Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2008-0055

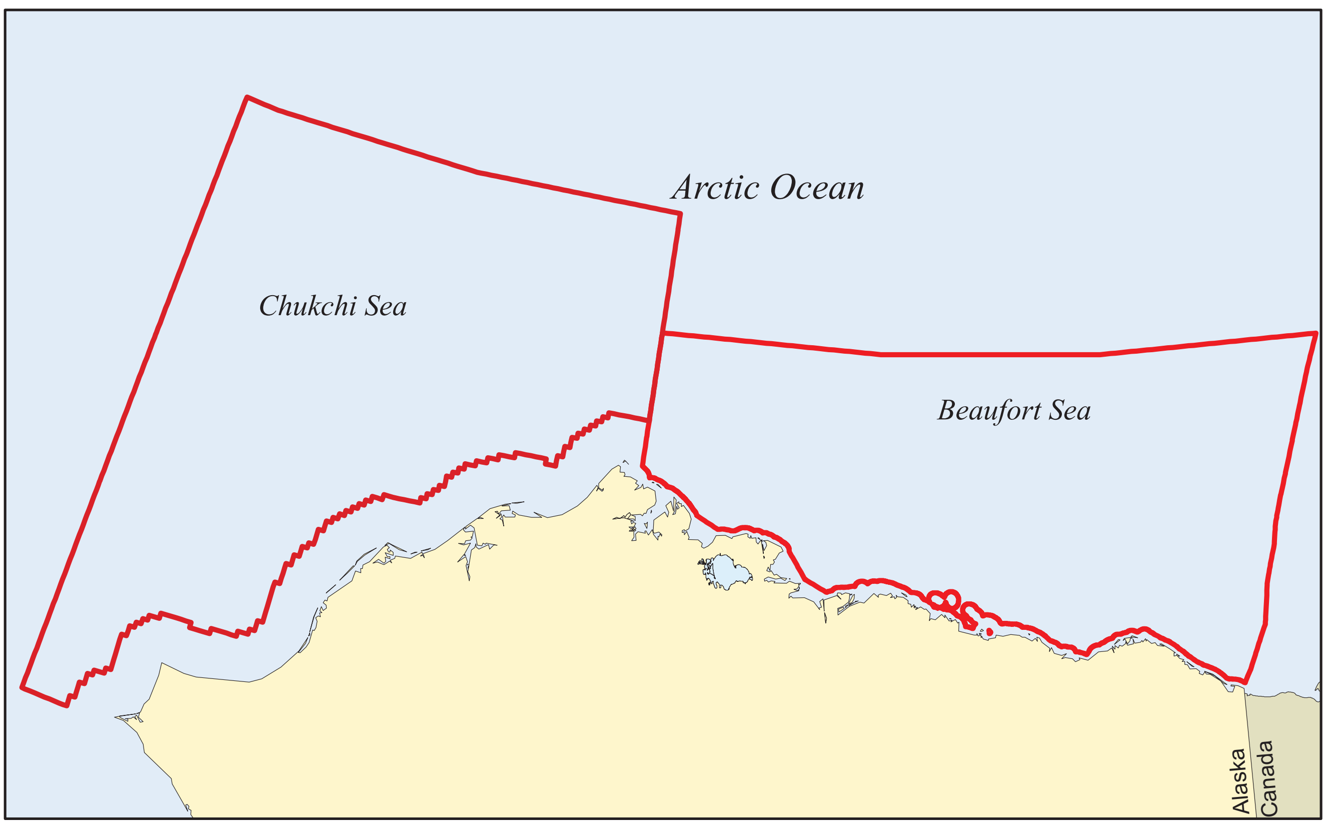
Beaufort Sea and Chukchi Sea Planning Areas

Oil and Gas Lease Sales 209, 212, 217, and 221

Draft Environmental
Impact Statement

Volume III

Chapters 4.5 through 5, Bibliography



U.S. Department of the Interior
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Chapter 4.5 - Environmental Consequences Chukchi Sea
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Bibliography

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ACRONYMS

AAC	Alaska Administrative Code
ABWC	Alaska Beluga Whale Committee
ACC	Alaska Coastal Current
ACIA	Arctic Climate Impact Assessment
ACMP	Alaska Coastal Management Program
ACP	Arctic Coastal Plain
ACS	Alaska Clean Seas
ACW	Alaska Coastal Water
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AES	ASRC Energy Services
AEWC	Alaska Eskimo Whaling Commission
AGIA	Alaska Gas Inducement Act
AGL	above ground level
AGS	Alaska Gas System
AHRS	Alaska Heritage Resource Survey
AI/AN	American Indian and Alaskan Native
AIS	aquatic invasive species
AIW	Atlantic Intermediate Water
AMMP	Adaptive Management and Mitigation Plan
ANGTS	Alaska Natural Gas Transportation System
ANHB	Alaska Native Health Board
ANILCA	Alaska National Interest Land Conservation Act
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Areas
ANMC	Alaska Native Medical Center
ANTHC	Alaska Native Tribal Health Consortium
ANWR	Arctic National Wildlife Refuge
AO	Arctic Oscillation
AOGMC	atmosphere-ocean general circulation models
APD	Application for Permit to Drill
APF	Alaska Permanent Fund
Area ID	Area Identification
ARBE	Arctic Region Biological Evaluation
ARRT	Alaska Regional Response Team
ASL	above sea level
ASRC	Arctic Slope Regional Corporation
ATV	all-terrain vehicle
AWIC	Arctic Women in Crisis
bbl	barrel(s)
Bbbl	billion barrels (of oil)
Bcf	billion cubic feet (of gas)
BE	Biological Evaluation
BLM	Bureau of Land Management
BO	Biological Opinion
BOD	biological oxygen demand
BOE	barrels of oil energy equivalent
B.P.	Before Present
BP	British Petroleum
bpd	barrels per day
BPXA	BP Exploration (Alaska), Inc.
BRFSS	Behavioral Risk Factor Surveillance Study
BS	Boundary Segment
BSU	Barrow Service Unit
BTEX	benzene, toluene, ethylbenzene, and xylene
BWASP	Bowhead Whale Aerial Survey Program
CAA	Clean Air Act, also conflict avoidance agreement
CAH	Central Arctic Caribou Herd
Call	Call for Information and Nominations
CANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Areas
CDC	Centers for Disease Control
CDFO	Canadian Department of Fisheries and Oceans
CBD	Center for Biological Diversity
CDFO	Canadian Department of Fisheries and Oceans
CEQ	Council on Environmental Quality
CER	Categorical Exclusion Review
CERCLA	Comprehensive Environmental Response Compensation and Liability Act of 1980
CFC	chlorofluorocarbons
CFR	Code of Federal Regulations
CH_4	methane
CHAP	Community Health Aide Program
CI	confidence interval
CIDS	concrete island drilling system
CIP	Capital Improvements Project
CITES	Convention on the International Trade in Endangered Species
cm	centimeter(s)
cm/sec.	centimeter(s) per second
CI	confidence interval
CIAP	Coastal Impact Assistance Program
CMP	Coastal Management Program
CO	carbon monoxide
COPB	chronic obstructive pulmonary disease
COY	cubs of the year (polar bear)
cP	centipoise (measure of viscosity and emulsification of oil)

CS	Chukchi Sea (population of polar bears)
CSSP	Climate Change Science Program
CWA	Clean Water Act
CYP1A	cytochrome P4501A
CYS	Children & Youth Services
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
dB	decibel(s)
DEW	Defense Early Warning
DHHS	(U.S.) Department of Health and Human Services
DLP	defense of life and property
DM	Department Manual
DMT	Delong Mountain Terminal
DOCD	development operations coordination documents
DO&G	Div. of Oil and Gas (State)
DPP	Development and Production Plan
DWM	Department of Wildlife Management (North Slope Borough)
E	evapotranspiration
EA	Environmental Assessment
EEZ	U.S. Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
ENP	Eastern North Pacific stock of gray whales
EO	Executive Order
E&P	Exploration and Production
EP	Exploration Plan
EPA	Environmental Protection Agency
ERA	environmental resource area(s)
ERAP	Emergency Response Action Plan
ERL	Effects Range-Low
ERM	Effects Range-Median
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index
ESP	Environmental Studies Program
EVOS	*Exxon Valdez* oil spill
EWC	(Alaska) Eskimo Walrus Commission
FAS	fetal alcohol syndrome
FDA	Food and Drug Administration
FLIR	forward looking infrared (videotape images)
FMP	Fishery Management Plan
FNOS	Final Notice of Sale
FOSC	Federal On-Scene Coordinator
FR	*Federal Register*
FSB	Federal Subsistence Board
ft	foot/feet
ft^3	cubic feet/foot
FY	Fiscal Year
G&G	Geological and Geophysical permit
g/m^2	gram(s) per square meter
gal	gallon(s)
GIS	Geographic Information System
GLS	grouped land segments
GPR	ground-penetrating radar
GWP	global warming potential
HAPs	hazardous air pollutants
HEC	Health Effect Category
Hz	Hertz
IAP	Integrated Activity Plan
IBHS	Integrated Behavioral Health Services
ICAS	Inupiat Community of the Arctic Slope
IDs	identification numbers
IHA	Incidental Harassment Authorization
in	inch(es)
in^3	cubic inch(es)
IPCC	Intergovernmental Panel on Climate Change
I/SS	Ice/Sea Segment(s)
ISC	Ice Seal Commission
ITL	Information to Lessees
ITM	Information Transfer Meeting
ITTC	Inupiat Teens Taking Control
IUCN/SSG	World Conservation Union/Species Survival Group
IV	intravenous
IWC	International Whaling Commission
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
km^3	cubic kilometers
kn	knot(s)
kPa	kiloPascal(s)
KyBP	thousand years Before Present
L	liter(s)
lat.	latitude
lb	pound(s)
LBCHA	Ledyard Bay Critical Habitat Area
LC_{50}	96-hour lethal concentration for 50% of test organisms
LHW	Lower Halocine Water
LME	large marine ecosystems
LMR	Land Management Regulation
LMW	low-molecular-weight (hydrocarbons)
LNG	liquefied natural gas
LOA	Letter of Authorization
long.	longitude
LOSC	Local On-Scene Coordinator
LS	land segment(s)

m	meter(s)
m/sec.	meter(s) per second
m^3/sec.	cubic meter(s) per second
MAD	Mutual Aid Agreement
Mcf	million cubic feet
mg/kg	milligram(s)/kilogram(s)
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
mm	millimeter(s)
MMbbl	million barrels (of oil)
MMC	Marine Mammal Commission
MMcf	million cubic feet
MMO	marine mammal observer
MMPA	Marine Mammals Protection Act
MMS	Minerals Management Service
MOU	Memorandum of Understanding
mph	miles per hour
MRSA	antibiotic-resistant staph infections
ms	millisecond(s)
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MyBP	million years Before Present
NAAQS	National Ambient Air Quality Standards
NAO	Arctic and North Atlantic Oscillations
NC	Nanuk Commission
NCP	National Contingency Plan
ng/g	nanogram(s) per gram(s)
ng/L	nanogram(s) per liter
NGO	non-Government Organization(s)
NRC	National Research Council
NEPA	National Environmental Policy Act
NISA	National Invasive Species Act of 1996
nmi	nautical mile(s)
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_x	nitrous oxide
NOI	Notice of Intent to Prepare an EIS
NORM	Naturally Occurring Radioactive Materials
NPDES	National Pollution Discharge Elimination System
NPFMC	North Pacific Fisheries Management Council
NPR-A	National Petroleum Reserve - Alaska
NPR-4	Naval Petroleum Reserve No. 4
NRC	National Research Council
NRDC	National Resources Defense Council
NSB	North Slope Borough
NSBCMP	North Slope Borough Coastal Management Plan
NSBMC	North Slope Borough Municipal Code
NSF	National Science Foundation
NTL	Notice to Lessees
NWAB	Northwest Arctic Borough
O_3	ozone
OBC	ocean-bottom cable
OCD	Offshore and Coastal Dispersion
OCS	Outer Continental Shelf
OPA	Oil Pollution Act of 1990
OSCP	Oil-Spill-Contingency Plan
OSRA	Oil-Spill-Risk Analysis (model)
OSRO	oil-spill removal organization
OSRP	oil-spill-response plan
OSRV	Oil Spill Response Vessel
OWM	Oil Weathering Model
P	precipitation
PAC	powdered activated carbon
PAH	polyaromatic hydrocarbons or polynuclear aromatic hydrocarbons (water quality)
PAH	polycyclic aromatic hydrocarbons (fish resources, lower trophic-level organisms)
PBR	potential biological removal
PBSG	Polar Bear Specialist Group
PCBs	polychlorinated biphenyls
PCH	Porcupine Caribou Herd
PDO	Pacific Decadel Oscillation
PHBA	Public Health Baseline Assessment
P.L.	Public Law
PBR	potential biological removal
PBSG	Polar Bear Specialist Group
PEA	Programmatic Environmental Assessment
PHN	Public Health Nursing
$PM_{2.5}$	fine particulates less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
PNOS	Proposed Notice of Sale
POPs	persistent organic pollutants
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PREP	Preparedness for Response Program
PSD	Prevention of Significant Deterioration
PTS	Permanent Threshold Shift
RCRA	Resource Conservation and Recovery Act
rms	root-mean-square
ROD	Record of Decision

ROI	rate of increase (in whale population)
ROP	Required Operating Procedure
RRT	Regional Response Team
RS/FO	Regional Supervisor/Field Operations
SAC	Scientific Advisory Committee
SAP4.6	Synthesis and Assessment Product 4.6
sBSW	summer Bering Sea Water
SBS	Southern Beaufort Sea (population of polar bears)
SCAT	Shoreline Cleanup Assessment Team
SCC	Siberian Coastal Current
SDH	social determinants of health
SDI	South Drilling Island
sec	second(s)
SEL	sound-exposure level
SLiCA	Survey of Living Conditions in the Arctic
SO_2	sulfur dioxide
SOI	Shell Offshore, Inc.
SOSC	State On-Scene Coordinator
SPL	sound-pressure level
SPM	suspended-particulate matter
SSDC	single steel drilling caisson
Sv	Sverdrup(s)
SWZ	Subsistence Whaling Zone
TAGS	Trans-Alaska Gas System
TAPS	Trans-Alaska Pipeline System
TB	tuberculosis
Tcf	trillion cubic feet (of gas)
TCH	Teshekpuk Lake Caribou Herd
Tg	teragrams
TLSA	Teshekpuk Lake Special Area
TLSUA	Teshekpuk Lake Special Use Area
TSS	total suspended solids
TTS	Temporary Threshold Shift
UC	Unified Command
U.S.C.	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USGS `	United States Geological Survey
USSR	United Soviet Socialist Republics
UV	ultraviolet
VOCs	volatile organic compounds
VSMs	vertical support members
WAH	Western Arctic Caribou Herd
wBSW	winter Bering Sea Water
WHB	Western Hudson Bay
WHO	World Health Organization
WIC	Women, Infants, and Children (program)
Y-K Delta	Yukon-Kuskokwim Delta
yd	yard(s)
yd^3	cubic yard(s)
2D	2-dimensional (seismic survey)
3D	3-dimensional (seismic survey)
°C	degrees Celsius
°F	degrees Fahrenheit
$<$	less than
$>$	greater than
$\geq$	greater than or equal to
µg	microgram(s)
µg/g	microgram(s) per gram
µg/kg	microgram(s) per kilogram
$\mu g/m^3$	microgram(s) per cubic meter
µg/L	microgram(s) per liter
µPa	microPascal(s)
~	about
§	section

4.5. Effects Assessments for Chukchi Sea Sales 212 and 221.

4.5.1. Alternative 1, Chukchi Sea No Lease Sale.

Under this alternative (no-action alternative), a proposed Chukchi Sea OCS lease sale, as scheduled in the 2007-2012 5-Year Program, would not be approved.

The cumulative effects analyses below evaluate the past, present, and reasonably foreseeable activities to environmental and sociocultural resources in the Beaufort Sea areas, without any of the proposed actions or alternatives. The analysis includes effects from Federal, State, and local activities, both offshore and onshore activities and both oil and gas-related and non-oil and gas related. The cumulative analysis includes consideration of the influence of dynamic climate and anticipated change in the environment. The effects are addressed quantitatively to the degree possible, using known types, levels, and trends of both oil and gas activities and non-oil and gas activities. Impacts that cannot be estimated quantitatively are described qualitatively.

The analysis below does not include the incremental effects of any of the alternatives, and so presents the cumulative effects that are reasonably likely to occur whether or not a lease sale analyzed in this EIS is held. In the cumulative analyses under the action alternatives (Alternatives 2-6), the incremental effects of the each alternative are evaluated. The potential difference in anticipated level of cumulative effects to environmental resources under each action alternative is then compared to anticipated level of effects in the cumulative analysis below.

4.5.1.1. Water Quality.

Water quality in the Chukchi Sea will be impacted by a number of ongoing and future activities and events, regardless of any decisions made about proposed Chukchi Sea Sales 212 and 221. This section describes the impacts of reasonably foreseeable future events such as those detailed in Section 4.2, including: construction activities on the coast, activities associated with the Red Dog Mine, pollution, climate change, and offshore operations resulting from Chukchi Sea Sale 193.

The impact levels used throughout this analysis are based on the four-level classification scheme for biological and physical resources outlined in the Cape Wind Energy Project Draft EIS (USDOI, MMS, 2008a). These four impact levels are defined as follows:

- **Negligible** - No measurable impacts.
- **Minor -** Most impacts to the affected resource could be avoided with proper mitigation, or if impacts occur, the affected resource would recover completely without any mitigation once the impacting agent is eliminated.
- **Moderate** - Impacts to the affected resource are unavoidable; the viability of the affected resource is not threatened although some impacts may be irreversible; or the affected resource would recover completely if proper mitigation is applied during the life of the proposed action or proper remedial action is taken once the impacting agent is eliminated.
- **Major** - Impacts to the affected resource are unavoidable; the viability of the affected resource may be threatened; and the affected resource would not fully recover even if proper mitigation is applied during the life of the proposed action or remedial action is taken once the impacting agent is eliminated.

Coastal construction and community development projects can cause adverse effects on water quality. The vegetation typically is cleared from an area in preparation for construction, leading to greater erosion and runoff from the site. Increased amounts of contaminants such as particulate matter, heavy metals, petroleum products, and chemicals are then transported to local streams, estuaries, and bays. Dredging operations to provide gravel for construction projects or to create trenches for pipelines also have detrimental effects on water quality. Dredging disturbs the seafloor, increasing suspended sediment in the water column. The amount of turbidity and size of the plumes would depend on a number of factors, including season and sediment-grain size. The impacts of these activities would be minor, local, and temporary.

Pollution from coastal communities and transportation activities also impacts water quality in the Chukchi Sea. Runoff and disposal of municipal waste can result in increased levels of suspended solids and other pollutants in the water column. These activities could have minor effects in localized areas, but regional effects will be negligible due to dilution.

Vessel traffic contributes to the degradation of water quality through oily discharges, dumping of bilge water, treated sanitary and other wastes, and the leaching of contaminants from antifouling paints, as well as possible increases in turbidity in some areas. Since 1973, discharges incidental to the normal operation of vessels have been excluded from NPDES permitting requirements. A recent court order has revoked 40 CFR § 122.3(a), the regulation excluding these discharges, effective December 19, 2008. Current U.S. Coast Guard regulations related to pollution prevention and discharges for vessels carrying oil, noxious liquid substances, garbage, municipal or commercial waste, and ballast water are found at 33 CFR § 151.

Activities associated with the Red Dog Mine, located approximately 80 km (50 mi) inland, also contribute contaminants to the Chukchi Sea. Red Dog Mine is the largest zinc mine in the world, producing more than one million tons of zinc and lead concentrates annually using conventional open-pit mining, milling, and flotation technologies. Concentrates are shipped to port facilities on the Chukchi Sea, where they are stored before being exported to world markets (ADNR, 2008).

Water quality in the vicinity of the port facility is affected by metals released through spillage of ore concentrates and windblown fugitive dust. Discharges from the Red Dog Port Site are authorized under NPDES permit AK-004064-9 (EPA, 2006a). The permitted discharges include those from sewage treatment and desalinization, concentrate storage building drainage, and industrial storm water. Dust and permitted discharges from the mine site can also be carried to the Chukchi Sea by local rivers and streams.

Airborne pollutants deposited directly on the sea surface or deposited on land and carried to the ocean through runoff can further reduce water quality. Contaminants of interest, which can be transported over very long distances, include: nitrogen and sulfur compounds; persistent organic pollutants (POPs), such as pesticides, polychlorinated biphenyls (PCBs), and PAHs; and trace metals including chromium, arsenic, cadmium, mercury, selenium, copper, zinc, vanadium, and barium (AMAP, 1997; Hanson, 2003).

These contaminants are of particular concern in the Arctic because of the colder temperatures, which allow them to persist in the environment and resist degradation. Although the atmospheric deposition rates of these pollutants in the Arctic is quite low (Gubala et al., 1995), even very low concentrations can cause serious impacts on biological resources because they accumulate in the tissues of organisms and become magnified as they move through the food chain. Spies et al. (2003) found evidence of bioaccumulation of these contaminants in five species of fish in the Beaufort Sea. The effects of atmospheric deposition of pollutants on water quality are minor, though impacts on biological resources could be more severe.

As noted in Section 3.2.5.2, water quality can be affected by climate change mechanisms such as loss of sea ice and changing weather patterns. In addition, climate change can lead to altered water chemistry, including acidification and reduced levels of dissolved oxygen. Increased vessel traffic is also a likely consequence of the loss of sea ice and extended period of open water. Because the magnitudes of the changes in climate are not well known, the severity and extent of the effects on water quality cannot be fully predicted, though the water quality changes would be expected to lead to severe impacts on biological resources. A comprehensive discussion of the effects of climate change is beyond the scope of this document, but water quality would be expected to completely recover if the climate change were reversed.

