss of property shall be immediately reported to the Supervisor.

5. All pipes, buoys, and other markers used in connection with work shall be properly flagged and lighted according to the navigation rules of the U.S. Corps of Engineers and the U.S. Coast Guard.

6. If the Permittee discovers any archaeological resource during geological and geophysical activities, the Permittee shall report the discovery immediately to the Supervisor. The Permittee shall make every reasonable effort to preserve the archaeological resource until the Supervisor has told the Permittee how to protect it.

7. In addition to the general provisions above, the following special provisions shall apply:

(a) This permit is applicable only to that portion of the program involving Federal OCS lands seaward of the submerged lands of the State of Alaska.

(b) The Permittee shall, on request of the Supervisor, furnish quarters and transportation for a Federal representative(s) or other designated observer to inspect operations.

(c) Operations shall be conducted in a manner to assure that they will not cause pollution, cause undue harm to aquatic life, create hazardous or unsafe conditions or unreasonably interfere with other uses of the area. Any difficulty encountered with other users of the area or any conditions which cause undue harm to aquatic life, pollution, or could create a hazardous or unsafe condition as a result of the operations under this permit shall be reported to the Supervisor. Serious or emergency conditions shall be reported without delay.

(d) A final summary report (one copy) shall be submitted to this office within 30 days of completion or cessation of operations.

This report shall include:

(i) Program commencement date.

(ii) Program completion date.

(iii) Field effort in crew weeks (actual work time based on 168-hour weeks).

(iv) Line miles of surveys completed.

(v) Summary of incidents or accidents from paragraph 4.

(vi) Date or reasonable estimation of date when data will be available for inspection or selection.

(e) The Permittee shall notify the Commander, U.S. Coast Guard and the Commander, 3rd Fleet as to the approximate time and place the work is to be conducted and to keep them informed:

Commander, U.S. Coast Guard
17th Coast Guard District
Aids to Navigation Branch
P.O. Box 25517
Juneau, AK 99801
(907)586-7365

COMTHIRD
Pearl Harbor, HI
96860
(808)472-8242

8. Information to the Permittee

(a) Operations authorized under permit are subject to the Marine Mammal Protection Act of 1972 as amended (16 U.S.C. 1361 et seq), the Endangered Species Act as amended (16 U.S.C. 1531 et seq), regulations found in 50 CFR Part 18 (U.S. Fish and Wildlife Service), and 50 CFR Part 228 (National Marine Fisheries Service). Special attention should be given to the prohibition of the "taking" of marine mammals. "Taking" means to harass, hunt, capture, collect, or kill or attempt to harass, hunt, capture, collect, or kill any marine mammal. National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (F&WS) regulations allow, under certain conditions, the incidental taking by harassment of specific marine mammals. Such a taking of marine mammals is controlled through Letters of Authorization issued by NMFS or F&WS. Permittees are advised to consult the appropriate agencies regarding these laws and regulations. Further information may be obtained from

Regional Director
U.S. Fish and Wildlife Service
Alaska Region
1011 East Tudor Road
Anchorage, Alaska 99503
telephone (907) 786-3542

National Marine Fisheries Service
222 West 7th Avenue, Box 43
Anchorage, Alaska 99513
telephone (907) 271-5006

(b) It is recommended that you contact the appropriate Regional Supervisor, Commercial Fish Division, Alaska Fish and Game Department, or the National Marine Fisheries Service for information on the fisheries and fishing activities in the proposed area of operations in order to minimize potential conflict between your activities and fishing activities. We are attaching a list of the Fish and Game offices with addresses and telephone numbers and a map showing the boundaries of the fishing districts for your convenience.

In addition to the standard stipulations above, the following stipulation has been included in G&G permits for seismic surveys in the Alaska OCS Region since the 1980's:

- Operators must maintain a minimum spacing of 15 miles between the seismic source vessels for separate surveys. The MMS must be notified by means of the weekly report whenever shut down of operations occurs to maintain this minimum spacing.

THE FOLLOWING DOCUMENT PROVIDES INFORMATION TO THE PERMITTEE ON THE ENDANGERED SPECIES ACT OF 1973, AS IT MIGHT APPLY WHEN CONDUCTING FIELD OPERATIONS.

The Endangered Species Act prohibits harassment of endangered and threatened species whether the harassment occurs through an intentional or negligent act or omission. Harassment refers to conduct of activities that disrupt an animal's normal behavior or cause a significant change in the activity of the affected animal. In many cases the effect of harassment is readily detectible: a whale may rapidly dive or flee from an intruder to avoid the source of disturbance. Other instances of harassment may be less noticeable to an observer but will still have a significant effect on endangered whales.

The Permittee must be prepared to take all reasonable and necessary measures to avoid harassing or unnecessarily disturbing endangered whales. In this regard, the Permittee should be particularly alert to the effects of boat and airplane or helicopter traffic on whales.

In order to ensure that the Permittee may derive maximum benefits from their operations at a minimum cost to the health and well being of endangered whales, the following guidelines are offered to help avoid potential harassment of endangered whales:

(1) (a) Vessels and aircraft should avoid concentrations or groups of whales. Operators should, at all times, conduct their activities at a maximum distance from such concentrations of whales. Under no circumstances, other than an emergency, should aircraft be operated at an altitude lower than 1,000 feet when within 500 lateral yards of groups of whales. Helicopters may not hover or circle above such areas or within 500 lateral yards of such areas.

(b) When weather conditions do not allow a 1,000-foot flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the 1,000-foot altitude stipulated above. However, when aircraft are operated at altitudes below 1,000 feet because of weather conditions, the operator must avoid known whale concentration areas and should take precautions to avoid flying directly over or within 500 yards of groups of whales.

(2) When a vessel is operated near a concentration of whales, the operator must take every precaution to avoid harassment of these animals. Therefore, vessels should reduce speed when within 300 yards of whales and those vessels capable of steering around such groups should do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group.

(3) Vessel operators should avoid multiple changes in direction and speed when within 300 yards of whales. In addition, operators should check the waters immediately adjacent to a vessel to ensure that no whales will be injured when the vessel's propellers (or screws) are engaged.

(4) Small boats should not be operated at such a speed as to make collisions with whales likely. When weather conditions require, such as when visibility drops, vessels should adjust speed accordingly to avoid the likelihood of injury to whales.

When any Permittee becomes aware of the potentially harassing effects of operations on endangered whales, or when any Permittee is unsure of the best course of action to avoid harassment of endangered whales, every measure to avoid further harassment should be taken until the National Marine Fisheries Service is consulted for instructions or directions. However, human safety will take precedence at all times over the guidelines and distances recommended herein for the avoidance of disturbance and harassment of endangered whales.

Permittees are advised that harassment of endangered whales may be reported to the National Marine Fisheries Service. For further information contact the National Marine Fisheries Service, Federal Building, Room C-554, Anchorage, Alaska, 99513, telephone (907) 271-5006.

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