Previous activities related to oil and gas exploration in the Chukchi Sea have been limited to a few exploratory drilling operations during the early 1990s. Further exploration activities are expected to occur as a result of Chukchi Sea Sale 193, however. The potential impacts on water quality of these operations have been described in the Chukchi Sea Sale 193 EIS (USDOI, MMS, 2007d) and the 2007-2012 5-Year Leasing Program Final EIS (USDOI, MMS, 2007c). These assessments concluded that permitted activities would have minor effects on local water quality, and negligible effects on regional water quality. Increases in turbidity from permitted construction and dredging activities would be temporary, but the effects of permitted discharges would last over the life of the fields. The adverse effects from most oil spills also would be local and temporary, but frequent small spills could result in local, chronic contamination.

Under Section 402 of the CWA, the EPA or authorized States can issue permits for pollutant discharges, or they can refuse to issue such permits if the discharge would create conditions that violate the water-quality standards developed under Section 303 (33 U.S.C. § 1313) of the CWA. The CWA, Section 403 (33 U.S.C. § 1343), also states that no NPDES permit shall be issued for a discharge into marine waters except in compliance with established guidelines.

The general NPDES permit AKG280000 (EPA, 2006b) for the offshore areas of Alaska located in the Beaufort Sea, Chukchi Sea, Hope Basin, and Norton Basin authorizes discharges from oil and gas exploration facilities. The Arctic general permit restricts the seasons of operation, discharge depths and areas of operation, and has monitoring requirements and other conditions. This permit does not apply to development and production facilities, which require individual permits. There are no individual NPDES permits for offshore oil and gas facilities in the Beaufort Sea currently in effect as of October 2008.

Applicable ambient-water quality standards for marine waters of the State of Alaska are (1) total aqueous hydrocarbons in the water column may not exceed 15 µg /L (15 parts per billion [ppb]); (2) total aromatic hydrocarbons in the water column may not exceed 10 µg /L (10 ppb) and (3) surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration (ADEC, 2008). The State of Alaska criterion of a maximum of 15 ppb of total aqueous hydrocarbons in marine waters—about 15 times background concentrations—provides the readiest comparison and is used in this discussion of water quality. This analysis considers 15 ppb to be a chronic criterion and 1,500 ppb—a hundredfold higher level—to be an acute criterion. Hydrocarbons from a large oil spill could exceed the 1,500 ppb acute toxic criterion during the first day of a spill and the 15 ppb chronic criterion for up to a month in an area the size of a small bay.

Conclusion. The level of impact from the combined effects of reasonably foreseeable activities and climate change on water quality in the Chukchi Sea would be minor to moderate.

4.5.1.2. Air Quality.

This section describes impacts that would still occur if the proposed Chukchi Sea Sales 212 and 221 were not held. Air emissions would result from power generation, home heating, motor vehicles, aircraft, and vessels. These emissions have only a very small effect on ambient air quality. On the whole, these activities are not expected to change significantly in the future. There likely would be an increase in vessel activity due to a decrease in sea ice resulting from climate change, but the more stringent standards on marine engines being implemented by EPA should mitigate any potential increases in emissions.

There are no significant industrial emission sources in the Chukchi Sea area. The nearest large source of air emissions is from oil-production activities in the Alpine and Kuparuk units on the North Slope and the Red Dog Mine about 50 mi from the village of Noatuk and about 55 mi inland from the Chukchi Sea. These emissions have a negligible impact on air quality around the Chukchi Sea. New oil development may result from future State leases and Federal lease sales in the National Petroleum Reserve-Alaska (NPR-A). Should any natural gas production occur in the future, there may be air emissions from any related gas processing. Any impacts to Chukchi Sea air quality would be negligible. Any development on potential State leases around the Chukchi Sea area would result in local increases in concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$, and CO. There also would be local sources of gaseous emissions and fugitive dust from construction and maintenance activities associated with both existing and new facilities. Any major emission sources (>250 tons per year) would be subject to the PSD incremental limits for NO_2, SO_2 and PM_{10}. Air quality impacts would be minor.

Major new emission sources (with potential emissions >250 tons per year) are required to meet the PSD Class II incremental limits for NO_2, SO_2 and PM_{10}. Modeling studies of proposed OCS production facilities in the Beaufort Sea show that concentrations of NO_2, SO_2, and PM_{10} are within the PSD incremental limits and the NAAQS with the highest concentrations of NO_2, SO_2, and PM_{10} occurring within about 200 m of the facility and considerably reduced values at distances greater than 1 km (USDOI, MMS, 2001c). Therefore, there would be little cumulative interaction between facilities that are spaced some distance apart.

Small accidental oil spills on land or on the water would cause small, localized increases in concentrations of VOC due to evaporation of the spill. Most of the emissions would be expected to occur within a few hours of the spill and decrease drastically after that period. Large spills would result in emissions over a large area and a longer period of time. A discussion of the effects of oil spills on air quality is presented in Section 4.2.2.15.2.2.

In situ burning of an oil spill would result in a visible plume and a localized increase in $PM_{2.5}$ concentrations. Studies of in situ burn experiments have shown that air quality impacts are localized and short lived, and that pollutant concentrations do not pose a health hazard to persons in the vicinity.

Conclusion. Routine emissions from ongoing and future activities without the proposed Chukchi Sea lease sales would result in ambient air quality levels that are within applicable standards. Air quality would not change significantly from existing levels. Air quality impacts would be minor. Air quality impacts from oil spills would be localized and of short duration.

4.5.1.3. Lower Trophic-Level Organisms.

No action on proposed Sales 212 and/or 221 means that the level of effect would be related primarily to mitigated operations on previous leases and climate change. The effects of previous Chukchi exploration on lower trophic-level organisms were assessed previously in the EIS for Chukchi Lease Sale 193 (USDOI, MMS, 2007d), and the seismic-survey PEA (USDOI, MMS, 2006a). Sale 193 included Stipulation No. 3, Transportation of Hydrocarbons, which explained that MMS preferred transportation of produced oil by pipelines rather than tankers/barges. The level of effect on lower trophic-level organisms of no action on Chukchi Sea Lease Sales 212 and/or 221 would be similar to that described in the Sale 193 assessment and Section 3.3.1.

As explained in the Sale 193 EIS, there have been only a few exploratory drilling operations in the Chukchi Sea. During the early 1990s five wells were drilled, but there have been no commercial discoveries and no pipelines have been buried. Changes in the Chukchi and Northern Bering benthic communities have been measured (Grebmeier et al., 2006), but the authors did not relate the changes to the previous exploratory drilling or discharges of drilling fluids. Instead, they related the changes to broad-scale changes in the ice cover and climate, as summarized in Sections 3.2.4.3 and 3.3.1.2.

The Sale 193 EIS also explained that the disturbance effect of 14 anticipated exploratory wells probably would be low, unless the wells were located near any special biological communities; regardless, MMS would review further any installation proposals and could require surveys. Exploratory discharges during summer probably would lead to low effects at deep offshore locations, and to slightly greater local effects in the shallower nearshore portions of Sale 193 Alternative I. Water circulation under the winter ice cover is relatively slow, so we assume that produced water would be reinjected; regardless, the local effects of produced-water discharge for the life of the field probably would be moderate, but any such discharge proposals would be reviewed in detail by MMS and EPA.

The Sale 193 EIS explained further that we assume an extensive system of buried pipelines would radiate from a central production platform, and that a single pipeline would extend to shore. This pipeline installation probably would disturb 1,000-2,000 acres of typical benthic organisms that would slowly recolonize the area within a decade, leading overall to a major level of effect. The disturbance effects would be assessed and probably monitored by the pipeline company, MMS, and/or the U.S. Army Corps of Engineers. The effects of an alternative to production pipelines—the transportation of produced oil in vessels—would pose a much greater spill risk to the coast near Cape Lisburne and Point Hope. The OSRA model estimated a 40% chance of one or more large spills ≥1,000 bbl occurring over the 25-year production life of Sale 193 Alternative I, but only 1% chance of one or more large spills occurring and contacting the U.S. Chukchi coastline within 3 days over the production life of Sale 193 Alternative I. If a large oil spill did contact this coastline, the oil probably would persist in a few of the tidal and subtidal sediments for a couple of decades, leading to a local but moderate effect on the few intertidal lower trophic-level organisms. The chance of one or more large spills contacting the U.S. Chukchi coastline increased to 6% within 30 days over the production life of Sale 193 Alternative I, demonstrating the advantages of requirements for rapid response capability.

During the abandonment phase, we assumed that the extensive pipeline system would be cleaned, plugged, and abandoned in place, at which time it would become a public responsibility. However, bond requirements could be increased for Chukchi developers, making the bond size commensurate with the estimated financial obligations associated with the careful construction and abandonment of pipelines. The Sale 193 EIS concluded that the effect on lower trophic-level organisms with standard mitigation would be local but moderate, and the level with proposed requirements for rapid spill-response capability would be minor. As explained above, the effect of no action on Chukchi Sea Lease Sales 212 and/or 221 would be similar, but altered slightly by ongoing changes in climate and Chukchi lower trophic-level organisms (see Section 3.3.1).

4.5.1.4. Fish Resources.

Summary. If these lease sales were not held, there would be no direct or indirect impacts to fish resources. Existing impacts to fish resources from underwater noise and habitat loss are anticipated to continue at no more than a minor level of effect. Existing Federal leases in the project area would continue to be explored with seismic surveys and possibly exploratory drilling, as well as other ancillary activities. Oil resources could be developed, although this is considered speculative. Spills, particularly in nearshore areas or at river crossings, pose a risk to fish resources. Oil spills from marine vessels are

considered high effect, low likelihood events. Transfer of bulk fuel to coastal communities poses the greatest risk of a large noncrude oil spill in the marine environment.

The changing climate could positively or negatively affect the distribution or abundance of numerous marine and freshwater species. Continuing climate change will lead to the loss or alteration of habitats important to fish resources and to changes in biological communities. Changes in the physical environment also may serve to promote increased vessel traffic in the Arctic, especially in the form of tourism or cargo shipping, thereby increasing the chance of vessel accidents, groundings, and spills.

The cumulative effects under this alternative are anticipated to be no greater than the levels of cumulative effect as determined in Section 4.4.1.4.3.2 for the Beaufort Sea (but as applied to the Chukchi Sea). These cumulative effects are likely reduced compared to the Beaufort Sea, because no oil and gas exploration or development is anticipated in State of Alaska waters of the Chukchi Sea in the reasonably foreseeable future. Alternative 1 is anticipated to result in a minor cumulative level of effect on fish resources in the Chukchi Sea, with the exception of climate change, which could have a major level of effect on fish resources.

In the following analysis, we determined the anticipated effects to fish resources from a variety of existing impact-producing factors (Section 4.4.1.4.1). This analysis considered relevant mitigation measures (Section 4.4.1.4.2) that would avoid or minimize these impacts. The anticipated effects under Alternative 1 are separated into direct and indirect effects (Section 4.5.1.4.3.1) and cumulative effects (Section 4.5.1.4.3.2).

4.5.1.4.1. Potential Effects to Fish Resources. The potential effects from a variety of existing sources on fish resources are the same as those described in Section 4.4.1.4.1.

4.5.1.4.2. Mitigation Measures. Standard lease stipulations and Information to Lessee (ITL) clauses from previous Beaufort Sea and Chukchi Sea lease sales would be part of the mitigation measures used to help protect sensitive biological resources during permitted seismic activities and exploration and drilling operations in the Chukchi Sea.

4.5.1.4.3. Anticipated Effects Under Alternative 1. This section describes the direct and indirect effects on fish resources resulting from this alternative (which is taking no action) and adding these incremental effects to other past, present, and reasonably foreseeable future actions to determine the cumulative effects under this alternative. Past and present actions affecting fish resources are described in Section 3.3.2. Reasonably foreseeable future actions are described in Section 4.2. Relevant mitigation measures are considered in determining the anticipated effects under this alternative.

4.5.1.4.3.1. Direct and Indirect Effects Under Alternative 1. There would be no direct or indirect impacts to fish resources in the project area if Lease Sales 212 or 221 were not held.

4.5.1.4.3.2. Cumulative Effects Under Alternative 1.

Summary. Existing impacts to fish resources from underwater noise and habitat loss are anticipated to continue at no more than a minor level of effect. Existing Federal leases in the project area would continue to be explored with seismic surveys and possibly exploratory drilling, as well as other ancillary activities. Oil resources could be developed, although this is considered speculative. Spills, particularly in nearshore areas or at river crossings, pose a risk to fish resources. Oil spills from marine vessels are considered high effect, low likelihood events. Transfer of bulk fuel to coastal communities poses the greatest risk of a large noncrude oil spill in the marine environment.

The changing climate could positively or negatively affect the distribution or abundance of numerous marine and freshwater species. Continuing climate change will lead to the loss or alteration of habitats important to fish resources and to changes in biological communities. Changes in the physical environment also may serve to promote increased vessel traffic in the Arctic, especially in the form of tourism or cargo shipping, thereby increasing the chance of vessel accidents, groundings, and spills.

The cumulative effects under this alternative are anticipated to be no greater than the levels of cumulative effect as determined in Section 4.4.1.4.3.2 for the Beaufort Sea (but as applied to the Chukchi Sea). These cumulative effects likely are reduced compared to the Beaufort Sea, because no oil and gas exploration or development is anticipated in State of Alaska waters of the Chukchi Sea in the reasonably foreseeable future. Alternative 1 is anticipated to result in a minor cumulative level of effect on fish resources in the Chukchi Sea, with the exception of climate change, which could have a major level of effect on fish resources.

4.5.1.4.3.2.1. Anticipated Level of Effect from Seismic Surveys. Seismic surveys are used to locate and delineate potential oil and gas resources. Under this alternative, seismic-survey activity in the Chukchi Sea likely would be reduced, but not eliminated, as ongoing efforts to delineate oil and gas potential on existing leases in the Chukchi Sea would continue. The anticipated adverse effects to those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity in the Chukchi Sea would be primarily from temporary displacement by noise or physical disturbances to the seafloor from anchor and cable deployment and retrieval. No more than a minor level of adverse effect to fish resources in the Chukchi Sea is anticipated.

A review of the available science and management literature shows that, at present, there are no empirical data to document potential impacts to fish resources that would result in indirect population-level effects to fish. The MMS concludes that seismic surveys, with standard mitigation measures imposed, are expected to result in no more than a minor level of effect on fish resources.

4.5.1.4.3.2.2. Anticipated Level of Effect from Exploration and Development. Potential effects to fish resources from exploration and development activities are described in Section 4.4.1.4.1. Numerous Federal leases have been issued from a previous sale, and ongoing oil and gas exploration activity in the Chukchi Sea would continue. These ongoing exploration activities may include generation of underwater noise and discharges of produced water and wastes from drilling operations. The present trend towards using disposal wells instead of discharges into the marine environment would help to reduce any adverse effects of these discharges on EFH. Future development and production of oil or gas resources on the Chukchi Sea OCS is considered speculative.

Continued development of coastal community facilities (e.g., roads, airports, public facilities) have the potential to destroy wetlands that support fish habitats or adversely affect ponds and lakes that support fish and fish habitats. Some of these activities are described in Sections 4.4.1.4 and 4.4.1.5. While perhaps fewer along the Chukchi coast compared to the Beaufort coast, these development activities likely would have greater effects on fish resources than ongoing exploration activities. Together these activities are anticipated to have no more than a minor level of effect on fish resources.

As existing leases are explored, exploration wells would result in a direct loss of seafloor habitats at the placement sites. However, these sites are relatively small compared to the amount of similar habitats available to fish in the marine environment. Affected habitats would begin to be repopulated once the disturbance ceased. A minor level of effect on fish resources is anticipated.

In the remote chance that development and production is proposed from these existing leases, effects from production wells may be similar as those from exploration wells, but such effects would remain for the duration of the production period. Trenching and pipelaying would take place during the open-water season or during winter, when landfast ice has stabilized. Offshore pipelines would be trenched as a protective measure against damage by ice in all water depths <165 ft (50 m). This trenching would create turbidity around the trenching site that, depending on the nature of the substrate, remains suspended for short amounts of time or be moved offsite into other areas. At a coastal landfall, the pipeline likely would be elevated on a short gravel causeway protect it against shoreline erosion. The specific locations of these facilities are unknown, but would be evaluated under a subsequent NEPA document in an effort to minimize any adverse fish habitat loss or degradation.

4.5.1.4.3.2.3. Anticipated Level of Effect from Petroleum Spills. The potential effects of petroleum spills on fish resources, including salmon, are described in Section 4.4.1.4.1.5. While spills can occur on land or in the marine environment, spills in the Arctic that occur in or reach the nearshore marine and estuarine environments have the greatest potential to affect fish resources. According to oil-spill records, most accidental spills in Alaska happen in harbors or during groundings; consequently, spills from vessels on the high seas should be an infrequent occurrence. Particular concern has been expressed over increases in tourism and shipping traffic between the Bering Sea and the North Atlantic, especially from vessels or crews unaccustomed or ill-prepared to traverse these remote and dangerous areas. Vessels traversing the Chukchi and Beaufort seas during period of ice are more prone to an accident. The ADEC (2007) reports that the highest probability of spills of noncrude products occurs during the transfer of bulk fuel at remote North Slope communities. As these would be accidental, illegal events, they cannot be predicted and are anticipated to have a negligible level of effect on fish resources.

Other sources of petroleum spills include a well blowout or other oil spills/toxics contamination from oil and gas exploration, but these are modeled as having a low percent chance of occurring (Appendic A, Section 1.1.4), and it is improbable that a major level of adverse effect to fish resources from these activities would occur.

Although leases have been issued and exploration efforts are ongoing, future development of oil or gas resources on the Chukchi Sea OCS remains speculative. If development and production from prior lease sales were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. While any spill in the marine environment by definition would contact a fish resource, the potential for spills from pipelines or offshore production facilities to contact nearshore fish habitats is greatest during the open-water season. The Sale 193 final EIS (USDOI, MMS, 2007d) contains an assessment of how a large spill could affect fish resources. Due to small changes in the location and size of the new lease-sale area and environmental resource areas, this assessment has been updated for the Proposed Action in Section 4.5.2.4.3.1.3.

In the unlikely event of an offshore oil spill occurring and contacting nearshore fish habitats, some fish may be harmed or killed through direct contact or by ingestion of oiled prey. However, lethal effects on fish from oil spills are seldom observed outside of the laboratory environment. For this reason, relatively small oil spills are likely to have mostly sublethal effects on the affected marine and anadromous fish. Recovery of fish habitats following a spill would depend on the type of oil spilled, the size of the spill, and its persistence in the environment. Fish resources are anticipated to experience a negligible to major level of adverse effect, because recovery could take anywhere from a few days from a small spill to many years in the case of a large crude oil spill. A major level of effect to fish habitats would not necessarily result in a commensurate effect to fish populations.

Small operational oil or fuel spills are unlikely to contact fish resources. Proper use of oil-spill-cleanup procedures are likely to have a minor level of effect on fish habitats and should help to hasten recovery of EFH to prespill conditions. A spill from MMS-authorized activity would be an accidental, illegal event that cannot be predicted and, based on industry spill history, is anticipated to have a negligible level of effect on fish resources.

4.5.1.4.3.2.4. Anticipated Level of Effect from Changes in the Physical Environment.

Potential effects to fish resources from climate change (Section 4.4.1.4.1.6) are linked to effects to fish habitats resulting from climate change. Changes in ocean temperature and chemistry would affect primary and secondary productivity and would lead to shifts in the distribution and abundance of multiple fish species, including salmon. Physical and chemical changes to fish habitats could be relatively easy to measure and quantify over time. However, associated detrimental or beneficial changes to fish resources in the Chukchi Sea would be difficult to quantify because of limited information on the status of many marine and freshwater species in the Arctic. Changes in diversity, distribution, or abundance may not become evident for many years. The no-action alternative would have no effect on the rate and degree of climate change being experienced in the Beaufort and Chukchi seas. Anthropogenic influences to climate change resulting from hydrocarbon consumption would remain unchanged; only the source of the hydrocarbons would change. Climate change is anticipated to have a major level of effect on fish and fish habitats.

Continued exploration for oil and gas resources on previously issued leases in the Chukchi Sea is not anticipated to have direct effects on climate change. While successful development and production of these particular leases is speculative, the worldwide trends in demand, production, and consumption of hydrocarbons also are expected to continue. Therefore, any anthropogenic influences on greenhouse gas emissions caused by oil and gas development are expected to continue, regardless of whether development occurs in the Arctic or elsewhere in the world.

4.5.1.5. Essential Fish Habitat.

Summary. If these lease sales were not held, there would be no direct or indirect impacts to EFH. Existing impacts to EFH from underwater noise and habitat loss are anticipated to continue at no more than a minor level of effect. Existing Federal leases in the project area would continue to be explored with seismic surveys and possibly exploratory drilling, as well as other ancillary activities. Oil resources could be developed, although this is considered speculative. Spills, particularly in nearshore areas or at river crossings, pose a risk to EFH. Oil spills from marine vessels are considered high effect, low likelihood events. Transfer of bulk fuel to coastal communities poses the greatest risk of a large noncrude oil spill in the marine environment.

The changing climate could positively or negatively affect the distribution or abundance of numerous marine and freshwater species. Continuing climate change will lead to the loss or alteration of habitats important to fish resources and to changes in biological communities. Changes in the physical environment also may serve to promote increased vessel traffic in the Arctic, especially in the form of tourism or cargo shipping, thereby increasing the chance of vessel accidents, groundings, and spills.

The cumulative effects for this alternative are anticipated to be no greater than the levels of cumulative effect as determined in Section 4.4.1.5.3.2 for the Beaufort Sea (but as applied to the Chukchi Sea). These cumulative effects are likely reduced compared to the Beaufort Sea because no oil and gas exploration or development is anticipated in State of Alaska waters of the Chukchi Sea in the reasonably foreseeable future. Alternative 1 will have no effect on the rate or degree of climate change. Alternative 1 is anticipated to result in a minor cumulative level of effect on EFH in the Chukchi Sea, with the exception of climate change, which could have a major level of effect on EFH.

As described in Section 3.3.3, large coastal and marine portions within or adjacent to the proposed Chukchi Sea lease sale area have been described as EFH for five species of Pacific salmon occurring in Alaska. Pacific salmon EFH along the Chukchi Sea coast also includes those freshwater streams, lakes, ponds, wetlands, and other waterbodies currently or historically accessible to salmon.

The following analysis describes the potential effects from a variety of existing sources to EFH. Next, mitigation measures that would avoid or minimize some of these impacts are described. The resultant anticipated effects are then used to determine the effects of this alternative on EFH.

4.5.1.5.1. Potential Effects to Essential Fish Habitat. The potential effects from a variety of existing sources on fish resources are the same as those described in Section 4.4.1.4.1.

4.5.1.5.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.1.4.2.

4.5.1.5.3. Anticipated Effects Under Alternative 1. Past and present actions are described in Section 3.3.3. Reasonably foreseeable future actions are described in Section 4.2. The mitigation measures (described in Section 4.5.1.5.2) are considered in determining the anticipated effects from this alternative. The anticipated effects under this alternative are divided into direct and indirect effects (Section 4.5.1.5.3.1) and cumulative effects (Section 4.5.1.5.3.2).

4.5.1.5.3.1. Direct and Indirect Effects Under Alternative 1. There would be no direct or indirect effects to EFH in the project area from Lease Sales 212 and 221 if the lease sales were not held.

4.5.1.5.3.2. Cumulative Effects Under Alternative 1.

Summary. Marine and coastal areas of the North Slope commonly are perceived to be pristine environments, yet there are number of past actions, ongoing activities, and potential sources of harmful effects to EFH. Under the no-action alternative, there would be a number of activities and anticipated environmental changes that would likely result in a minor level of adverse effect to EFH and fish resources in the project area well into the future. Climate change, for example, may serve to promote increased vessel traffic in the Arctic, especially in the form of tourism or cargo shipping, thereby increasing the risk of vessel accidents, groundings, and spills. Spills, particularly in nearshore areas or at river crossings, pose a risk to EFH. Transfer of bulk fuel to coastal communities poses the greatest risk of a large noncrude oil spill in the marine environment. Additionally, existing leases in the project area would continue to be explored. Seismic surveys, exploratory drilling, and other ancillary activities would continue. Continuing climate change would lead to a major level of effect to EFH, including the loss or alteration of EFH and other changes in biological communities. The changing climate could affect the current distribution or abundance of Pacific salmon and their prey. Adult salmon may become more common in arctic waters, and straying salmon may colonize new spawning locations.

This section describes the anticipated effects on EFH resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

4.5.1.5.3.2.1. Anticipated Level of Effect from Seismic Surveys. Seismic surveys are used to locate and delineate potential oil and gas resources. Under this alternative, seismic survey activity in the Chukchi Sea likely would be reduced, but not eliminated, as ongoing efforts to delineate oil and gas potential on existing leases in the Chukchi Sea would continue. Anticipated adverse effects to those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity in the

Chukchi Sea would be primarily from temporary displacement by noise or physical disturbances to the sea floor from anchor and cable deployment and retrieval. No more than a minor level of adverse effect to EFH in the Chukchi Sea is anticipated.

A review of the available science and management literature shows that, at present, there are no empirical data to document potential impacts to EFH that would result in indirect population-level effects to fish. The MMS concludes that seismic surveys, with mitigation measures imposed, are expected to result in no more than a minor level of effect to EFH.

4.5.1.5.3.2.2. Anticipated Level of Effect from Exploration and Development. The potential effects to EFH from exploration and development activities are described in Section 4.4.1.5.1.2. Numerous Federal leases have been issued from a previous sale, and ongoing oil and gas exploration activity in the Chukchi Sea would continue. These ongoing exploration activities may include generation of underwater noise and discharges of produced water and wastes from drilling operations. The present trend towards using disposal wells instead of discharges into the marine environment would help to reduce any adverse effects of these discharges on EFH. Future development and production of oil or gas resources on the Chukchi Sea OCS is considered speculative.

Continued development of coastal community facilities (e.g., roads, airports, public facilities) have the potential to destroy wetlands that support fish habitats or adversely affect ponds and lakes that support fish and fish habitats. Some of these activities are described in Sections 4.4.1.4 and 4.4.1.5. While perhaps fewer along the Chukchi coast compared to the Beaufort coast, these development activities likely would have greater effects on EFH than ongoing exploration activities. Together these activities have no more than a minor level of effect on EFH.

As previously issued leases are explored, exploration wells would result in a direct loss of seafloor habitats at the placement sites. However, these sites are relatively small compared to the amount of similar habitats available to fish in the marine environment. A minor level of effect to EFH is anticipated. Affected habitats would begin to be repopulated once the disturbance ceased.

In the remote chance that development and production is proposed from these existing leases, effects from production wells may be similar as those from exploration wells, but such effects would remain for the duration of the production period. Trenching and pipelaying would take place during the open-water season or during winter, when landfast ice has stabilized. Offshore pipelines would be trenched as a protective measure against damage by ice in all water depths <165 ft (50 m). This trenching would create turbidity around the trenching site that, depending on the nature of the substrate, remains suspended for short amounts of time or be moved offsite into other areas. At a coastal landfall, the pipeline likely would be elevated on a short gravel causeway protect it against shoreline erosion. The specific locations of these facilities are unknown, but would be evaluated under a subsequent NEPA document and EFH consultation in an effort to minimize any adverse fish habitat loss or degradation.

4.5.1.5.3.2.3. Anticipated Level of Effect from Petroleum Spills. The potential effects of petroleum spills to fish resources, including salmon, are described in Section 4.4.1.4.1.5. While spills can occur on land or in the marine environment, spills in the Arctic that occur in or reach the nearshore marine and estuarine environments have the greatest potential to affect EFH. According to oil-spill records, most accidental spills in Alaska happen in harbors or during groundings; consequently, spills from vessels on the high seas should be an infrequent occurrence. Particular concern has been expressed over increases in tourism and shipping traffic between the Bering Sea and the North Atlantic, especially from vessels or crews unaccustomed or ill-prepared to traverse these remote and dangerous areas. Vessels traversing the Chukchi and Beaufort seas during period of ice are more prone to an accident. The ADEC (2007) reports that the highest probability of spills of noncrude products occurs during the transfer of bulk fuel at remote North Slope communities. As these would be accidental, illegal events, they cannot be predicted and are anticipated to have a negligible level of effect to EFH.

A large spill from a well blowout is described as a very unlikely event in Section 1.1.4. Other sources of petroleum spills include oil spills/toxics contamination from oil and gas exploration, but these are modeled as having a low percent chance of occurring and it is improbable that a major level of adverse effect to EFH from these activities would occur.

Although leases have been issued and exploration efforts are ongoing, future development of oil or gas resources on the Chukchi Sea OCS remains speculative. If development and production from prior lease sales were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. While any spill in the marine environment by definition would contact EFH, the potential for spills from pipelines or offshore production facilities to contact nearshore EFH is greatest during the open-water season. The Sale 193 final EIS (USDOI, MMS, 2007d) contains an assessment of how a large spill could affect EFH. Due to small changes in the location and size of the new lease sale area and environmental resource areas, this assessment has been updated for the Proposed Action in Section 4.5.2.5.3.1.3.

In the unlikely event of an offshore oil spill occurring and contacting nearshore EFH, juvenile or adult salmon may be harmed or killed through direct contact or by ingestion of oiled prey. However, lethal effects on fish from oil spills are seldom observed outside of the laboratory environment. For this reason, relatively small oil spills into EFH are likely to have mostly sublethal effects to the affected marine and anadromous fish. Recovery of EFH following a spill would depend on the type of oil spilled, the size of the spill, and its persistence in the environment. A negligible to major level of adverse effect to EFH could result, because recovery could take anywhere from a few days from a small spill to many years in the case of a large crude oil spill. A major level effect to EFH would not necessarily result in a commensurate effect on salmon or salmon populations.

Small operational oil or fuel spills are unlikely to contact EFH. Proper use of oil-spill-cleanup procedures are likely to have a minor level of effect on EFH and should help to hasten recovery of EFH to prespill conditions. A spill from authorized activity would be an accidental, illegal event that cannot be predicted and, based on industry spill history, is anticipated to have a negligible level of effect on EFH.

4.5.1.5.3.2.4. Anticipated Level of Effect from Changes in the Physical Environment.

Potential effects to fish resources from climate change (Section 4.4.1.4.1.6) are linked to effects to EFH from climate change. Changes in ocean temperature and chemistry would affect primary and secondary productivity and would lead to shifts in the distribution and abundance of multiple fish species, including salmon. Physical and chemical changes to EFH could be relatively easy to measure and quantify over time. However, associated detrimental or beneficial changes to fish resources in the Chukchi Sea would be difficult to quantify because of limited information on the status of many marine and freshwater species in the Arctic. Changes in diversity, distribution, or abundance may not become evident for many years. The no-action alternative would have no effect on the rate and degree of climate change being experienced in the Beaufort and Chukchi seas. Anthropogenic influences to climate change resulting from hydrocarbon consumption would remain unchanged; only the source of the hydrocarbons would change. Climate change is anticipated to have a major level of effect to EFH.

Continued exploration for oil and gas resources on previously issued leases in the Chukchi Sea is not anticipated to have a direct effect on climate change. While successful development and production of these particular leases is speculative, the worldwide trends in demand, production, and consumption of hydrocarbons also are expected to continue. Therefore, any anthropogenic influences on climate change and EFH caused by oil and gas development are expected to continue, regardless of whether development occurs in the Arctic or elsewhere in the world.

4.5.1.6. Threatened and Endangered Species.

4.5.1.6.1. Threatened and Endangered Whales.

Summary. The ESA-listed whales that can occur within or near the Chukchi Sea Planning Area or that potentially could be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. Alternative 1 (No Lease Sale) would result in a minor level of cumulative effects from past, current, and anticipated activities (including existing OCS lease activity) on bowhead and humpback whales and negligible level effects on fin whales in the Chukchi Sea. Lease Sales 212 and 221 would not occur under the no-action alternative and, therefore, no effects would occur in addition to existing past, current, and anticipated direct, indirect, and cumulative effects.

The following analysis describes potential adverse effects to endangered whales from existing sources (Section 4.4.1.6.1.1), mitigation measures to avoid or minimize potential adverse effects to endangered whales (Section 4.4.1.6.1.2), and the resulting potential adverse effects with mitigation applied are the anticipated effects (Section 4.4.1.6.1.3). Anticipated effects are applied to determine the effects of the no action alternative on bowhead, fin, and humpback whales.

For purposes of analyses, the levels of effects for endangered cetaceans are defined as follows:

Negligible:

- Localized, short-term disturbance or habitat effect experienced during one season that is not anticipated to accumulate across 1 year.
- Population-level effects are not detectable.
- No mortality is anticipated.
- Mitigation measures implemented fully and effectively or are not necessary.

Minor:

- Widespread annual or chronic disturbances or habitat effects not anticipated to accumulate across 1 year or localized effects that are anticipated to persist for more than 1 year.
- Population level effects are not detectable. Temporary, nonlethal adverse effects would affect some individuals (<1.0%).
- No mortality is anticipated. Mitigation measures are implemented on some, but not all, impacting activities, indicating that some adverse effects are avoidable. Unmitigable or unavoidable adverse effects are short term and localized.

Moderate:

- Onetime events, widespread annual or chronic disturbances or habitat effects anticipated to persist for more than 1 year.
- Population-level effects from temporary, nonlethal adverse effects may be detectable.
- Anticipated or potential collective mortality above the subsistence quota is estimated or measured in terms of individuals consisting of <0.25% of the bowhead whale population or <25% of a year class cohort (calf cohort assuming 50% females), which may produce a long-term population-level effect. For fin whales, collective mortality from human causes of <2.0% is a moderate level of effect. **Note**: Percentages approximate the potential biological removal (PBR) level defined by NMFS as the as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor and for bowhead whales the percentage noted above is the PBR above the allowable harvest quota.

- Mitigation measures are implemented for a small proportion of similar impacting activities, but more widespread implementation for similar activities likely would be effective in reducing the level of avoidable adverse effects. Unmitigable or unavoidable adverse effects are short term but more widespread.

Major:

- One-time events, widespread annual or chronic disturbance or habitat effects experienced during one season that would be anticipated to persist for decades or longer.
- Anticipated or potential collective mortality above the subsistence quota is estimated or measured in terms of individuals or consisting of >0.25% of the bowhead whale population or >25% of a year class cohort (calf crop assuming 50% females), which could produce a long-term population-level effect. For fin whales, a mortality of >2.0% is a major effect as it exceeds the potential biological removal allowable for recovery (see note above). For humpback whales, any mortality from human causes is a major effect to the Western North Pacific stock.
- Mitigation measures are implemented for limited activities. Iimplementation for other similar activities would be effective in reducing the level of avoidable adverse effects. Unmitigable or unavoidable adverse effects are widespread and long-lasting.

4.5.1.6.1.1. Potential Effects to Threatened and Endangered Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified under Alternative 1, the no-action alternative, that could occur if the entire Chukchi Sea Planning Area would not be open to proposed Lease Sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain the same for all alternatives, including the no-action alternative, and will not be repeated here.

4.5.1.6.1.2. Mitigation Measures. The measures listed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.2 may be applied, as appropriate, to existing OCS Lease Sale 193 activities to protect ESA-listed whales and other marine mammals during Federal seismic and exploratory drilling in the Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities on current leases in the Chukchi Sea. Under the no-action alternative, no new leases would occur.

4.5.1.6.1.3. Anticipated Effects Under Alternative 1.

4.5.1.6.1.3.1. Anticipated Effects from Seismic Surveys. There are existing Federal leases in OCS portions of the Chukchi Sea, and it is expected that leaseholders and others would conduct 2D/3D seismic surveys to evaluate the potential for oil and gas production in the future. These surveys would occur during the open-water period. These seismic activities are subject to mitigation measures, terms, and conditions of IHAs under the Marine Mammal Protection Act (MMPA) and OCS mitigation measures required through ESA consultation to avoid or minimize effects such that adverse effects on endangered whales are negligible level.

Continuation of 2006, 2007, and 2008 levels of 2D/3D seismic surveys likely would continue. These surveys are subject to required mitigation measures to avoid or minimize adverse effects to endangered whales in the Beaufort Sea. Negligible level effects are anticipated from existing levels of 2D/3D seismic surveys, and no additional effects from OCS actions would be attributable to the no-action alternative.

4.5.1.6.1.3.2. Anticipated Effects of Noise from High-Resolution Seismic Surveys. There are existing leases in OCS portions of the Chukchi Sea, and it is expected that leaseholders and others would conduct high-resolution seismic surveys to evaluate the OCS for future oil and gas exploration drilling, delineation, and production. If potential commercial deposits are indicated, localized high-resolution seismic surveys would be expected to increase as leaseholders evaluate, plan, and execute specific exploration, delineation, and production actions. High-resolution surveys would be expected to decline in localized areas as production and transport facilities are completed.

The authorized postlease high-resolution surveys in the Chukchi Sea are expected to increase as potential prospects are investigated for oil and gas production potential and subsequent development and production. These surveys are subject to specific required mitigation measures to avoid or minimize adverse effects to endangered whales in the Chukchi Sea from multiple activities that collectively could affect endangered whale movement, foraging, seasonal migration, and subsistence-harvest availability. Incremental ESA consultation with NMFS, as appropriate, would be reinitiated if development and production become a reality. Specific mitigation and/or avoidance measures to reduce impacts to endangered whales to a negligible level would be required. No additive effects from the no-action alternative are anticipated, as high-resolution seismic surveys related to Chukchi Sea Sales 212 and 221 would not occur.

4.5.1.6.1.3.3. Anticipated Effects from Vessel and Aircraft Traffic.

Icebreakers. Icebreakers introduce noise levels to the marine environment at greater levels than vessels not engaged with the high-intensity power needed for ice management. Bowhead whales would be most sensitive to icebreaker activity, as the fin and humpback whales are not likely to be present during periods of ice cover. Bowhead whale response to icebreaker noise usually is avoidance. Increased use of icebreakers over an expanding region of activity in the Chukchi Planning Area could expose more whales to more frequent short-term exposure to noise earlier and later in the ice-associated period of the year. Drillships often are attended by an icebreaker in late fall as ice forms and assists in prolonging the drilling season. Existing information indicates an increasing trend in amounts of vessel traffic associated with tourism and research cruises as well as interests in investigating the feasibility of shipping via the Northwest Passage. This trend is anticipated to continue into the foreseeable future. Icebreakers often are the primary research vessels, and icebreakers may attend other vessels in transit during early portions of open-water periods and during the spring bowhead whale migration through the spring open-lead system. These vessels would be relatively free to navigate in areas where disturbance to concentrations of bowhead whale cows and calves could occur in the open-lead systems. Icebreaker traffic and related mitigation, if any, not associated with OCS activities in the Chukchi spring lead system can only be speculated on at this time, and effects could vary from minor to moderate.

Postlease exploration activity likely would increase to two concurrent drillships operating from current levels of zero in the Chukchi Sea to explore current leases. Each likely would be attended by an icebreaker-class vessel in late fall. Noise from icebreakers attending drillships often mask the operating drillship noise when active and would be a localized source of noise that migrating bowheads would avoid and potentially deflect from normal migration corridors. The level of effect would be minor. Required mitigation would avoid or minimize the effect of such activity to spring and fall whale migration so as to not interfere with the traditional availability of bowhead whales for subsistence hunts and concentrations of vulnerable cows and calves in the spring lead system. No additive OCS icebreaker activity would result from the no-action alternative, because there would be no additional leases to those currently existing.

Other Vessel Traffic. Increase in vessel traffic is anticipated to occur for the same reasons as icebreaker activity and involves increases in tourism, research, military, and commercial vessel traffic. More frequent encounters with listed bowhead, fin, and humpback whales are likely to occur where whale habitats overlap vessel travel corridors. Encounters involve higher potential for injury or mortality from vessel-whale collision or propeller strikes as well as the chronic increasing exposure to vessel noise and presence. The level of, distribution of, and purpose of vessel-related mitigation measures, if any, is speculative on at this time, and levels of effects could vary from minor to moderate but remain unpredictable at this time.

Vessel-related postlease activities likely would increase incrementally in the Chukchi Sea; however, required mitigation measures on vessels associated with oil and gas exploration and development activities avoid or minimize effects on endangered whales. As a result, authorized vessel activity would have proportionately fewer impacts to endangered whales than unrestricted vessel operations. Anticipated effects could result in the injury or mortality of a few individual bowhead, humpback, or fin whales as result of vessel-whale contact. Noise-related effects are anticipated to be minor. No additional or alteration in levels of effects to endangered whales would occur related to Alternative 1, as Lease Sales 212 and 221 would not by held.

Aircraft Traffic and Noise. Increased air traffic from commercial or private aircraft operations is not anticipated to change in the OCS except nearshore, where air traffic related to freight and other commercial services may increase frequency of straight-line flights over portions of the OCS. Effects from aircraft activity that is not subject to MMS mitigation requirements in nearshore areas providing habitat for endangered whales would continue to be subject to low-level overflights serving a wide variety of non-OCS activities.

Oil- and gas-related support for postlease operations is expected to increase as exploration, development, and production phases occur on the Chukchi Sea existing leases. Existing leases are considerable distances offshore and require aircraft to fly over water for moderate duration flights in areas of the Chukchi that have not experienced high frequency overflights in recent years. The required mitigation avoids or minimizes the effects of aircraft traffic and noise on endangered whales and other marine mammals. There may be rapid increases in numbers of support, crew transport, and monitoring flights; however, mitigation measures avoid adverse effects from OCS aircraft activity. Negligible effects in nearshore areas are anticipated, and no additive effects are anticipated for the no-action alternative, as Lease Sales 212 and 221 would not be held.

4.5.1.6.1.3.4. Anticipated Effects of Noise from Drilling Operations. Drilling is anticipated to increase as current leaseholders explore potential productive oil and gas finds. Exploration drilling likely would involve drillships; however, bottom-founded platforms, and other drilling technologies could be feasible for exploration and if development and production are pursued. If exploration drilling indicates development and production are feasible, drilling would be expected to continue at a rate determined by the number of drill rigs available.

Exploration drilling is anticipated to increase by up to two drillships operating concurrently in the Chukchi Sea on existing leases. These may drill at more than a single location in a given year. Currently, there are no drillships active in the Beaufort OCS; however, limited drilling has occurred in the past in the Chukchi Sea OCS. Drillship operations are subject to mitigation measures that avoid or eliminate adverse effects to endangered whales. Effects of drillship operations can cause slight deflection of some migrating bowhead whales from established migration corridors; however, the deflection is transitory and migration corridor fidelity is reestablished after passage of a drillship. Little is known about humpback and fin whale response to drilling operations; however some degree of avoidance may be expected. Uncertainty regarding endangered whale habitat and habitat use in the Chukchi OCS increases the importance of mitigation measures to avoid deflecting migrating whales away from subsistence-hunt areas and periods, avoid impacts to subsistence-harvest opportunity, avoid or minimize displacement from important prey concentrations and feeding areas, and ensure negligible effects to endangered whales. Similar mitigation would be applied should delineation and production wells be developed. Synergistic adverse effects as a result of multiple seismic surveys, platform placement and construction, drilling, and other concurrent activities are avoided or minimized by application of mitigation measures to minimize the potentially dynamic footprint relative to bowhead whale and other endangered whale biological activities and subsistence-hunt periods. No population-level effects and minor level effects are anticipated.

4.5.1.6.1.3.5. Anticipated Effects of Noise from Production Activities. No effects on bowhead humpback or fin whales are anticipated from these activities, as production activities are absent from the Chukchi Sea at this time. Effects on humpback and fin whales are unknown at this time.

Production facilities are speculative. If discoveries are determined to be commercially productive on existing leases from Chukchi Sea Sale 193, it is reasonable to anticipate these to be developed and produced. Effects from noise related to production activity to endangered whales is anticipated to be one of slight avoidance, displacement of some individuals or groups from feeding sites with concentrated prey, and deflection of some migrating whales. Vessel traffic and noise associated with production at times appears to be greater than the noise from production activity alone. Mitigation and monitoring measures would be required to verify effects, maintain minimal effects, or avoid effects to endangered whales. Minor level effects to endangered whales are anticipated.

4.5.1.6.1.3.6. Anticipated Effects of Noise from Facility Abandonment. Abandonment activities would be anticipated for production facilities in the Chukchi Sea when no longer capable of commercial production. Abandonment activities and associated noise are anticipated to be localized and short term and would involve OCS facilities and infrastructure associated with existing leases.

If development and production occur, production facilities and infrastructure would be abandoned. Mitigation measures would be required to avoid or minimize effects to endangered whales and the subsistence hunts for bowhead whales on OCS leases. Minor level effects to endangered whales are anticipated.

4.5.1.6.1.3.7. Anticipated Effects of Noise from Oil-Spill Cleanup. In the event of a petroleum spill in the Alaska Chukchi OCS, it is reasonable to expect emergency response and cleanup activities that involved aircraft and vessel deployment. Refer to sections 4.4.1.6.1.1.1.4 and 4.4.1.6.1.3.3.3 for discussion of potential and anticipated impacts to endangered whales from vessel and aircraft traffic and noise. Avoidance by whales of active vessels, deployment of deterrent devices, and low flying aircraft would buffer whale contact with a spill. This is especially true if the spill were in the spring lead system and of fresh oil with high concentrations of volatile aromatic hydrocarbons, which would be potentially injurious or fatal to bowhead whale adults, subadults, and especially cows and their neonatal or very young calves. It is anticipated that, depending on the location, timing, and circumstances of a spill, delayed spring bowhead migration and route alteration could occur for some whales. Much of the spring lead system and known bowhead migration in the Chukchi Sea is nearshore. Existing leases occupy areas offshore of the spring lead system used for migration; however, it is uncertain how bowheads use the portions of the lead system farther offshore. Sources of fresh oil could be from pipelines or result from winter-spilled oil trapped under and within the ice; aging could be delayed and the oil would be released into the spring lead system when whales are present. Endangered whale avoidance of noise from spill-cleanup vessels, aircraft and human activity, and deployment of deterrent devices in the open-water season would serve to decrease contact with spilled petroleum but could alter use or displace whales from preferred habitat or prey concentrations. Effects of noise oil-spill-cleanup activities are anticipated to be minor, temporary and nonlethal.

Refined petroleum spills could occur from vessel accident, grounding, or collision. OCS vessel operations are delayed until after July 1, thereby avoiding the open spring leads and migrating bowhead concentration. Other vessel traffic not associated with OCS operations may or may not be restricted similarly, and fuel spills could occur in the lead system at a time when migrating and newborn whales are concentrated and vulnerable. Noise from cleanup activities, however, could provide stimulus to bowheads to avoid spilled oil and active cleanup operations.

4.5.1.6.1.3.8. Anticipated Effects from Discharges. Discharges related to exploration drilling on existing OCS leases could occur, and effects would remain localized in relation to affecting endangered whale habitat and prey populations if released into the marine environment. The effects of such discharges is anticipated to remain localized as a result of rapid deposition and dilution and potentially contaminate (if toxic contaminants are present in discharges) an extremely small proportion of the habitat or the prey base available to endangered whales. Level of effects would be negligible in terms of population-level effects. Bottom-founded drilling units may obliterate small areas of benthic habitat and seafloor that support epibenthic invertebrates that bowheads and other endangered whales may use as food. Such effects would be at negligible levels in relation to the available habitat in the Chukchi Sea. Localized turbidity or sediment suspension in marine waters as result of gravel island construction, placement of fill, installation of gravel bags, or sheetpile are not anticipated to affect bowhead whales. Such construction activities likely would occur when bowhead, fin and humpback whales are not present in the winter and in the open-water periods. Anticipated level effects specifically on fin and humpback whales cannot be determined at this time.

Exploration drilling on existing leases would add discharges into the Chukchi Sea, which would remain localized to the immediate areas of OCS exploration drilling activity. Mitigation measures likely would require toxic discharges not be discharged into marine waters but be treated and disposed of by other means. The level of effects is anticipated to be negligible for bowhead whales and, because humpback and fin whales have some overlap with bowhead prey use and feeding habits, we assume negligible levels of effects for them until we have better information regarding their use of prey and habitats in the Chukchi Sea Planning Area..

4.5.1.6.1.3.9. Anticipated Effects from Large and Small Oil Spills. Potential effects of petroleum spills on endangered whales are discussed in Section 4.4.1.6.1.1.1.11. Fresh oil spills with high content of volatile aromatic hydrocarbons into marine waters associated with the spring lead system and the large numbers of bowhead whales migrating through the lead system present the greatest potential to affect large numbers of bowhead whales and vulnerable newborn calves. Fin and humpback whales are not expected to be present in the spring lead system. Spill records indicate accidental petroleum spills in Alaska occur in harbors and from groundings. Vessel-related spills on the high seas are considered infrequent. Concern has been expressed of increasing tourism and shipping vessel traffic between the Bering Sea and the North Atlantic, especially vessels and crews unaccustomed or ill-prepared for these remote and dangerous areas. Vessels transiting the Beaufort or Chukchi seas during ice periods are more prone to accidents. The ADEC (2007) reports the highest probability of spills of refined petroleum products occurs during bulk-fuel transfer operations at remote North Slope villages.

No large spills are anticipated to occur during exploration activities in the Chukchi Sea. Development and Production projects and associated infrastructure for product transport may occur related to existing leases and in the Chukchi Sea OCS. It is anticipated that in the unlikely event of a large oil spill, some individual bowhead whales may experience injury or mortality as a result of prolonged exposure to freshly spilled oil; however, the number affected likely would be small. Some individual whales could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, localized reduction in prey sources, consumption of petroleum contaminated food items, perhaps temporary displacement from feeding/resting areas and temporary interruption of migration timing and route. Anticipated effects of prolonged exposure of whales to freshly spilled oil may result in lethal effects to a few individuals, and most individuals exposed to spilled oil likely would experience temporary, nonlethal effects. Moderate level effects could be anticipated for bowhead whales under specific circumstances noted for spills within the spring open lead system. Minor level effects are anticipated under most circumstances for the three species of endangered whales.

4.5.1.6.1.3.10. Anticipated Effects from Subsistence Hunting. Anticipated effects of the closely regulated subsistence harvest of bowhead whales are discussed in section 4.4.1.6.1.3.10**.** The harvest of bowhead whales for subsistence purposes would remain the major known human-caused mortality and is expected to continue at the current levels until 2012, when subsistence-harvest quotas may be revisited by the International Whaling Commission (IWC). Humpback and fin whales are not subject to harvest and not expected to be so in the future.

Activities from the no-action alternative are not anticipated to contribute any effects on subsistence activities and harvest of bowhead whales. Existing Chukchi leases occur far offshore of traditional bowhead subsistence-hunt areas, and no effects are anticipated that would alter subsistence hunting and the effects of that hunting on bowhead whales. If additional recoverable oil and gas resources are discovered and produced from existing leases in the Chukchi Sea, subsistence hunting of endangered bowhead whales would continue. Depending on where discovery and production activities and facilities may occur, required mitigation measures would ensure whale movement into harvest areas and that interference with subsistence-hunting activities and the opportunity to harvest bowhead whales are not impaired by OCS actions. The OCS activities in the Chukchi are not anticipated to alter the subsistence harvest or the vulnerability of bowhead whales to harvest.

4.5.1.6.1.3.11. Anticipated Level of Effect from Changes in the Physical Environment. Trends in arctic warming are anticipated to continue, and potential or predicted effects are discussed in Section 4.4.1.6.1.1.1.13. Direct and indirect effects of arctic warming remain speculative as to timing, magnitude, and intensity. Continuing monitoring, evaluation, and appropriate ESA Section 7 consultation procedures will allow MMS and others to adjust activities as appropriate to protect endangered whales.

Required mitigation measures, terms, and conditions would continue to be applied to OCS oil and gas activities to ensure effects to endangered whales are negligible and that no unmitigated actions that may affect the subsistence hunting of bowhead whales occur.

4.5.1.6.1.4. Direct and Indirect Effects Under Alternative 1. No additional direct or indirect vessel traffic, noise, oil spills, discharges, or other effects would occur related to OCS, if Lease Sales 212 and 221 were not held. Effects from activities existing OCS leases and non-OCS-related activities still would occur.

4.5.1.6.1.5. Cumulative Effects Under Alternative 1.

Summary. Endangered Whales. The effects of OCS oil and gas operations on endangered whales have been assessed in a number of documents: *Biological Evaluation of the Effects of Oil and Gas Leasing and Exploration in the Alaska OCS Beaufort Sea and Chukchi Sea Planning Areas on endangered Bowhead Whales (Balaena mysticetus), Fin whales (Balaenoptera physalus) and Humpback Whales (Megaptera novaeangliae)* (USDOI, MMS 2006c, 2008b); the Five-Year Programmatic EIS (USDOI, MMS, 2007c); an ESA biological opinion (BO) for Oil and Gas Leasing and Exploration Activities in the U. S. Beaufort and Chukchi Seas, Alaska: and Authorization of Small Takes under the Marine Mammal Protection Act (USDOI, NOAA, 2006a); the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a); environmental assessments updates for Lease Sales 195 and 202 (USDOI, MMS 2004, 2006b); and the Chukchi Sea Oil and Gas Lease sale 193 EIS (USDI, MMS 2007d).

If the proposed lease sale is not held, there are past and existing environmental changes and conditions that may be sources of adverse effects to endangered bowhead, fin and humpback whales, and these are expected to persist. Many of these are beyond the authority of the OCS region to control, and some endangered whales and populations could be adversely effected over the next 30 years. Past and existing OCS activities and previous assessments not associated with Lease Sale 212 and/or 221 include mitigation measures. Activities beyond OCS region authority may or may not be subject to mitigation measures or, in the case of climate change, not be subject to direct mitigation measures.

Cumulative effects of the no-action alternative on current status and trend of endangered bowhead and humpback whales associated with the Reasonably Foreseeable Future scenario (Section 4.2) would be the following:

- The bowhead population is subject to an annual regulated harvest by Alaskan Natives and other mortality. Subsistence harvest of bowhead whales is likely to continue at current levels and, if the population continues to recover at current rates, additional subsistence harvest could be allocated. The western Arctic bowhead stock has been increasing in recent years; the current estimate is between 19% and 105% of the pre-exploitation abundance and this stock may now be approaching its carrying capacity (Brandon and Wade, 2004). Current bowhead whale population-trend analysis indicates a 1978-1993 rate of increase of 3.1% and including 2001 data a 3.4% (George et al., 2004) or 3.5%(Brandon and Wade, 2004) rate of increase. This rate of increase does not include data from 2002-2007; however, the period considered in the analyses covers periods of OCS activities as well as activities and environmental changes beyond the authority of the OCS region and indicate a healthy and increasing population. Traditional subsistence harvest by Alaskan Natives could be interrupted due to changes in bowhead whale habitat use, movement pattern shifts, and availability that result in unsafe and inefficient distances to obtain harvest. This potentially could result in modification of subsistence methods, timing, and technology.
- The estimated annual mortality incidental to U. S. commercial fisheries (0.2) is not known to exceed 10%, or 9.4 animals, of the annual potential biological removal and the annual level of human-caused mortality and serious injury is not known to exceed the PBR (95) or the IWC maximum (67). If fisheries in the Chukchi Sea improve to the level that commercial fishing is allowed in the Arctic, a slight increase in entanglement in fishing gear could be expected.
- Climate change may be modifying distribution and productivity of bowhead, fin and humpback whale prey and, thereby, may be modifying carrying capacity and distribution of endangered whales. Such effects could be either positive or adverse, but remain speculative at this time. Diligent monitoring and timely data analysis is important to detecting adverse changes in the bowhead population productivity, abundance, distribution, movement, and mortality. Until such analysis indicates bowhead population and habitat-use patterns are adversely affected by the existing conditions, it is expected that the current situation indicating a healthy and robust population of bowhead whales will continue relative to the no-action alternative. Information on humpback and fin whales remains insufficient to draw conclusions; however, new evidence of unprecedented humpback occurrence in the Beaufort Sea and Chukchi Sea and fin whale distribution in the Chukchi Sea is likely indicative of ongoing change in the ocean environment under existing conditions, and trends are expected to continue with implementation of the no-action alternative. Traditional subsistence harvest by Alaskan Natives could be interrupted or become terminated due to changes in bowhead whale-habitat use, movement, pattern shifts, and availability that result in unsafe and inefficient distances to obtain harvest. This potentially could result in modification of subsistence methods, timing, and technology.
- Longer ice-free seasons and broader ice-free areas could result in new vessel-shipping patterns (Northwest Passage and over the North Pole from Europe routes) that may disturb whale-habitat use in large areas of offshore waters previously having no or very little disturbance or presence of

vessel traffic and associated noise. Previous and present shipping patterns confine the majority of vessel traffic to nearshore support for local communities and nearshore and onshore industrial activities. Future nearshore traffic could increase as the region responds to increased accessibility, shipping opportunity, development opportunity, and infrastructure needs. Increased shipping traffic, icebreaking support for shipping, military and regulatory vessels traffic, commercial fishing, recreation (cruise ships), research, and uncontrolled aircraft and vessel disturbance noise are expected as current trends regarding climate change and economic opportunity continue.

- Increased levels of vessel traffic and expanding routes of vessel traffic could create opportunity for greater incidence of injury or mortality of endangered whales via collisions and propeller contact.
- Increased vessel activity could increase the probability of fuel spills from vessels. Increasing bulk-fuel needs and transport could result in higher risk of a large fuel spill and, although individuals whales could be injured or mortality result, population-level effects could occur in the specific circumstances presented in the spring lead system during calving and migration, where exposure of concentrations of bowhead whale females with calves to fumes could result in substantial loss or injury, especially of the young-of-the-year.
- Climate change could either intensify interspecific and intraspecific competition for prime feeding areas and prey or expand available habitat resources among bowhead, fin, gray, and humpback whales. Expansion of regional habitat use and abundance by orcas, a potential predator of baleen whales, may increase with climate changes and subsequent ocean ecosystem changes.
- Changing conditions potentially could provide opportunity for exotic or invasive species of marine life to expand into the Chukchi or Beaufort Sea; potential pathogens and parasites previously absent in the Arctic could survive and affect arctic species lacking resistance or immunity.
- Humpback and fin whale habitat may be enhanced by longer ice-free periods and greater expanses of ocean where prey bases are enhanced by changing oceanographic conditions. Humpbacks and fin whales could migrate earlier, outmigrate later in the fall, and expand range, numbers, and duration of presence in the Beaufort and Chukchi sales.
- Spatial and temporal changes of ice-cover duration, movement, age, and thickness could alter the distribution, timing, and patterns of the spring lead system; bowhead migration timing and movement efficiency through ice conditions; seasonal-use areas; prey productivity; and distribution in both the Chukchi and Beaufort Seas.

The cumulative interaction of ongoing or existing activities and climate change processes may or may not adversely affect endangered whales, depending on the complex temporal, spatial, magnitude, rate of change, and many more variables that effects are unpredictable at this time. Climate change may create positive and/or negative effects to endangered whales. How such potential changes would occur singly or in combination would be highly speculative at this time, and continued intensive monitoring effort would be necessary to document changes and effects and develop responsive management as appropriate. Increased human-caused activities could deflect and possibly alter nearshore spring and fall bowhead whale migration corridors that, in turn, may or may not adversely affect whales, their habitat, and human use of the whale resource. Such traffic could prevent effective duration of use or prevent bowhead and other endangered whales access to high-quality prey concentrations. Frequent encounters and exposure to noise disturbance could reach levels of chronic and cumulative stress to some animals so as to impact health, social bonds, and productivity of individuals and potentially populations.

There would be no small or large oil- and gas-related spills attributed to the no-action alternative, as Lease Sales 212 and 221 would not be held. Spills associated with OCS prelease activities and existing lease activity could occur as well as spills from those past, present, and foreseeable activities (e.g., shipping, military operations, cruise-ship activity, refueling, vessel collision and grounding, State oil and gas activity, aircraft crashes, etc.) not authorized by the Alaska OCS region. Analysis of OCS spill probabilities and response has been analyzed in previous documents (USDOI, MMS, 2003a; USDOC, NOAA, 2006) for past and existing OCS activities in the Beaufort and Chukchi Sea. Most whales exposed to spilled oil are expected to experience temporary, nonlethal effects from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil-contaminated prey items, baleen fouling, reduced food resources , or temporary displacement from feeding areas. A few individuals may be killed, or temporarily or permanently experience sensory or physical impairment or tissue contamination as result of exposure to freshly spilled oil; however, the chance of a spill occurring and also contacting whale habitat during the periods when whales are present is considered low. Whales tend to avoid spill-cleanup vessel and aircraft traffic, noise, and human activity, and the percentage of the Western Arctic stock that would be affected is expected to be very low. The probability of an oil/fuel spill increases with more and broader regional distribution of oil- and gas-related activity, nonshipping-vessel activity, refueling events, increased vessel transport of fuel and goods, and other activities or events that can result in spilled oil. Potential climate change-induced increases in numbers, changes, and/or expansion in seasonal distribution and range by Northwest Pacific humpback, Alaska (Northeast Pacific) fin whales, and Western Arctic bowhead whales also could increase potential exposure of whales to oil in the event of spills, depending on the circumstances of a spill event.

Mitigation measures associated with foreseeable OCS exploration, development, and production associated with existing offshore lease areas are expected to minimize adverse effects to whale migration-corridor use at key periods, minimize interference with availability of bowhead whales for subsistence hunts, and endangered whale use of important seasonal habitats and feeding areas. Monitoring of endangered whales would continue to document and provide data regarding climate change-induced alterations of whale populations, ecology, and human use from which to formulate and implement informed and adaptive decisions.

4.5.1.6.2. Threatened and Endangered Birds.

Summary. In the following analysis, we determined that there would be no direct or indirect effects if the lease sales were not held; there would be a negligible level of cumulative effects from seismic surveys and petroleum spills; and a continued minor level of cumulative effects from vessel presence and noise, aircraft presence and noise, subsistence hunting, collisions with structures, loss of habitat, and increased predator populations. The greatest potential for a major level of cumulative effect is associated with continuing physical changes in the Arctic environment. Mitigation measures imposed on future exploration and development activities on existing leases or surrounding waters avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. The total effect of MMS-authorized actions would be proportionately lower when compared to similar, but unrestricted activities in the area.

Threatened and endangered birds in the Chukchi and Beaufort seas include the Steller’s eider (Threatened) and spectacled eider (Threatened). The Kittlitz’s murrelet is a candidate species (Listing Priority Number 2). The FWS defines a candidate species as “… one for which we have sufficient information to prepare a proposed rule to list it because it is in danger of extinction or likely to become endangered within the foreseeable future throughout all or a significant portion of its range.” We included the Kittlitz’s murrelet because it may be proposed for listing or be listed in the reasonably foreseeable future. We often refer to these species collectively as ESA-listed or ESA-protected birds.

In the following analysis we describe the potential effects to threatened and endangered birds (and marine and costal birds in general) from a variety of existing sources (Section 4.5.1.6.2.1) in the project area. We then identify mitigation measures (Section 4.5.1.6.2.2) would avoid or minimize some of these impacts.

The anticipated levels of effect of implementing this alternative (Section 4.5.1.6.2.3) are broken down between direct and indirect effects (Section 4.5.1.6.2.3.1) and cumulative effects (Section 4.5.1.6.2.3.2). As Threatened and Endangered Birds are a resource group, we address differential effects to each species separately in Section 4.5.1.6.2.4.

4.5.1.6.2.1. Potential Effects to Threatened and Endangered Birds. The principal human-caused sources of potential adverse effects to birds in the Beaufort and Chukchi seas include:

- vessel presence and noise,
- aircraft presence and noise,
- collisions,
- petroleum spills,
- increased bird predator populations,
- habitat loss,
- hunting,
- seismic airgun noise, and
- changes in the physical environment.

These impact sources were described in Section 4.4.1.6.2.1. These sources of impacts arise from a number of sources, including community development; transportation; tourism; oil and gas exploration and development on private, State, and Federal lands; and climate change. Oil and gas exploration activities include vessel presence and noise, aircraft presence and noise, collisions, and seismic-airgun noise. Other than the pending Liberty and existing Northstar developments, production of oil or gas from existing leases in the Chukchi and Beaufort seas is speculative. Oil and gas development activities include those of exploration (to differing degrees) and increased bird predator populations, hunting, habitat loss, and petroleum spills. In the following section, we describe how these sources may operate in the Chukchi Sea as compared to the Beaufort Sea (i.e., whether the potential effect could be greater or less).

4.5.1.6.2.1.1. Potential Effects from Vessel Presence and Noise. The potential effects from vessel presence and noise would affect ESA-protected birds much as described in Section 4.4.1.6.2.1.1; however, there are a few notable differences in how birds could be affected in the Chukchi Sea that warrant special emphasis. 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. Vessel 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, such as egg laying. 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.

A similar situation occurs during the postbreeding period, except that the migration for some species is phased with males departing for molting areas first, followed by females that have lost their nests, and finally by successfully breeding females and their broods. The flow of birds into the molting areas takes place over an extended period of time. While there is a benefit of not having the entire population concentrated in one particular area, such as may occur in the spring lead system, certain cohorts (such as a years' successful hens) could be in one area at one time. In the most extreme case, an estimated 33,200 spectacled eiders have been counted in the Ledyard Bay Critical Habitat Area (LBCHA) (Figure 3.4.2.1) during the latter portion of the molting season. Most of these eiders are believed to be successfully-breeding females and their hatch-year broods.

While concentrations of molting eiders in the LBCHA 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. 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. Even a seemingly trivial incremental degree of adverse effect to individual fitness (caused by chronic vessel disturbance) applied to such a large number of molting birds in Ledyard Bay could result in decreased winter survival with resultant decreased population size, productivity, and recruitment.

4.5.1.6.2.1.2. Potential Effects from Aircraft Presence and Noise. The potential effects from aircraft presence and noise would affect ESA-protected birds much as described in Section 4.4.1.6.2.1.2; however, there are a few notable differences in how birds could be affected in the Chukchi Sea that warrant special emphasis. The potential effects of aircraft disturbances could be similar to vessel-based disturbances (previous section) in terms of impacting ESA-protected birds in the Spring Lead System and the LBCHA.

Altitude restrictions have been used to separate birds and aircraft to reduce the potential to harm eiders (USDOI, MMS, 2006a). Altitude restrictions often are impracticable in arctic coastal areas, however, due to frequent inclement weather. Evidence suggests that some birds may habituate to certain sources of disturbance or avoid impacts associated with certain areas (USDOI, FWS, 2005). 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.

4.5.1.6.2.1.3. Potential Effects from Collisions. Collisions could result from aircraft striking birds and birds striking vessels or offshore/onshore facilities. These sources are described in Section 4.4.1.6.2.1.3. The potential could be elevated where birds concentrate such as in the spring lead system or the LBCHA.

4.5.1.6.2.1.4. Potential Effects from Petroleum Spills. In the event of a spill, birds could die due to a variety of direct and indirect effects as described in Section 4.4.1.6.2.1.4. The spring lead system and the LBCHA are important areas where large numbers of ESA-protected species could be affected.

4.5.1.6.2.1.5. Potential Effects from Increased Bird Predator Populations. The potential effects from increased predator populations are the same as those described in Section 4.4.1.6.2.1.5.

4.5.1.6.2.1.6. Potential Effects from Increased Subsistence-Hunting Activity. The potential effects from increased subsistence-hunting activity are the same as those described in Section 4.4.1.6.2.1.6.

4.5.1.6.2.1.7. Potential Effects from Habitat Loss. Habitat loss could be more important in the Chukchi Sea due to the designation of some offshore areas as critical habitat under the ESA.

4.5.1.6.2.1.8. Potential Effects from Seismic-Airgun Noise. The potential effects from seismic-airgun noise are the same as those described in Section 4.4.1.6.2.1.8. The greatest related effect from seismic activity is associated with the vessels that may disturb ESA-protected birds when conducting seismic surveys (Section 4.5.1.6.2.1.1 above).

4.5.1.6.2.1.9. Cumulative Effects from Global Forces. The climate-induced changes described in Section 4.4.1.6.2.1.9 are the same as those expected in the Chukchi Sea. How these potential effects influence physical conditions of the spring lead system or the LBCHA are of particular concern. The ESA-protected bird species likely will face altered conditions, and their traditional food sources will be lost or become available at different times of the year, potentially threatening long-established relationships that are essential to species survival. Changes in oceanographic processes and sea-ice distribution, duration of snow and ice cover, distribution of wetlands and lakes, and sea level rise could lead to alterations of the historical spring lead system or the importance of the LBCHA.

4.5.1.6.2.2. Mitigation Measures. The same mitigation measures described in Section 4.4.1.6.2.2 apply to the Chukchi Sea, except that there are no mitigation measures for State lease sales in the Chukchi Sea, because the State is not considering any lease sale activities there (ADNR, 2008).

4.5.1.6.2.3. Anticipated Effects Under Alternative 1. The following section describes the impact on threatened and endangered birds resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions are described in Section 3.1 as they affected threatened and endangered birds. Reasonably foreseeable future actions are described in Section 4.2.

The following analysis describes effects anticipated to occur in the future if the MMS does not hold a lease sale in the Chukchi Sea. As there would be no other effects from this alternative in the project area, the anticipated effects from the reasonably foreseeable and speculative future events (Section 4.2) in this case are the cumulative effects for this alternative. This analysis considers important factors (timing, residence time and productivity, spatial extent, environmental factors, etc.) described in Section 4.4.1.6.2.3. The terms used for the level of effect are also defined in Section 4.4.1.6.2.3. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.1.6.2.3.1) and cumulative effects (Section 4.5.1.6.2.3.2). As threatened and endangered birds represent a resource group, we address differential effects to specific species in Section 4.5.1.6.2.4.

4.5.1.6.2.3.1. Direct and Indirect Effects Under Alternative 1. There would be no direct or indirect impacts to ESA-listed birds in the project area from Lease Sales 212 and 221 if these sales were not held.

4.5.1.6.2.3.2. Cumulative Effects Under Alternative 1.

Summary. While there would be no direct or indirect effects from implementing the proposed action, ESA-protected birds in the project area would continue to be affected by a variety of factors. Marine and coastal areas of the North Slope are commonly perceived to be a pristine environment, yet there are number past and existing sources of harm, an increasing number of threats, and anticipated environmental changes (identified in Section 4.2, Reasonably Foreseeable and Speculative Future Events) that will negatively affect spectacled and Steller’s eiders and Kittlitz’s murrelets in the project area well into the future, even if none of the proposed lease sales is held. Primary considerations include:

- The most important impacts to Steller’s and spectacled eiders and Kittlitz’s murrelets likely will arise from continued climate change and the loss or expansion of habitats important to these birds, any changes in breeding chronology or trophic asynchrony. As these species already are imperiled, an inability to adapt to a changing environment could negatively affect their distribution or abundance.
- Uncontrolled vessel and aircraft disturbance could continue to harm ESA-listed birds in spring migration or summer/fall molting areas. It is unclear if these impacts accumulate from year-to-

year, but chronic stress during sensitive life stages, especially the molt, would likely lead to long-term changes in survival and productivity.

- Collisions with existing structures (production facilities on State lands, power lines, communication towers, etc.) in coastal areas could continue at a low rate. Preventive measures were not required for most structures and special lighting protocols would likely not be implemented on existing developments. New development presents sources of collision hazard if preventive measures are not taken. Collision mortality, however, does not appear to be a significant source of mortality; however, there is little monitoring for collision mortality.
- Bird predator species, especially foxes and ravens, are anticipated to continue to expand in distribution and abundance due to a lack of effective control over access to human-use foods or garbage and an increasing abundance of nesting or denning sites. The adverse effect these predators have on ESA-listed bird populations is not clearly understood and is partially offset by small mammal population cycles, but the relationship appears to be out of natural ecological balance and will only continue to negatively affect ESA-listed bird populations without concerted management action.
- Spills, particularly in offshore areas, pose the greatest risk to birds in marine areas. Existing and anticipated future increases in vessel traffic, especially from tourism or shipping, will increase the risk of a marine accident. Barring these events, deliveries of bulk fuel to coastal communities pose the greatest risk of a large noncrude oil spill in the marine environment.
- Seismic surveys and other postlease exploration activities for existing OCS leases in the Chukchi Sea require specific mitigation or avoidance measures that reduce impacts to marine and costal birds to a negligible level.
- Climate-related changes will continue to occur to bird habitats along the Chukchi Sea, perhaps to a greater extent than all other anticipated effects combined.

While many of these negative influences are difficult or impossible to control, increased attention to minimizing these effects could reduce anthropogenic sources of stress or mortality to listed eiders. As it remains unclear what factor(s) is most affecting eider populations, changes in eider populations are difficult to predict. We anticipate that existing trends would continue and ESA-listed eider populations would stabilize. While little information exists for the Kittlitz's murrelet in the Chukchi Sea, recent surveys indicated a surprising abundance of post-breeding Kittlitz's murrelets immediately west of Barrow (Renner, Hunt, and Kuletz, 2008). Additional surveys are needed to verify if there is consistent use of this area by Kittlitz's murrelets.

4.5.1.6.2.3.2.1. Anticipated Level of Effect from Vessel Presence and Noise. Section 3.1.1 describes the general past and present vessel traffic patterns in the Chukchi Sea. Existing information indicates an increasing amount of vessel traffic, particularly in tourism and research vessels in the Arctic, such as those seeking to explore and study arctic regions via the Northwest Passage. We anticipate this trend to continue into the reasonably foreseeable future. These vessels are free to navigate open waters where they could encounter and disturb Steller's and spectacled eiders and Kittlitz's murrelets. For example, traffic between the Beaufort Sea and the Bering Sea could pass through areas seasonally important to spectacled eiders, such as the LBCHA.

There is a high level of interest in using the Northwest Passage as a shipping route to decrease the distance ships would have to travel between the Pacific Ocean and the Atlantic Ocean. Increasing military activities also are anticipated. As with tourism and research traffic, both commercial and military large-vessel traffic could disturb large numbers of ESA-protected birds. Uncontrolled vessel disturbance from anticipated tourism, research, shipping, and military vessels could result in chronic, long-term disturbances to ESA-listed birds, especially during the sensitive molting period in Ledyard Bay.

Mitigation measures imposed on exploration activities avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. The authorized actions would have proportionately fewer impacts on ESA-protected birds compared to other unrestricted vessels operating in this area.

Summary. Vessel presence and noise under Alternative 1 are anticipated to result in a continued minor level of effect on threatened and endangered birds.

4.5.1.6.2.3.2.2. Anticipated Level of Effect from Aircraft Presence and Noise. Aircraft traffic could adversely affect listed birds by: (1) displacing adults and/or broods from preferred habitats during pre-nesting, nesting, and brood rearing and migration; (2) displacing females from nests, exposing eggs or small young to inclement weather or predators; and (3) reducing foraging efficiency and feeding time. The behavioral response of eiders to low-level aircraft flights is unknown; 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.

Disturbance to nesting spectacled and Steller's eiders probably is limited due to their extremely low densities across the North Slope. Across the Arctic Coastal Plain (ACP) of the North Slope, breeding-season density averages approximately one pair per 8 km^2 for spectacled eiders (Larned, Stehn, and Platte, 2003). 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, the highest nesting density recorded during 4 years of aerial surveys was estimated as approximately one pair per 12.5 km^2 (Ritchie and King, 2002). Densities elsewhere on the ACP are much lower.

Most aircraft on the North Slope are operated without altitude or route restrictions to protect threatened or endangered birds. Some traffic associated with State oil and gas operations in and south of the Beaufort Sea is restricted to protect certain species that also may benefit ESA-listed birds (ADNR, 2008). Frequent low-level flights associated with freight, intercommunity travel, research studies, and oil and gas operations likely impact birds, but at an unknown level. Any adverse effects are anticipated to continue.

The number of nesting Steller's or spectacled eiders that would be exposed to low-level flights associated with OCS oil and gas development is low, because the potential direct flight from an airbase to offshore drilling sites within the OCS would primarily be over coastal waters. Mitigation measures imposed on exploration activities avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. The authorized actions would have proportionately fewer impacts on ESA-protected birds compared to other aircraft operating in the project area.

Summary. Aircraft presence and noise under Alternative 1 are anticipated to result in a continued minor level of effect on threatened and endangered birds.

4.5.1.6.2.3.2.3. Anticipated Level of Effect from Collisions. The ESA-protected birds will continue to strike structures during periods of darkness or inclement weather in nearshore areas. Some facilities are lit in such a manner that may attract and disorient flying birds, resulting in avoidable impacts if improvements to lighting were made. The location of the project is a primary determinant whether some risk of collisions exists. For example, the NSB has proposed to reconstruct/relocate the existing airport on Barter Island. This airport services Kaktovik. The project proposes to run a power line to the new sites, which could increase the number of migratory birds killed. As the site is outside the typical distribution of ESA-listed eiders, few impacts to eiders from collisions would be expected.

Monitoring of bird-strike mortality across the North Slope is infrequent, so the level of mortality cannot be estimated. The FWS maintains a database of reported collisions (USDOI, FWS, 2005). The MMS review of this database indicates the level of mortality to ESA-protected birds appears low, having minor effects on listed eiders. Furthermore, there are few communities and no oil or gas infrastructure in coastal areas of the Chukchi Sea. With fewer structures to strike, the risk of collision should be lower.

Oil and gas exploration activities likely would increase the total number of structures in the project area. Mitigation measures imposed on exploration activities are believed to minimize collision mortality to ESA-listed birds in the Chukchi Sea. Vessels and drillships must operate their lights to minimize collisions. Furthermore, the lease sale 193 boundary excluded nearshore areas used by migrating birds.

Both MMS and FWS both acknowledge that estimating incidental take of listed eiders is extremely difficult due to a lack of available information. An estimated incidental take of listed species was calculated in the Biological Opinion for the Chukchi Sea Lease Sale 193 (USDOI, FWS, 2007). Collisions with exploration structures on existing leases in the Chukchi Sea OCS were calculated to result in an incidental take of three spectacled eiders and one Steller's eider. There were a variety of assumptions made to support these calculations.

Although production from existing Chukchi Sea leases is speculative, MMS calculated that as many as 17 spectacled eiders and one Steller's eider would occur from collisions with structures associated with hypothetical production drilling on existing leases in the Chukchi Sea OCS (USDOI, MMS 2006c).

Summary. Bird collisions resulting from Alternative 1 are anticipated to result in a continued minor level of effect on threatened and endangered birds.

4.5.1.6.2.3.2.4. Anticipated Level of Effect from Petroleum Spills. The potential effects from spills to birds were described in Section 4.4.1.6.2.1.4 and factors in Section 4.4.1.6.2.3.2. 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 birds. According to oil-spill records, most accidental spills in Alaska happen in harbors or during groundings; consequently, spills from vessels on the high seas should be an infrequent occurrence. Particular concern has been expressed over increases in tourism and shipping traffic between the Bering Sea and the North Atlantic, especially from vessels or crews unaccustomed or ill-prepared to traverse these remote and dangerous areas. Vessels traversing the Chukchi and Beaufort seas during period of ice are more prone to an accident. The ADEC (2007) reports that the highest probability of spills of noncrude products occurs during fuel-transfer operations at the remote villages of the North Slope.

Other sources of petroleum spills include a well blowout (Section 1.1.4), but these are modeled as having a low percent chance of occurring and it is improbable that adverse effects to ESA-protected birds from these activities would occur.

The potential for spills to contact ESA-protected species was described in the BE supporting Section 7 consultation with the FWS on Lease Sale 193 (USDOI, MMS 2006c). The companion BO (USDOI, FWS, 2007) concluded that: "…a potential oil spill associated with possible oil development in or near the LBCHU may appreciably affect both the survival and recovery of the North Slope population of threatened spectacled eiders." The same BO concluded that: "Because all North Slope-breeding Steller's eiders may migrate northward in spring leads or broken ice near shore, the Service believes it is possible for an oil spill in the spring lead system to contact and kill a majority of Alaska-breeding Steller's eiders. This would be a catastrophic population-level mortality event for this listed species." Similarly, "possibly thousands" of Kittlitz's murrelets could be killed during the same spill event.

It is important to remember that a large spill event associated with OCS oil and gas activities likely would only occur during the production phase, when volumes of oil/gas product are being moved to production facilities in the existing facilities at Kuparuk or Prudhoe Bay. Such a commercial discovery warranting production has not been identified or proposed for development and is considered speculative at this time. In other words, while both MMS and FWS acknowledge that a large spill could have major impacts on ESA-protected species, a spill(s) from production activities is not considered a reasonably foreseeable future event.

If such a resource discovery is made and is considered for development, the MMS must reconsult with the FWS on a production plan. The Sale 193 final EIS (USDOI, MMS, 2007d) made potential lease bidders aware of this future need, specifically:

> Information to Lessees: No. 7 - Information on the Spectacled Eider and Steller's Eider. Lessees are advised that the spectacled eider *(Somateria fischeri*) and Steller's eider (*Polysticta steller*i) are listed as threatened by the U.S. Fish and Wildlife Service (FWS) and are protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).
>
> Spectacled eiders and Steller's eiders are present in the Chukchi Sea during spring migration in May and June. Males return to the open sea in late June, while nesting females remain on the arctic coastal tundra until late August or early September. Molting eiders occur in certain offshore areas until freeze-up (typically in November). Onshore activities related to OCS exploration, development, and production during the summer months (May-September) may affect nesting spectacled eiders and Steller's eiders.
>
> Lessees are advised that exploration and development and production plans submitted to MMS will be reviewed by the FWS to ensure that spectacled eider, Steller's eider, and their habitats are protected. For the proposed Lease Sale 193, MMS specifically requested an incremental Section 7 consultation with the FWS. The MMS consulted with FWS regarding the potential effects of leasing and seismic/exploration activities. As few details are known regarding the specific location/design of a future development, that stage of the process will require further consultation with the FWS. To allow this stepwise approach, FWS found that the leasing and seismic/exploration stage of the project would not result in a jeopardy determination to either the Steller's eider or spectacled eider nor would adverse modification of spectacled eider critical habitat occur.
>
> The FWS also concluded that there "is a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the [Endangered Species] Act." Section 7(a)(2) of the Act requires that Federal Agencies ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species or adversely modify designated critical habitat. Lessees are advised that future development projects arising from Lease Sale 193 are subject to Section 7 consultation with the FWS and a future project would not be authorized by MMS if it results in jeopardy or adverse modification of designated critical habitat as determined by FWS.

The MMS believes that this condition will help industry incorporate more stringent spill prevention measures into their plans that avoid the risk of population-level effects on ESA-protected species in the Chukchi Sea.

Summary. This alternative is anticipated to result in a negligible level of effects on threatened and endangered birds, because petroleum spills are considered infrequent, illegal, or accidental events.

4.5.1.6.2.3.2.5. Anticipated Level of Effect from Increased Bird Predator Populations. The dependence by ravens on human-use foods and garbage, combined with the potential increase in nesting sites from existing and future developments, are anticipated to continue and will result in the expansion in the distribution and abundance westward across the North Slope. Only a concerted management program to deny ravens access to artificial food sources and removal of nests or ravens would halt the facilitated expansion of breeding ravens across the North Slope. This is not anticipated to occur in the reasonably foreseeable future and moderate adverse effects to ESA-listed birds are anticipated to continue.

A similar, but lesser, impact occurs from foxes obtaining human-use foods/garbage or denning in sites made suitable from development. While foxes are endemic to the North Slope, densities may be greater due to increased availability of food or den sites.

Should development ever be proposed, mitigation measures would avoid or minimize adverse effects to ESA-listed birds. While there likely would be an incremental increase in the total number of structures or facilities that could be used by bird predators such as ravens or foxes, these facilities would not be constructed or operated in a manner that would support bird predators. For example, a lease stipulation (requiring that new infrastructure would avoid the artificial enhancement of predator populations) recently has been implemented for the Liberty project and is anticipated to be implemented for any future developments associated with Federal leases. Implementation and enforcement of a leasing stipulation could be expected to minimize any effects of increased predator populations resulting from Federal actions in the OCS.

Summary. Alternative 1 is anticipated to result in a continued minor level of effect on threatened and endangered birds.

4.5.1.6.2.3.2.6. Anticipated Level of Effect from Subsistence-Hunting Activity. The FWS has made an effort to educate the local hunting public about the plight of spectacled and Steller's eiders, and has stated that the prohibition against harvest of these species would be enforced, but some level of (accidental) harvest may be continuing. It is unknown what that level of harvest is. Improved access can increase the range of hunters to areas where ESA-listed eiders could be misidentified and be killed.

There would not be any change in subsistence hunting activity due to exploration activities. Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). If development and production were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. The pipeline would need a road for periodic maintenance and this road could increase access of local hunters to previously inaccessible areas. Waterfowl hunters may be able to access pipeline roads during the period immediately following spring breakup to hunt geese and eiders.

It is unknown whether increased access would result in an increased accidental or illegal harvest of spectacled or Steller's eiders following the creation of a road along a pipeline. The long-term consequences of this speculative development would be evaluated in future NEPA documents and via formal consultation under the ESA, but at the present time were not anticipated to affect listed eiders.

Summary. Alternative 1 is anticipated to result in a continued minor level of effect on threatened and endangered birds, because it is reasonable to assume some accidental hunting mortality of ESA-listed birds likely occurs annually.

4.5.1.6.2.3.2.7. Anticipated Effects from Habitat Loss. Existing human development in coastal areas of the Chukchi and Beaufort seas is relatively sparse and limited to several small communities that include Point Hope, Point Lay, Wainwright, Barrow, and Kaktovik. Development likely will occur in the future, and a corresponding amount of eider-nesting habitat will be lost. For example, the Arctic Slope Native Association applied for a Section 404 permit to place gravel fill in about 10 acres of wetlands at Barrow (U.S. Army Corps of Engineers, 2007). Similarly, the State of Alaska is managing a project to fill another 19 acres of wetland habitats to expand the Barrow Airport (U.S. Army Corps of Engineers, 2006). Secondary effects from the zone of influence around new or expanded developments would also result in habitat loss for ESA-listed eiders.

The closest industrial development of size southwest of the proposed lease areas is the Red Dog Mine Port Site near Kivalina and existing industrial development (Kuparuk and Prudhoe Bay fields) are east of Teshekpuk Lake (Section 3.3.1). Continued development likely will occur in and around these sites in the future and a corresponding amount of eider nesting habitat will be lost. Secondary effects from the zone of influence around new or expanded developments also would result in habitat loss. For example, in April 2008, BPXA applied to the U.S. Army Corps of Engineers for Section 404 permits to fill over 28 acres of wetlands "to support placement of infrastructure for oil and gas development" or similar project (U.S. Army Corps of Engineers, 2008). Secondary impacts to nesting birds could be smaller due to existing developments nearby. The project sites are within the range of ESA-listed eiders.

There would not be any permanent loss or alteration of bird habitat during exploration and delineation activities. Small amounts of temporary habitat loss of Steller's and spectacled eider migration habitats could occur from drilling exploration or delineation wells into the seafloor. Wells would not be drilled in benthic habitats within the LBCHA, because this area was excluded from Lease Sale 193.

Future production of oil or gas resources on the Beaufort Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). Permanent habitat loss could occur if production facilities (offshore platform, an undersea pipeline, a pipeline landfall to an onshore base, and a pipeline linking to existing infrastructure) are located in areas used by Steller's and spectacled eiders. It was assumed that onshore developments would originate at a pipeline landfall, location presently unknown. The pipeline and associated developments conceivably would then be the shortest, most cost-effective route to connect with pre-existing support infrastructure. Additional airstrip construction or use of overland ice roads/pads is not anticipated. Indirect habitat losses could result from eiders and murrelets not using habitats near sites of industrial activity.

The MMS can only speculate about the size and location of permanent onshore developments associated with a future phase of oil production, but it was estimated in the Sale 193 final EIS (USDOI, MMS, 2007d):

> As a pipeline is expected to be placed on elevated structures or, less frequently, buried near, but not immediately adjacent to, the 19.8-meter-wide (65-foot-wide) road, the pipeline "footprint" was integrated with the road footprint into a 0.03 km-wide (100-foot-wide) road/pipeline development "corridor". The road/pipeline corridor was assumed to be 482.8 km (300 miles) long. Consequently, direct impacts from pipeline/road construction are estimated to affect 14.72 km^2 (3,636 ac) of eider nesting habitat [see Table 4.5.1.6.2-1].
>
> The shore base and staging facilities were assumed to each have gravel footprints of 0.2 km^2 (50 ac) on eider nesting habitat. Up to four pump stations would be needed to move oil eastward and these stations are estimated to each have a gravel footprint of 0.16 km^2 (395 ac total).
>
> Material to construct the road, shore base, and other facilities would likely come from upland gravel pits, if practicable, or from coastal areas (intertidal areas, barrier islands, etc.) if no feasible and prudent non-coastal alternative is available. The locations of gravel sources near a

future alignment are unknown, however it is likely that some known gravel sources (identified in NPR-A, presently undeveloped) or existing gravel pits would be utilized/expanded for material construct fill for the development facilities. For the purposes of analysis, we estimated that 1.60 km^2 of eider nesting habitat would be affected by gravel extraction.

Overall, these developments have a footprint of 17.37 km^2 (4,291 ac) in eider nesting habitats, resulting in an estimated direct take of 19 spectacled eiders and one Steller's eider [see Table 4.5.1.6.2-1].

Indirect Habitat Losses. Secondary or indirect effects to nesting eiders would arise from habitat modifications (drainage, flooding, dust impacts to vegetation, changes in thermokarst) and disturbances from traffic and human activities. For the purposes of consistency in estimating the incidental take of spectacled and Steller's eiders associated with indirect loss of nesting habitat, MMS decided to adopt the methodology used by recent similar projects for NPR-A (BLM 2003, FWS 2005). The rational for these calculations and the biological basis for a "zone of influence" are detailed in those biological assessments and resultant biological opinions and are not repeated here. As with previous calculations, our calculations used a zone of influence away from developments measuring 200 m (656 ft). Our calculations did not take into account the amount of overlap in the secondary effects zone that would occur where certain facilities meet.

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 was considered not applicable.

Overall, these zones of influence associated with development facilities developments have a collective areal extent of 196.13 km^2 (48,464 ac) in eider nesting habitats, resulting in an estimated direct take of 216 spectacled eiders and 12 Steller's eider [see Table 4.5.1.6.2-1].

Summary. Alternative 1 is anticipated to result in a continued minor level of effect on threatened and endangered bird habitats because of annual destruction of eider habitats for community development.

4.5.1.6.2.3.2.8. Anticipated Effects from Seismic-Airgun Noise. Seismic activities are used to locate and delineate potential oil and gas resources. Most seismic activity on land is done during the winter when ESA-protected birds are absent.

Offshore surveys on Federal lands are conducted by vessels during the open-water period. There are existing Federal leases in the OCS lands of the Chukchi Sea, and it is reasonable to expect leaseholders and others to investigate the potential for oil or gas production in the future. Exploratory/delineation drilling, seismic work, and related support activities would generally occur primarily during the ice-free, open-water period.

While there likely would be a continuation of existing levels of seismic activity and increased exploration drilling in the Chukchi Sea compared to 2006 and 2007, MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. No mortality is anticipated from seismic activities.

Summary. Seismic activity under Alternative 1 is anticipated to result in a negligible level of effect on threatened and endangered birds.

4.5.1.6.2.3.2.9. Anticipated Level of Effect from Changes in the Physical Environment. Section 4.4.1.6.2.1.9 briefly described likely ongoing effects from changes in oceanographic processes and sea-ice distribution, duration of snow and ice cover, distribution of wetlands and lakes, and sea level rise. These changes in the physical environment may affect marine and coastal bird populations, including ESA-protected birds.

Some of these expected changes could benefit coastal birds using habitats on the ACP, at least initially. Expansion of more productive wetland habitats could provide additional nesting sites for several species and boost the abundance and distribution of aquatic plants and insects important to many bird species. These benefits to birds would be expected to decline over time as the wetlands and lakes disappear.

Climatic change could have stochastic or habitat effects on many species that may surpass the impacts of other activities. As previously stated, however, the implications of climate change on coastal and marine birds are impossible to predict with any precision. For purposes of analysis, we assume most of the obvious trends are anticipated to continue. We considered these trends in determining the effects of the alternatives.

Changes in the physical environment are believed to result from climate changes superimposed on the vagaries of regional weather patterns. These long-term trends are outside the influence of authorized actions. The argument that potential sources of energy that could be generated from Arctic OCS oil or gas development contributes to further changes in the physical environment fails to recognize that America has large energy needs and energy not produced from the Alaska OCS would continue to be replaced by foreign imports. Overall, as America uses these fuels, it affects worldwide CO_2 levels/climate change to the same extent, regardless of their source. OCS actions are anticipated to have a negligible direct effect on greenhouse gas emissions.

Summary. Continued climate change is anticipated to result in a major level of effect on threatened and endangered birds.

4.5.1.6.2.4. Species-Specific Level of Effects.

4.5.1.6.2.4.1. Cumulative Level of Effect to the Steller's Eider. Wetland fills from community and industry infrastructure development would immediately eliminate Steller's eider habitat compared to the more gradual habitat changes expected to result from climate change. Collisions with existing or future developments at these and other sites would continue to present a collision hazard and small numbers of Steller's eiders would be expected to be killed. Unrestricted vessel and low-level aircraft traffic would continue to be a chronic source of disturbance, especially to Steller's eiders in the spring lead system.

Reduction in some of the adverse effects associated with disturbance from oil and gas exploration activities in the OCS would be achieved, because vessels and aircraft associated with these activities would be managed to avoid conflicts with eiders. Exploration and delineation activities present a risk that Steller's eiders would collide with a vessel or drilling structure. Despite mitigation measures to reduce the risk of this occurring, an incidental take of one (0.2 rounded up) Steller's eider was calculated to be killed by collision with drilling structures during exploration and delineation activities associated with existing leases in the Chukchi Sea (USDOI, MMS, 2007d).

The overall effects from potential production (considered speculative) include periodic interruption of postbreeding Steller's eiders migrating in nearshore coastal areas. Activity associated with the construction and operation or maintenance of onshore facilities (pipelines, roads, etc.) likely would not result in a loss of Steller's eider-nesting habitat. The MMS considers the level of incidental take during exploration activities to be an unavoidable but minor level of effect to Steller's eiders.

4.5.1.6.2.4.2. Cumulative Level of Effect to the Spectacled Eider. Wetland fills from community and industry infrastructure development would immediately eliminate spectacled eider habitat compared to the more gradual habitat changes expected to result from climate change. Collisions with existing or future developments at these and other sites would continue to present a collision hazard, and small numbers of spectacled eiders would be expected to be killed. Unrestricted vessel and low-level aircraft traffic would continue to be a chronic source of disturbance, especially to spectacled eiders in the spring lead system (spring) and LBCHA (summer/fall).

Reduction in some of the adverse effects associated with disturbance from oil and gas exploration activities on the OCS would be achieved, because vessels and aircraft associated with these activities would be managed to avoid conflicts with eiders. For example, oil and gas exploration vessels would not disturb molting eiders because they would not be permitted in the LBCHA after July 1 of each year, even if they were transiting areas outside the Chukchi Sea.

Exploration and delineation activities present a risk that spectacled eiders would collide with a vessel or drilling structure or be struck by an aircraft. Despite mitigation measures to reduce the risk of this occurring, an incidental take of four spectacled eiders was calculated to be killed by collision with drilling structures during exploration and delineation activities associated with existing leases in the Chukchi Sea (USDOI, MMS, 2007d).

The overall effects of potential production (considered speculative) include periodic interruption of post-breeding and molting spectacled eiders migrating in nearshore coastal areas. Activity associated with the construction and operation or maintenance of on-shore facilities (pipelines, roads, etc) would likely result in a loss of eider nesting habitat and cause eiders nesting outside a zone of influence around these sites. The direct impact to eider nesting habitats would be 17.37 km^2 (4,291 acres), displacing an estimated 19 spectacled eiders. The zone of secondary influence associated with development facilities could have a collective areal extent of 193.13 km^2 (48,464 acres) in eider nesting habitats, resulting in an estimated indirect take of 216 spectacled eiders (Table 4.5.1.6.2-1).

We calculated that as many as 17 spectacled eiders would occur from collisions with structures associated with production from existing leases in the Chukchi Sea OCS.

The MMS considers the level of incidental take during exploration activities to be an unavoidable, but minor level of effect to spectacled eiders.

4.5.1.6.2.4.3. Cumulative Level of Effect to the Kittlitz's Murrelet. Relatively large numbers of Kittlitz's murrelet recently have been reported just west of Barrow. Foraging Kittlitz's murrelets could be disturbed periodically by vessels and aircraft. Most mitigation or conservation measures that reduce impacts to threatened eiders benefit murrelets as well. Mortality of Kittlitz's murrelets could occur from chronic low-volume spills or a large marine spill, but the number affected depends on the time and location of the spills.

Selecting Alternative 1 is anticipated to result in a negligible level of effect on Kittlitz's murrelets in the Chukchi Sea.

4.5.1.6.3. Polar Bear. In the following analysis, we describe the potential effects to the polar bear from a variety of existing sources (Section 4.5.1.6.3.1). We then describe mitigation measures that would avoid or minimize some of these impacts (Section 4.5.1.6.3.2). The anticipated effects are the effects on polar bears of this alternative with mitigation in place.

4.5.1.6.3.1. Potential Effects to Polar Bears. The principle anthropogenic sources of potential adverse effects to polar bears in the Beaufort and Chukchi Seas include:

- vessel presence and noise,
- motorized vehicle presence and noise,
- subsistence and other harvest,
- petroleum spills,
- habitat loss and degradation,
- seismic noise and
- changes in the physical environment.

Analysis of Alternative 1, the no-action alternative, forms the environmental baseline for the Arctic multiple sales. This baseline is the current status of past and present natural and anthropogenic actions on the environment. The baseline also includes anticipated effects from other MMS-authorized activities taking place within the sale area. This section addresses potential effects to polar bears, a species recently listed as threatened throughout its range under the ESA. Polar bears also are protected under the MMPA. This section refers to the Chukchi Sea (CS) population of polar bears and the Southern Beaufort Sea (SBS) population of polar bears. The proposed lease-sale area occurs where the two populations' ranges overlap (Figure 3.3.4.3-1). For a more thorough discussion of the SBS population, see the Beaufort Sea alternatives.

The following terms are used throughout this analysis of impacts: negligible, minor, moderate, and major. For purposes of analysis on polar bears, these terms are defined in Section 4.4.3.6.3.1.

4.5.1.6.3.1.1. Potential Effects from Vessel Presence and Noise. Most vessel traffic in the Chukchi Sea is associated with local fishing and hunting, travel between villages, supply ships and barges serving local villages or the oil industry. Less frequently, cruise ships, icebreakers, U. S. Coast Guard operations, and scientific research vessels operate in the Beaufort Sea. With the exception of an occasional icebreaker, traffic at present is limited primarily to summer and early autumn. Polar bears temporarily may be drawn to or displaced by icebreaker traffic (Brueggeman et al., 1991). In addition, icebreaker activity may alter habitat used by polar bears, particularly when icebreakers take advantage of the lead system to move more easily through ice-infested waters. Polar bears may be stressed by energy expenditures related to avoiding ships or traffic in the lead systems. Encounters are less likely to occur in open water.

4.5.1.6.3.1.2. Potential Effects from Motorized Vehicle Presence and Noise. Sources of flights and motorized travel in the Chukchi Sea area include local transit from village to village, subsistence activities, industry activities, scientific research, and some guiding and tourism. The potential effects to polar bears are described in Section 4.4.1.6.3.1.2. Impacts, if any, may occur nearshore or as a result of localized activities or due to industry activities occurring far offshore.

The SBS population of polar bears commonly den along the northeastern coast of the Beaufort Sea in Alaska. The CS population of polar bears den on Wrangell and Herald islands, along the Russian coast of the Chukchi Sea, and along the U. S. coast of the Chukchi Sea. For more information on potential impacts to denning polar bears, see Section 4.4.1.6.3.1.2.

4.5.1.6.3.1.3. Potential Effects from Subsistence and Other Harvests. For information on harvest of the SBS population of polar bears, and on harvest in general, see Section 4.4.1.6.3.1.3. For more information on subsistence use of polar bears, see Section 4.4.1.12.

The CS population is believed to have increased after harvest was reduced in 1972, but current status and trends are unknown (73 *FR* 28212-28217). The best estimate available at present is about 2,000 (Schliebe et al., 2006). There is a low level of subsistence harvest from this population in Alaska, but there is believed to be a high level of ongoing illegal harvest in Russia. More than 100 bears are thought to be taken annually in Russia and, in some years, the illegal take has been more than 200 polar bears. This level of harvest is not sustainable (Schliebe et al., 2006).

4.5.1.6.3.1.4. Potential Effects from Petroleum Spills. Exposure of polar bears to petroleum or other hydrocarbons could result from a number of ongoing or future events. Petroleum spills may occur as a result of ongoing industry activities, barge and other vessel traffic, accidents at sea, accidents onshore, equipment malfunctions, spills during bulk-fuel transfers, local village activities, or research activities. Most spills are expected to be of refined materials (diesel fuel, gasoline, antifreeze, etc.) and to be very small.

For a description of the potential physical effects of spills on polar bears, see Section 4.4.1.6.3.1.4. The CS population of polar bears is broadly distributed on the pack ice from the northern Bering Sea through the Chukchi Sea. Polar bears move south with the advancing pack ice in fall and winter, and north with the retreating ice edge in spring and summer. This leaves them particularly vulnerable to potential spills in the proposed lease sale area in spring and fall. Oil spills have a great potential for affecting polar bears in part due to the difficulties involved in cleaning up spills in remote areas, given the wide variety of possible ice conditions. A large spill could impact large numbers of polar bears in broken pack ice and lead systems offshore, or at coastal aggregations on Wrangell Island, Herald Island, or along the Russian Chukotka coastline.

4.5.1.6.3.1.5. Potential Effects from Habitat Loss and Degradation. Habitat loss due to changes in arctic sea ice has been identified as the primary cause of decline in polar bear populations. The decline of sea ice is expected to continue throughout the polar bear's range for the foreseeable future and to lead to a further decline in the population (73 *FR* 28212-28303). For a more complete discussion of sea-ice decline see Section 3.2.4.3. The SBS and the CS populations of polar bears inhabit the Polar Basin Divergent Ecoregion. This ecoregion is characterized by ice forming and then being drawn away from the nearshore area by wind and current, particularly in summer (Amstrup, Marcot, and Douglas, 2007). The sea-ice decline is characterized by decreases in sea-ice extent and thickness and increases in the sea-ice retreat in spring and summer (see early summer sea ice, see Figure 3.3.1-1). This decline is expected to have major impacts for the SBS and CS populations of polar bear. Amstrup et al. have projected that these populations will be extirpated within the next 45-75 years, if sea ice declines continue at current rates.

Some coastal and nearshore habitat loss may occur from expansion of human activities in nearshore and coastal areas, or from coastal erosion due to increasing storm impacts along the coast. New facilities, pipelines, or roads may cause loss of coastal habitat.

4.5.1.6.3.1.6. Potential Effects from Seismic Noise. Potential effects to polar bears from seismic noise are described in Section 4.4.1.6.3.1.6.

4.5.1.6.3.1.7. Cumulative Effects from Global Forces. The status of polar bears worldwide is declining primarily as a result of climate change and the resultant loss of sea-ice habitat (73 *FR* 28212-

28303). The effects of these changes on polar bears populations are in Section 4.4.1.6.3.1.7. Observed changes to date include reduced sea-ice extent, particularly in summer (Section 3.2.4.3) and progressively earlier sea-ice breakup dates, especially in more southerly areas. For a more in depth review of climate change effects, see Section 4.2.1.3.

Polar bear use of coastal areas during the fall open-water period has increased in recent years in the Beaufort Sea. This change in distribution has been correlated with the distance to the pack ice at that time of year (i.e., the farther from shore the leading edge of the pack ice is, the more bears are observed onshore) (Schliebe et al., 2005). The same correlation occurs in Chukotka, aggregations of CS polar bears and walruses on Wrangel Island, Herald Island, and along the coast are larger when the sea ice retreats farther offshore (Kochnev, 2005).

4.5.1.6.3.2. Mitigation Measures. The mitigation measures in effect for ongoing MMS activities that result from the Beaufort Sea multi-sale can be found in the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a), which can be found on the web at:
http://www.mms.gov/alaska/ref/EIS%20EA/BeaufortMultiSaleFEIS186_195_202/2003_001vol1.pdf.
The mitigation measures in effect for ongoing activities in the Chukchi Sea as a result of Sale 193 can be in the Chukchi Sea Sale 193 EIS (USDOI, MMS, 2007d), which can be found on the web at:
http://www.mms.gov/alaska/ref/EIS%20EA/Chukchi_FEIS_193/feis_193.htm

These mitigation measures include standard stipulations that have mitigation effects for polar bears. The portions of these stipulations that mitigate potential effects to polar bears are briefly described in Section 4.4.1.6.3.2.

4.5.1.6.3.3. Conclusions - Effects Under Alternative 1.

4.5.1.6.3.3.1. Direct and Indirect Effects Under Alternative 1. There are no direct or indirect impacts to polar bears of selecting alternative 1, the no-action alternative.

4.5.1.6.3.3.2. Cumulative Effects Under Alternative 1. The cumulative impacts of selecting the no-action alternative are based on the existing natural environment and current anthropogenic ongoing actions in the Chukchi Sea. Primary considerations for the polar bear include the anticipated environmental changes that will have major impacts, regardless of whether the lease sales are held. Continued climate change and loss of sea-ice habitat are likely to lead to the extirpation of the polar bear from Alaska within the next 45-75 years (Amstrup, Marcot, and Douglas, 2007).

4.5.1.6.3.4. Anticipated Effects Under Alternative 1. This section describes the impact to polar bears resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions are described in Section 3.1.1 as they relate to polar bears. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures are described above and in Section 4.4.1.6.3.2. Important factors that are considered in determining the anticipated effects from this alternative, include timing, spatial extent, and the effects of oil spills, are described in more detail in Section 4.4.1.6.3.4.

4.5.1.6.3.4.1. Anticipated Effects from Vessel Traffic.

Summary. Vessel presence and noise under Alternative 1 are anticipated to result in negligible impacts to polar bears. For more information, see Section 3.1.3.2 and Section 4.4.1.6.3.4.1.

Mitigation measures required on future exploration and development activities avoid or minimize adverse effects to polar bears in the Chukchi Sea. The OCS actions would result in an incremental increase in the total number of vessels operating in the Chukchi Sea, including icebreakers.

4.5.1.6.3.4.2. Anticipated Effects from Motorized Vehicle Presence and Noise.

Summary. Aircraft and motorized vehicle traffic and noise under Alternative 1 are anticipated to result in continued minor effects on polar bears. For more information, see Section 4.4.1.6.3.4.2.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse effects to polar bears in the Chukchi Sea. While there would be an incremental increase in the total amount of activity, appropriate mitigation would be imposed by FWS through the Letter of Authorization process. With mitigation, impacts are likely to be minor.

4.5.1.6.3.4.3. Anticipated Effects from Subsistence and Other Harvests.

Summary. We anticipate that subsistence take of the SBS population of polar bears will continue to be managed cooperatively through the Inuvialuit-Inupiat Polar Bear Management Agreement, and that overharvest will not occur. Overharvest of the CS population of polar bears is due primarily to illegal take occurring in Russia and may continue for the foreseeable future. Any increase in the numbers of polar bears remaining onshore near human habitation, or in the duration of time that polar bears spend onshore, may make them more vulnerable to poaching and to an increase in take in defense of human life and property (DLP).

Mitigation measures in place throughout the North Slope decrease the likelihood of polar bears being taken in DLP takes. Typically, polar bears may be hazed away from platforms or industrial camps to eliminate the potential risk to humans or bears. No bears have been taken in relation to industry activities since MMPA ITR went into effect in 1993. We expect these mitigation measures to continue to be effective.

4.5.1.6.3.4.4. Anticipated Effects from Petroleum Spills.

Summary. This alternative is anticipated to result in minor effects to polar bears because petroleum spills are considered infrequent illegal or accidental events.

The potential effects of spills on polar bears were described in Section 4.4.1.6.3.4.4. In the Chukchi Sea, spills in the marine environment that occur during fall or spring in the open lead or polynya systems and spills that contact the coastlines of Wrangel Island, Herald Island, or the Chukotka coast have the greatest potential to affect polar bears.

If a large oil spill occurred in the vicinity of an aggregation of polar bears, any substantial loss of individual bears would represent a major impact. However, the Beaufort Sea multiple-sale EIS OSRA modeling runs predict the probability of such a spill scenario to be very low. For more information, see Section 4.4.1.6.3.4.4.

4.5.1.6.3.4.5. Anticipated Effects from Habitat Loss and Degradation.

Summary. Effects from habitat loss and degradation are described in Section 4.4.1.6.3.4.5.

There would not be any permanent loss of polar bear habitat during exploration and delineation activities. Some displacement of polar bears and their prey (e.g., ringed seals) may occur. The level of this impact would depend on the extent of habitat involved and the duration and timing of the activities.

No offshore developments currently are planned in the Chukchi Sea, and production is not considered to be reasonably foreseeable at this time. We expect effects to polar bears from currently planned and reasonably foreseeable actions to be minor or moderate over time, depending upon the location of any future developments and potential changes in polar bears' use of the nearshore environment due to climate change.

4.5.1.6.3.4.6. Anticipated Effects from Seismic Noise.

Summary. Polar bears are more likely to be affected by on-ice seismic surveys than by open-water surveys. In the Chukchi Sea, there is less landfast ice suitable for on-ice surveys than occurs in the Beaufort Sea. Therefore, ongoing exploration activities are open-water surveys or terrestrial surveys. Some displacement may occur, but these effects are expected to be short term and sublethal. Terrestrial seismic surveys may take place on lands leased by the State or within the NPR-A.

Open-water seismic surveys are occurring on areas leased in the Chukchi Sea during Lease Sale 193. In addition, seismic surveys also take place off lease. Most effects from seismic activity are expected to be minor due to mitigation measures currently in place.

4.5.1.6.3.4.7. Anticipated Level of Effect from Changes in the Physical Environment.

Summary. Specific future effects from climate change are difficult to predict with any certainty; however, we expect current trends to continue and to accelerate over time (IPCC, 2007). If current trends continue as predicted, polar bears from the CS population may spend more time onshore at walrus haulouts along the Chukotka coast, or spend more time on sea ice that has retreated over deepwater not suitable for foraging. There may be declines in abundance and availability of ringed and other ice seals as prey items. Current declines in fitness (as measured by weight, fat reserves, and fecundity) also may continue. We anticipate that these ongoing trends will have major impacts on the polar bear, and that these trends are likely to adversely affect the polar bear.

In addition, worldwide trends in demand, production, and consumption of hydrocarbons also are expected to continue for the foreseeable future. The current trend in anthropogenic influences on climate change caused by oil and gas use and development also are expected to continue.

We expect exploration of existing Federal leases in the Chukchi Sea to continue. Leaseholders and others will continue to investigate the potential for oil and/or gas production in the future. Authorized activities will contribute incrementally to production levels worldwide and to the positive and negative effects of this production.

4.5.1.6.3.5. Cumulative Effects to the Polar Bear. This analysis describes the anticipated effects that will occur if MMS does not hold either of the Chukchi Sea lease sales. As there would be no effects from this alternative in the project area, the anticipated effects in this case are the cumulative effects for this alternative. For each of the other alternatives, the anticipated effects from Alternative I (Section 4.5.1.6.3.4) will be combined with the anticipated effects from each of the remaining action alternatives to determine the cumulative effect for that alternative.

4.5.1.7. Marine and Coastal Birds.

Summary. In the following analysis, we determined that there would be no direct or indirect effects if the lease sales were not held. There would be a negligible cumulative level of effect from seismic surveys, subsistence hunting, and petroleum spills, and a continued minor cumulative level of effect from vessel presence and noise, aircraft presence and noise, collisions with structures, loss of habitat, and increased predator populations. The greatest potential for a major cumulative level of effect is associated with continuing physical changes in the Arctic environment. Mitigation measures imposed by MMS on future exploration activities on existing leases and surrounding waters avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea. The total effect of MMS-authorized actions would be proportionately lower when compared to similar, but unrestricted activities in the area.

The following analysis describes what anticipated effects would likely occur in the future if the MMS does not hold lease sales in the Chukchi Sea. We start by describing the potential effects to marine and coastal birds from a variety of existing sources (the same as those described in Section 4.4.1.6.2.1). We then identify existing mitigation measures that would avoid or minimize some of these effects in Section 4.5.1.7.2. We considered important factors level-of-effect terms identified in Section 4.4.1.6.2.3. The resultant anticipated levels of effect are then determined for species or species groups of marine and coastal birds (Section 4.5.1.7.3). The effects of implementing the alternative are separated into direct and indirect effects (Section 4.5.1.7.3.1) and cumulative effects (Section 4.5.1.7.3.2). As marine and coastal birds represent a resource group, we address differential effects to certain species separately in Section 4.5.1.7.4.

4.5.1.7.1. Potential Effects to Marine and Coastal Birds. Marine and coastal birds in the Chukchi Sea are subject to the same potential effects described for threatened and endangered birds (Section 4.5.1.6.2.1). These potential effects are not repeated here.

4.5.1.7.2. Mitigation Measures. The same mitigation measures described in Section 4.5.1.6.2.2 apply to the Chukchi Sea, except that there are no mitigation measures for State lease sales in the Chukchi Sea, because the State is not considering any lease sale activities there (ADNR, 2008).

4.5.1.7.3. Anticipated Effects Under Alternative 1. The following section describes the anticipated impact to marine and coastal birds resulting from the implementing of an action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions affecting marine and coastal birds are described in Section 3.1. Reasonably foreseeable future actions are described in Section 4.2.

Future actions discussed in the Chukchi Sea describe those anticipated oil and gas activities on existing leases and surrounding areas in the Chukchi Sea. Our effects analysis considered other important factors (timing, residence time and periodicity, spatial extent, environmental factors, etc.) are described in Section 4.4.1.6.2.3. We defined the level of effect terms in Section 4.4.1.6.2.3. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.1.7.3.1) and cumulative effects (Section 4.5.1.7.3.2).

4.5.1.7.3.1. Direct and Indirect Effects Under Alternative 1. There would be no direct or indirect impacts to coastal and marine birds in the project area from Lease Sales 212 and 221 if these sales were not conducted.

4.5.1.7.3.2. Cumulative Effects Under Alternative 1.

Summary. Marine and coastal areas of the North Slope commonly are perceived to be a pristine environment, yet there are number past and existing sources of harm, an increasing number of threats, and anticipated environmental changes that will negatively affect coastal and marine birds in the project area well into the future, even if none of the proposed lease sales are held. More attention to minimizing these effects could maintain the present condition of most bird populations; however, some environmental influences appear well outside regional control and some local or regional bird populations could become much rarer or extirpated within the next 40 years. Given the anticipated adverse effects from Reasonably Foreseeable and Speculative Future Events (Section 4.2), selecting Alternative 1 still would result in a moderate cumulative level of effect on most marine and coastal birds in the action area. Ice-dependent species will likely experience a major level of effect due to changes in the Arctic environment in the foreseeable future.

If Lease Sales 212 and 221 were not held, the cumulative effect of selecting Alternative 1 consists of combining the existing status of coastal and marine bird resources with those impacts anticipated under the Reasonably Foreseeable and Speculative Future Events (Section 4.2). An overview of the consequences includes:

- The most important impacts to coastal and marine birds likely will arise from continued climate change and the loss or expansion of habitats important to birds, or any changes in breeding chronology or trophic asynchrony. Species already in serious decline due to loss of sea ice (e.g., black guillemot and ivory gull) will continue to be negatively affected.
- Other sources of potential harm arise from uncontrolled vessel and aircraft disturbance in nearshore broodrearing or molting areas. It is unclear if these impacts accumulate from year-to-year, but chronic stress during sensitive life stages would likely lead to long-term changes in survival and productivity.
- Collisions with existing structures (power lines, communication towers, drilling/production structures, etc.) in coastal areas would continue at a low rate. This mortality, however, does not appear to be affecting waterfowl species, the group most prone to strike structures. Future effects are anticipated to be a continuation of existing mortality rates.
- Bird predator species, especially foxes and ravens, are anticipated to continue to expand in distribution and abundance due to a lack of effective control over access to human-use foods and garbage. The adverse effect these predators have on North Slope bird populations is not clearly understood and is partially offset by small mammal population cycles, but the relationship between these predators and breeding birds appears to be out of ecological balance and will only continue to negatively affect populations of marine and coastal birds.
- Petroleum spills, particularly in offshore areas, pose the greatest risk to birds in marine areas. Increased vessel traffic, especially from tourism or shipping, will increase the risk of a marine accident. Barring these events, deliveries of bulk fuel to coastal communities would pose the greatest risk of a large spill in the marine environment.
- Seismic surveys and other postlease exploration activities for existing OCS leases in the Chukchi Sea require specific mitigation or avoidance measures that reduce future impacts to marine and costal birds to no more than a negligible level.
- Climate-related changes will continue to occur to bird habitats along the Chukchi Sea, perhaps to a greater extent than all other anticipated effects combined.

More attention to minimizing these effects could reduce anthropogenic sources of stress or mortality to coastal and marine birds nesting, migrating through, or molting on, the North Slope and adjacent coastal areas. Some marine and coastal bird populations are subject to influences or harm well outside the proposed action area, such as wintering areas that have contaminated or altered habitats or increased human harvest or predation. As it remains unclear what factor(s) is most affecting these bird populations, changes are difficult to predict. We anticipate that existing trends would continue and selection of Alternative 1 would result primarily in minor cumulative effects on coastal and marine birds.

As there would be no direct and indirect effects from this alternative in the project area, the anticipated effects from the Reasonably Foreseeable and Speculative Future Events (Section 4.2) in this case, are the cumulative effects for this alternative.

This section describes the anticipated effects to marine and coastal birds resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions are described in Section 3.3.1 as they affect marine and coastal birds. Reasonably Foreseeable and Speculative Future Events are described in Section 4.2. This analysis describes what anticipated effects would likely occur in the future if MMS does not hold any future lease sales in the Chukchi Sea.

4.5.1.7.3.2.1. Anticipated Level of Effect from Vessel Presence and Noise. Section 3.1.1 describes the general past and present vessel traffic patterns in the Chukchi Sea. Existing information indicates an increasing amount of vessel traffic, particularly in tourism and research vessels in the Arctic, such as those seeking to explore and study arctic regions via the Northwest Passage. We anticipate this trend to continue into the reasonably foreseeable future. These vessels are free to navigate open waters, where they could encounter and disturb marine and coastal birds. For example, traffic between the Beaufort Sea and the Bering Sea could pass through areas seasonally important to migrating birds, such as the spring lead system.

There is a high level of interest in using the Northwest Passage as a shipping route to decrease the distance ships would have to travel between the Pacific Ocean and the Atlantic Ocean. Increasing military activities also are anticipated. As with tourism and research traffic, both commercial and military large-vessel traffic could disturb large numbers of marine and coastal birds. Uncontrolled vessel disturbance from anticipated tourism, research, shipping, and military vessels could result in chronic, long-term disturbances to these birds, especially during sensitive molting or migrating periods.

Mitigation measures required on future exploration and development activities avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea. While OCS actions likely would result in an incremental increase in the total number of vessels operating in the Chukchi Sea, these vessels would have proportionately fewer impacts compared to other unrestricted vessels operating in this area.

Summary. The existing and expected future levels of vessel activity in Ledyard Bay/spring lead system are anticipated to have a minor level of effect on marine and coastal birds.

4.5.1.7.3.2.2. Anticipated Level of Effect from Aircraft Presence and Noise. Aircraft traffic could adversely affect marine and coastal birds by: (1) displacing adults and/or broods from preferred habitats during prenesting, nesting, and broodrearing and migration; (2) displacing females from nests, exposing eggs or small young to inclement weather or predators; and (3) reducing foraging efficiency and feeding time. The behavioral response of many species to low-level aircraft flights is unknown; some species likely are more tolerant than other. Some birds may be displaced, with unknown physiological and reproductive consequences.

Disturbance to nesting waterfowl or shorebirds is probably limited due to their dispersed breeding patterns across the North Slope. A few species nest in colonies, but others have limited nesting-habitat preferences that limit the formation of "core" areas. Densities outside of these conceptual core areas on the Arctic Coastal Plain likely are much lower.

Most aircraft on the North Slope are operated without altitude or route restrictions to protect threatened or endangered birds. Some traffic associated with State oil and gas operations in and south of the Beaufort Sea is restricted to protect certain species (ADNR, 2008). Frequent low-level flights associated with freight, intercommunity travel, research studies, and oil and gas operations likely impact birds, but at an unknown level. Any adverse effects are anticipated to continue.

The number of marine and coastal birds that would be exposed to low-level flights associated with OCS oil and gas development is low, because the potential direct flight from an airbase to offshore drilling sites within the OCS would primarily be over coastal waters. Mitigation measures required on future exploration and development activities avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea and these flights would have proportionately fewer impacts compared to other aircraft operating in the project area.

Summary. The existing and expected future levels of aircraft activity over the Ledyard Bay/spring lead system are anticipated to have a minor level of effect on marine and coastal birds.

4.5.1.7.3.2.3. Anticipated Level of Effect from Collisions. Certain species of coastal and marine birds (waterfowl, in particular) are prone to collisions with facilities or structures during periods of darkness or inclement weather in nearshore areas. Some facilities are lit in such a manner that may attract and disorient flying birds, resulting in avoidable impacts if improvements to lighting were made. The location of the project is a primary determinant whether some risk of collisions exists. For example, the NSB has proposed to reconstruct/relocate the existing airport on Barter Island. This airport services Kaktovik. The project proposes to run a power line to the new sites, which could increase the number of migratory birds killed.

Monitoring of bird strike mortality across the North Slope is infrequent, so the level of mortality cannot be estimated. The FWS maintains a database of reported collisions (USDOI, FWS, 2008). The MMS review of this database indicates the level of mortality to marine and coastal birds appears low. Furthermore, there are few communities and no oil or gas infrastructure in coastal areas of the Chukchi Sea. With fewer structures to strike, the risk of collision should be lower.

Oil and gas exploration activities would likely increase the total number of structures in the project area. Mitigation measures required on exploration activities are believed to minimize collision mortality to marine and coastal birds in the Chukchi Sea. For example, vessels and drillships must operate their lights to minimize collisions. Furthermore, the lease sale 193 boundary excluded nearshore areas used by migrating birds. The MMS, however, cannot assume that recommendations for the design and implementation of lighting of structures would result in no strikes by marine and coastal birds.

Summary. The levels of collisions with existing and future structures are anticipated to have a minor level of effect on marine and coastal birds.

4.5.1.7.3.2.4. Anticipated Level of Effect from Petroleum Spills. The potential effects of spills on birds were described in Section 4.4.1.6.2.1.4 and factors in Section 4.4.1.6.2.3.2. 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 birds. According to oil-spill records, most accidental spills in Alaska happen in harbors or during groundings; consequently, spills from vessels on the high seas should be an infrequent occurrence. Particular concern has been expressed over increases in tourism and shipping traffic between the Bering Sea and the North Atlantic, especially from vessels or crews unaccustomed or ill-prepared to traverse these remote and dangerous areas. Vessels traversing the Chukchi and Beaufort seas during period of ice are more prone to an accident. ADEC (2007) reports that the highest probability of spills of noncrude products occurs during fuel transfer operations at the remote villages of the North Slope.

Other sources of petroleum spills include a well blowout (Section 1.1.4), but these are modeled as having a low percent chance of occurring, and it is improbable that adverse effects to marine and coastal birds from these activities would occur. The analysis in Section 4.5.1.6.2.3 describes how threatened and endangered birds are the most vulnerable species in the area and protective measures to protect them would also serve to provide protection to other species of coastal and marine birds.

It is important to remember that a large spill event associated with OCS oil and gas activities likely would occur only during the production phase, when volumes of oil/gas product are being moved to production facilities in the existing facilities at Kuparuk or Prudhoe Bay. Such a commercial discovery warranting production has not been identified or proposed for development, and is considered speculative at this time. In other words, while both MMS and FWS acknowledge that a large spill could have major impacts on certain species of marine and coastal birds, a spill(s) from production activities is not considered a reasonably foreseeable future event.

If such a resource discovery is made and proposed for development, MMS must reconsult with FWS on a production plan. The Lease Sale 193 final EIS made potential lease bidders aware of this future consultation via: Information to Lessees: No. 7 - Information on the Spectacled Eider and Steller's Eider. The MMS believes that this condition will help industry incorporate stringent spill-prevention measures into their plans that avoid the risk of population-level effects on ESA-protected species in the Chukchi Sea.

Summary. The existing and expected future levels of vessel activity in the Chukchi Sea would increase the risk of a marine spill, however as these are accidental or illegal activities; a negligible level of effect on marine and coastal birds is anticipated.

4.5.1.7.3.2.5. Anticipated Level of Effect from Increased Bird Predator Populations. The dependence of ravens on human-use foods and garbage, combined with the potential increase in nesting sites from existing and future developments, are anticipated to continue and will result in the expansion in the distribution and abundance westward across the North Slope.

A similar, but lesser, impact occurs from foxes obtaining human-use foods/garbage or denning in sites made suitable from development. While foxes are endemic to the North Slope, densities may be greater due to increased availability of food or den sites.

Should development ever be proposed, mitigation measures would avoid or minimize adverse effects to marine and coastal birds. While there likely would be an incremental increase in the total number of structures or facilities that could be used by bird predators such as ravens or foxes, these facilities would not be constructed or operated in a manner that would support bird predators. For example, a requirement that new infrastructure would avoid the artificial enhancement of predator populations was recently specified for the Liberty project and is likely to be required for any future developments associated with OCS leases.

Summary. Only a concerted management program to deny ravens access to artificial food sources and removal of nests or ravens would halt the facilitated expansion of breeding ravens across the North Slope.

This is not anticipated to occur in the reasonably foreseeable future, and a moderate adverse level of effect to marine and coastal birds is anticipated to continue.

4.5.1.7.3.2.6. Anticipated Level of Effect from Subsistence-Hunting Activity. There would not be any change in subsistence-hunting activity due to MMS-authorized exploration activities. Waterfowl hunters may be able to access pipeline roads during the period immediately following spring breakup to hunt geese and nonlisted eiders, but oil development is considered speculative.

There would not be any change in subsistence-hunting activity due to exploration activities. Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). If development and production were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. The pipeline would need a road for periodic maintenance, and this road could increase access of local hunters to previously inaccessible areas. The long-term consequences of any future development would be evaluated in future NEPA documents.

4.5.1.7.3.2.7. Anticipated Level of Effect from Habitat Loss. Existing human development in coastal areas of the Chukchi and Beaufort seas is relatively sparse and limited to several small communities that include Point Hope, Point Lay, Wainwright, Barrow, and Kaktovik. Development likely will occur in the future, and a corresponding amount of marine and coastal bird nesting habitat will be lost. For example, the Arctic Slope Native Association applied for a Section 404 permit to place gravel fill in about 10 acres of wetlands at Barrow (U.S. Army Corps of Engineers, 2007). Similarly, the State of Alaska is managing a project to fill another 19 acres of wetland habitats to expand the Barrow Airport (U.S. Army Corps of Engineers, 2006). Secondary effects from the zone of influence around new or expanded developments also would result in habitat loss nesting birds.

The closest industrial development of size southwest of the proposed lease areas is the Red Dog Mine Port Site near Kivalina and existing industrial development (Kuparuk and Prudhoe Bay fields) are east of Teshekpuk Lake (Section 3.3.1). Continued development will likely occur in and around these sites in the future and a corresponding amount of bird nesting habitat will be lost. Secondary effects from the zone of influence around new or expanded developments would also result in habitat loss. For example, in April 2008, BPXA applied to the U.S. Army Corps of Engineers for Section 404 permits to fill over 28 acres of wetlands "to support placement of infrastructure for oil and gas development" or similar project (U.S. Army Corps of Engineers, 2008). Secondary impacts to nesting birds could be smaller due to existing developments nearby

There would not be any permanent loss or alteration of bird habitat during exploration and delineation activities. Small amounts of temporary habitat loss of bird-migration habitats could occur from drilling exploration or delineation wells into the seafloor. Wells would not be drilled in benthic habitats within the Ledyard Bay Critical Habitat Area (LBCHA), because this area was excluded from Lease Sale 193.

Future production of oil or gas resources on the Beaufort Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). Permanent habitat loss could occur if production facilities (offshore platform, an undersea pipeline, a pipeline landfall to an onshore base, and a pipeline linking to existing infrastructure) are located in areas used by marine and coastal birds. It was assumed that onshore developments would originate at a pipeline landfall, the location of which presently is unknown. The pipeline and associated developments conceivably would then be the shortest, most cost-effective route to connect with pre-existing support infrastructure. Additional airstrip construction or use of overland ice roads/pads is not anticipated. Indirect habitat losses could result from marine and coastal birds not using habitats near sites of industrial activity.

The MMS can only speculate about the size and location of permanent onshore developments associated with a future phase of oil production, but it was estimated in the Lease Sale 193 final EIS (USDOI, MMS, 2007a):

> As a pipeline is expected to be placed on elevated structures or, less frequently, buried near, but not immediately adjacent to, the 19.8-meter-wide (65-foot-wide) road, the pipeline "footprint" was integrated with the road footprint into a 0.03 km-wide (100-foot-wide) road/pipeline development "corridor". The road/pipeline corridor was assumed to be 482.8 km (300 mi) long. Consequently, direct impacts from pipeline/road construction are estimated to affect 14.72 km^2 (3,636 ac) of bird nesting habitat [see Table 4.5.1.6.2.-1].
>
> The shore base and staging facilities were assumed to each have gravel footprints of 0.2 km^2 (50 ac) on eider nesting habitat. Up to four pump stations would be needed to move oil eastward and these stations are estimated to each have a gravel footprint of 0.16 km^2 (395 ac total).
>
> Material to construct the road, shore base, and other facilities would likely come from upland gravel pits, if practicable, or from coastal areas (intertidal areas, barrier islands, etc.) if no feasible and prudent non-coastal alternative is available. The locations of gravel sources near a future alignment are unknown, however it is likely that some known gravel sources (identified in NPR-A, presently undeveloped) or existing gravel pits would be utilized/expanded for material construct fill for the development facilities. For the purposes of analysis, we estimated that 1.60 km^2 of bird nesting habitat would be affected by gravel extraction.
>
> ***Indirect habitat losses.*** Secondary or indirect effects to nesting birds would arise from habitat modifications (drainage, flooding, dust impacts to vegetation, changes in thermokarst) and disturbances from traffic and human activities. Many long-term disturbing activities could have fewer impacts to marine and coastal birds if they were to occur during the winter, when most birds are not present. Material extraction activities were assumed to occur during the winter, when most birds would not be present, and a secondary zone of influence from these areas was considered not applicable.
>
> Overall, these zones of influence associated with development facilities developments have a collective areal extent of 196.13 km^2 (48,464 ac) in bird nesting habitats.

Summary. The destruction of marine and coastal bird nesting, molting, and broodrearing habitats from continued community and industrial developments would continue to have a minor level of effect on marine and coastal birds.

4.5.1.7.3.2.8. Anticipated Level of Effect from Seismic Airgun Noise. Seismic activities are used to locate and delineate potential oil and gas resources. Most seismic activity on land is done during winter when most birds are absent. The MMS is the only entity anticipated to authorize seismic surveys in the Chukchi Sea OCS, because the State of Alaska is not planning any leasing of state waters.

Offshore surveys on Federal lands are conducted by vessels during the open-water period. There are existing Federal leases in the OCS lands of the Chukchi Sea, and it is reasonable to expect leaseholders and others to investigate the potential for oil or gas production in the future. Exploratory/delineation drilling, seismic work, and related support activities would generally occur primarily during the ice-free, open-water period.

While there would likely be a continuation of existing levels of seismic activity and increased exploration drilling in the Chukchi Sea compared to 2006 and 2007, mitigation measures would be required on future exploration activities to avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea, and a negligible level of effect is anticipated.

4.5.1.7.3.2.9. Anticipated Level of Effect from Changes in the Physical Environment.

Section 4.4.1.6.2.1.9 briefly described likely ongoing effects from changes in oceanographic processes and sea ice distribution, duration of snow and ice cover, distribution of wetlands and lakes, and sea level rise. These changes in the physical environment are highly likely to affect marine and coastal bird populations.

Some of these expected changes could benefit coastal birds using habitats on the ACP, at least initially. An expansion of more productive wetland habitats could provide additional nesting sites for several species and boost the abundance and distribution of aquatic plants and insects important to many bird species. These benefits to birds would be expected to decline over time as the wetlands and lakes disappear.

Climatic change could have stochastic or habitat effects on many species that may surpass the impacts of other activities. As previously stated, however, the implications of climate change on coastal and marine birds are impossible to predict with any precision. For the purposes of analysis, we assume most of the obvious trends are anticipated to continue. We considered these trends in determining the effects of the alternatives.

Summary. Given the anticipated adverse effects anticipated to result from Reasonably Foreseeable and Speculative Future Events (Section 4.2), Alternative 1 (No Action) still would result in a moderate cumulative level of effect on most marine and coastal birds in the action area. Ice-dependent species could experience a major level of effect in the foreseeable future.

4.5.1.7.4. Species-Specific Level of Effect.

Puffins. Puffins are more abundant in the Chukchi Sea compared to the Beaufort Sea. The tufted puffin nests along cliffs at Cape Lisburne. Horned puffins can breed on suitable beach habitat on islands nearshore by digging burrows or hiding under large pieces of driftwood or debris. Puffins foraging near their nesting colonies would continue to be impacted by unrestricted vessel and low-level aircraft traffic. Climate change (increased storm waves/tidal surge) could erode burrow sites or reduce driftwood abundance on barrier islands of the Chukchi Sea.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse effects to puffins in the Chukchi Sea.

This level of disturbance is believed to result in a negligible cumulative level of effect to puffins.

Short-Tailed Shearwaters and Auklets. These seabirds are abundant in the Chukchi Sea. Large-scale collision events involving crested auklets and high-intensity lights on commercial-fishing vessels have been documented in other ocean regions. Collisions may occur with an increasing number of vessels that could be operating in the Chukchi Sea. As few collisions from the Chukchi Sea have been documented to date; however, it appears that this is not a large source of mortality.

Shearwaters or auklets could be harmed by collisions with seismic vessels and exploration structures, but mitigation measures imposed on these exploration activities avoid or minimize adverse effects to shearwaters and auklets in the Chukchi Sea.

This level of disturbance or mortality is believed to result in a negligible cumulative level of effect to short-tailed shearwaters and auklets.

Black Guillemot. These birds usually are closely associated with the ice edge. As the ice edge has been receding away from breeding colonies, guillemot breeding success has fluctuated due to vagaries in ice location/duration and direct competition with horned puffins. It is likely that continued climate change (long-term decreases in sea-ice distribution/abundance) will negatively affect black guillemot populations in the Chukchi Sea, as they have in the Beaufort Sea, in the foreseeable future, regardless of other efforts to minimize sources of disturbance or mortality.

Mitigation measures imposed on future exploration activities avoid or minimize adverse effects to black guillemots in the Chukchi Sea.

The single most important factor influencing black guillemots in the Chukchi Sea is the distribution and abundance of sea ice. Unrestricted vessel or low-level aircraft disturbance could result in no more than a minor level of effect to black guillemots, but this species likely will experience a major adverse population-level level of effect from climate change, if ongoing trends continue.

Loons. Loons using nearshore areas of the Chukchi Sea could be affected by disturbance from vessels and low-flying aircraft. Loons, in particular the yellow-billed loon, are at particular risk due to their low numbers and low reproductive rate. The yellow-billed loon is highly vulnerable to environmental change compared to most waterfowl. Patchy distributions and specific habitat requirements may make yellow-billed loons more susceptible to environmental perturbations, such as disturbance and habitat alterations, than more abundant and widely distributed species that are able to exploit a greater diversity of habitats (Hunter, 1996).

The yellow-billed loon is little studied, and basic biological information (such as the seasonal distribution of immature and nonbreeding yellow-billed loons) is unknown. Additional research could improve our understanding of the vulnerabilities of the yellow-billed and other loons using nearshore areas of the Chukchi Sea.

In April 2008, the Center for Biological Diversity (CBD) announced it had reached a tentative agreement with the FWS to make a decision by mid-February 2009, regarding whether or not to propose the species for listing as a threatened or endangered species under the Endangered Species Act (ESA). At the time of the CBD press release, the judge in the lawsuit had not ruled on the proposed settlement. If the FWS proposes to list the species in February 2009, it would take at least several more months to complete or decline the listing proposal. While the species is in a proposed status, Federal Agencies would have to conference with the FWS only for those projects that could jeopardize the continued existence of the yellow-billed loon. The MMS will consult with the FWS if the yellow-billed loon is proposed for or becomes listed under the ESA. Mitigation measures imposed on future exploration activities avoid or minimize adverse effects to loons, especially yellow-billed loons, in the Chukchi Sea area.

Overall, a minor level of effect on loons is anticipated to continue.

Long-Tailed Duck. Long-tailed ducks are prone to collisions with structures and vessels. Vessels conducting seismic surveys on State leases could pose a threat to long-tailed ducks, especially if the vessels were using high-intensity work lights while operating during darkness or inclement weather. The risk of collisions with seismic-survey vessels would be highest when these vessels are in the area of the 20-m isobath during fall migration. Long-tailed ducks are uncommon farther offshore.

Disturbance impacts to long-tailed ducks from vessels and low-flying aircraft associated with seismic-survey and exploration-drilling activities on State leases will occur unless specific mitigation measures are implemented.

Potential disturbance impacts to long-tailed ducks from seismic surveys on Federal leases in the Chukchi Sea would be low during the postbreeding molting period, because most birds are concentrated in coastal lagoons, outside of the OCS. Mitigation measures imposed on future exploration activities avoid or minimize adverse effects to long-tailed ducks in the Chukchi Sea.

Overall, a minor level of effect on long-tailed ducks is anticipated to continue.

Common Eider. Most common eiders follow the 20-m isobath, which predominantly is in nearshore waters at the outer margin of the OCS (Figure 3.3.5.5). Vessels could pose a threat if the vessels were using high intensity lights in migratory paths in darkness or inclement weather. The risk of collisions with vessels would be highest when these vessels are in the area of the 20-m isobath during fall migration.

Potential disturbance impacts to common eiders from seismic surveys on Federal leases in the Chukchi Sea would be low during the migration period, because most birds are concentrated in nearshore coastal areas and not in more remote areas of the OCS. Similarly, the risk of collisions with drillships would be lower, because many existing leases are farther offshore than known migration pathways for common eiders. The risk of collisions would decrease markedly, if vessels were located well outside typical migration pathways. Mitigation measures imposed on future exploration and development activities avoid or minimize adverse effects to common eiders in the Chukchi Sea.

Overall, a minor level of effect to common eiders is anticipated to continue.

King Eider. Impacts to king eiders would be similar to common eiders. Migration distances from shore are similar, so the collision risks would be the same as for common eiders.

As with common eiders, mitigation measures imposed on future exploration activities avoid or minimize adverse impacts to king eiders in the Chukchi Sea.

Overall, a minor level of effect on king eiders is anticipated to continue.

Black-Legged Kittiwake. Kittiwakes in pelagic offshore waters are being affected by disturbance activities, such as vessel traffic and low-flying aircraft, in the Chukchi Sea.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse effects to black-legged kittiwakes in the Chukchi Sea.

Overall, a minor level of effect to kittiwakes is anticipated to continue.

Pacific Brant. Pacific brant could continue to be affected by disturbances from low-flying aircraft, but this activity does not appear to consistently adversely affect brant populations. Predation by foxes can continue to reduce the net productivity of brant nesting colonies, but fox numbers appear to fluctuate, and several years may go by without foxes depredating larger colonies. Kasegaluk Lagoon is a very important area for Pacific brant. A large proportion of the entire Pacific coast brant population uses Kasegaluk Lagoon during the summer. Any chronic disturbance or large-scale impact affecting this site when these brant are present could have a moderate effect.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse effects to Pacific brant in the Chukchi Sea.

Overall, a minor level of effect to Pacific Brant is anticipated to continue.

Phalaropes. Phalaropes are most abundant in the Chukchi Sea during the postnesting period in late summer and fall. Phalaropes use habitats within a few meters of shore as well as pelagic areas, where they forage on patchy concentrations of zooplankton. Phalaropes could be disturbed by vessels and low-flying aircraft in nearshore coastal areas.

Collisions with vessels or structures are a possibility. Lambert (1988) reported that red-necked phalaropes were attracted to lights on a ship in the Gulf of Guinea and reacted most strongly at night in inclement weather. There do not appear to be any other documented cases of collisions involving phalaropes, so the incidence of collisions may either be low or unreported.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse impacts to phalaropes in the Chukchi Sea to a negligible level.

Overall, a minor level of effect to phalaropes is anticipated to continue.

Ice-Associated Gulls. Ross's gulls and ivory gulls breed outside the lease-sale areas. They are present in the proposed lease-sale areas for a short period when migrating to overwintering locations. These gulls, particularly ivory gulls, are expected to continue to decline due to climate change-induced habitat changes outside the Chukchi and Beaufort seas. These climate change effects are expected to have major adverse population-level effects on these species.

Other Gulls and Terns. Gulls likely would benefit from sources of unsecured human-use foods and garbage associated with communities and the oil/gas industry. As ground nesters, gulls are more apt to spread to areas where they are not limited by facilities for elevated nesting structures, such as are required by ravens. Gulls also occur in large numbers at unnatural concentrations of food, such as bone piles from whale harvests near coastal villages.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse impacts to other species of gulls and terns in the Chukchi Sea.

Overall, a negligible level of effect to gulls and terns is anticipated.

Northern Fulmar. Most fulmars are present in the Chukchi Sea for a few weeks at the end of summer. Negligible effects are anticipated.

Jaegers. Jaegers are present throughout the Chukchi Sea, but are not known to occur in high concentrations. A negligible level of effect is anticipated.

Other Waterfowl and Shorebirds. At the present time, it appears that large numbers of these birds could be affected during the postbreeding period by low-level overflights and other disturbances. Impacts on many species of waterfowl and shorebirds are anticipated to be relatively minor, but there are some key areas of vulnerability where they would continue to experience elevated levels of adverse effects. There appear to be coastal sites along the Chukchi Sea where large numbers of migrating shorebirds concentrate. These include Kasegaluk Lagoon, Peard Bay, Icy Cape, and seabird colonies near Point

Hope. These sites may become highly modified due to changes in coastal morphology from increased storm frequency, magnitude, and wave height.

Mitigation measures imposed on future exploration and development activities avoid or minimize adverse impacts to shorebirds of the Chukchi Sea.

Overall, a minor level of effect to shorebirds and less-abundant waterfowl is anticipated to continue.

Raptors/Ravens. Raptors and ravens may continue to extend their range and increase in abundance if they continue to nest on community/development structures. These structures benefit raptors. Ravens also benefit from easy access to human-use foods and garbage, allowing them to overwinter in areas where they previously were unable to. These effects would have a net negative impact on other marine and coastal birds because of increased predation, particularly by ravens. Enforcement of NSB ordinances could help eliminate bird predator access to human-use foods or garbage and would not facilitate the continued increase in fox and raven distribution or abundance across the North Slope.

No adverse effects to raptors or raven populations are anticipated during exploration activities in the Beaufort Sea. While production is speculative until commercially-developable discoveries are made, recent MMS authorizations required mitigation measures to prevent the nesting of ravens and denning of foxes associated with production and transportation facilities (USDOI, MMS, 2007a).

Overall, the expansion of raptors/ravens is anticipated to continue to result in a minor level of effect to coastal and marine birds.

Summary. Marine and coastal birds would continue to be exposed to a variety of potential negative effects including disturbances, collisions, habitat loss, petroleum exposure, and increased predator populations during the reasonably foreseeable future. The greatest potential for substantial adverse impacts would arise from collisions and vessel/aircraft disturbance in important coastal bird habitats, especially nearshore migration routes. Other important areas include barrier islands and coastal lagoons. Barrier islands provide important nesting, molting, and migration habitat to a variety of waterfowl and shorebirds. While Federal oil and gas exploration activities may include some activities (e.g., vessel or aircraft trips) that could impact birds, mitigation measures will reduce the incremental level of these additional impacts to a negligible or minor level effect for marine and coastal birds in the Chukchi Sea area. Other than long-term effects of climate change having a major level of effect on influencing the abundance and distribution of key bird habitats, a minor level of effect to marine and coastal birds is anticipated.

4.5.1.8. Other Marine Mammals.

Summary. This section addresses those marine mammals not currently listed under the ESA that commonly occur in Alaska Chukchi Sea habitats that may be affected by the proposed sale. Marine mammals are protected under the MMPA of 1972. Species addressed include ice seals (ribbon, ringed, bearded, and spotted seals); the Pacific walrus; toothed whales (beluga whales, killer whales, narwhal, and harbor porpoise;) and baleen whales (minke and gray whales, see Section 3.3.6.2). The Pacific walrus and all four of the ice seals have been petitioned for listing under the ESA. The principle anthropogenic sources of adverse effects to marine mammals in the Chukchi Sea are marine vessel and aircraft traffic and noise, collisions, petroleum spills, habitat loss and degradation, seismic noise, and environmental contaminants.

Ringed, Spotted, Ribbon, and Bearded Seals. The vast majority of ice seals occurring in the Chukchi Sea analysis area are ringed seals (Frost and Lowry, 1988). The principle anthropogenic sources of adverse effects to ice-dependent phocid seals in the Chukchi Sea are marine vessel and aircraft traffic and noise, climate change, seismic noise, and environmental contaminants. Ringed, spotted, ribbon, and bearded seals are relatively common in the Beaufort Sea. These ice seals are hunted by Alaskan Natives and coexist with numerous aircraft operations and an increasing volume of vessel traffic. Existing levels of oil and gas exploration, including seismic surveys, continue to have negligible effects on ice seals; however, ongoing changes in the physical environment from climate change have the greatest potential to result in a major level of effect on ice seals.

Pacific Walrus. Most of the Pacific walrus population inhabits the Chukchi and Bering seas. Exploration and development in the Arctic could impact walruses through disturbance, displacement, or accidental petroleum spills. The level of impact from these activities would depend on the location and the temporal and spatial extent of the exploration and development. Pacific walruses may be increasingly impacted by changes in sea-ice cover. In recent years, walruses have been coming ashore in greater numbers as the sea ice retreats over the continental shelf, areas too deep for walruses to forage successfully. Continued declines in the spatial and temporal extent of sea ice may have major impacts on walruses. Continued declines in sea-ice extent may limit resting and calving habitat available to walruses, increase the importance of coastal haulouts, decrease available foraging habitat, and increase energetic expenditures as walruses are forced to swim further between feeding and resting areas.

Beluga Whale, Killer Whale, Narwhal, and Harbor Porpoise. Killer whales, narwhals, and harbor porpoises are infrequent visitors to the Chukchi Sea. Beluga whales are more common with an estimated population of 32,000, but the population trend is unknown. Beluga whales are subject to subsistence harvest, and the harvest does not exceed the potential biological removal (PBR). The annual harvest of about 186 belugas is expected to continue and is the largest known source of removal. Existing oil and gas industry activities, including seismic exploration, may result in a minor level of effect on individual whales but are expected to have a negligible level of effect on the species populations. Habitat changes from climate warming are anticipated to affect these species, but the complete consequences are not predictable. Lease Sales 212 and 221 would not occur under Alternative 1, the no-action alternative and, therefore, no direct or indirect effects would occur. The cumulative effects are those resulting from past, current, and reasonably foreseeable events.

Minke Whale and Gray Whale. The minke whale is relatively common in the Chukchi Sea. We anticipate the effects to be generally similar to effects noted for gray whales; however, little is known regarding minke whale habitat use, distribution, movements, or productivity in the Chukchi Sea, and determination of a level of effect under this alternative cannot be made at this time.

Existing levels of various vessel and aircraft activity and Federal oil and gas activities have a minor level of effect on gray whales. Ongoing changes in the physical environment from climate change are uncertain and may benefit or harm gray whales in the Chukchi Sea. Effects of exploration, development, production, and abandonment of existing Chukchi Sea OCS leases are anticipated to result in a minor level of effect to small numbers of gray whales that use the nearshore shelf and offshore shoal habitats of the Chukchi Sea.

4.5.1.8.1. Potential Effects to Other Marine Mammals. The principle sources of potential adverse effects to marine mammals in the Chukchi Sea include: (1) underwater noise, (2) vessel and aircraft disturbance, (3) subsistence, (4) habitat loss, (5) environmental contaminants, (6) petroleum spills, and (7) changes in the physical environment. These impacts arise from a number of sources, including community development, transportation, tourism, OCS oil and gas exploration, and climate change. Development and production of oil or gas from existing OCS leases in the Chukchi Sea is speculative.

The potential effects from these impact sources were described in Section 4.4.1.8.1. In the following section, we describe how these sources may operate in the Chukchi Sea as compared to those previously described for the Beaufort Sea (i.e., whether the potential effect could be greater or less). If no specific differences or additional information are indicated, the potential effects are the same as described in Section 4.4.1.8.1. Section 4.4.1.6.1.1.1.3 provides a general background on the effects of noise and disturbance on cetaceans. Information from that section is incorporated by reference.

Minke whales occur in the Chukchi Sea (Section 3.3.6.2.4). We assume the potential effects described in Section 4.4.1.8.1 pertaining to gray whales would be similar for minke whales but to a lesser extent, as minke whales are less abundant in the Chukchi Sea.

Killer whales and harbor porpoises occur in the Chukchi Sea (Sections 3.3.6.2.1.3 and 3.3.6.2.1.4, respectively). We assume the potential effects described in Section 4.4.1.8.1 pertaining to beluga whales would be similar for killer whales and harbor porpoises but to a lesser extent, as these species are less abundant in the Chukchi Sea.

4.5.1.8.1.1. Potential Effects from Underwater Noise. If underwater noise causes disruption of important behaviors such as mating, nursing, or feeding, or if animals are frightened away from important habitat over long periods of time, then these impacts could affect the long-term survival of the population (Erbe and Farmer, 2000). Noise also can interfere with an animal's communication signals, environmental sounds that animals might use for orientation, and the ability to hear the sounds of predators and prey (Erbe and Farmer, 2000). Knowledge of absolute thresholds (i.e., absolute audiograms) is crucial for estimating acoustic impact (Erbe, 2002).

There are four sources of underwater noise in the Alaskan Arctic: (1) vessel traffic noise, (2) aircraft noise, (3) seismic-survey noise, and (4) exploration and production drilling noise.

Ringed, Spotted, Ribbon, and Bearded Seals. The potential effects from underwater noise are the same as described in Section 4.4.1.8.1.1.

Pacific Walrus. The potential effects from underwater noise are similar to those described in Section 4.4.1.8.1. The bulk of the walrus population is present in the Chukchi Sea in late winter through early fall. Walruses have a patchy distribution in the Chukchi Sea that is largely dependent on the location of the pack ice. Large groups of females with calves of the year would be especially vulnerable to disturbance events in the Chukchi Sea. The ability of females to avoid disturbance events is limited by the young calves' inability to swim long distances.

Beluga Whale, Killer Whale, and Harbor Porpoise. The potential effects from underwater noise are the same as described in Section 4.4.1.8.1 with the following additional information pertaining to effects from seismic sound.

Major spring migration routes exist in the Chukchi Sea for belugas. Noise associated with ongoing exploration and potential future exploration and development of offshore hydrocarbon resources will ensonify marine mammal habitat (e.g., supply vessels, drill rigs, seismic transport vessels, icebreakers, aircraft, and helicopters). These activities have the potential to disrupt beluga and other toothed whale behavior and communication (Cosens and Dueck, 1993). Important variables in determining the sphere of influence for noise include frequency and source level, rate of attenuation, ambient sound levels, sensitivity of species, and various frequencies and intensity by which a signal must exceed background to be heard (Finley et al., 1990).

Estimated killer and beluga whale auditory bandwidth (estimated lower to upper frequency hearing cut off) are 150-160 kHz,; harbor porpoise have 200- to 180-kHz bandwidths (Southall et al., 2007); sounds that elicit TTS in cetaceans have been reported only for belugas and bottlenose dolphins; using a seismic watergun that produced a single pulse, Finneran et al. (2002, cited in Southall et al., 2007) measured TTS of >6 dB at 0.4 and 30 kHz after exposing a beluga to (peak: 160 kPa [23psi]; peak-to-peak:226 dB re: 1µPa (peak-to-peak); SEL 186 dB re: 1µPa2-s). Thresholds returned to within ± 2 dB within 4 minutes of exposure.

Beluga whales in the Alaskan Arctic consistently congregate in shallow coastal or estuarine waters during at least a portion of the summer. In the Eastern Chukchi, these areas of concentration are known to occur in Kotzebue Sound and Kasegaluk Lagoon. Research suggests these and other areas along the eastern Chukchi coast likely are used for calving and molting, and subsistence hunting occurs in or near these areas principally during spring. Beluga whales also can be found in large aggregations during the remainder of the summer, when they are located farther offshore and associated with deeper slope water. Additional analysis must then be considered on how seismic activity may affect these concentrations of whales, especially when they are engaged in important biological behaviors such as calve rearing and/or molting. Such analysis was done in a recent programmatic environmental assessment for 2006 exploration seismic surveying (USDOI, MMS, 2006a).

Minke and Gray Whales. The potential effects from underwater noise on gray and minke whales are the same as described in Section 4.4.1.8.1.

4.5.1.8.1.2. Potential Effects from Vessel and Aircraft Disturbance. The potential effects of vessel and aircraft disturbance are largely the same as described in Section 4.4.1.8.1.2**.** However, Pacific walruses are much more vulnerable to these disturbance events in the Chukchi Sea. As the sea ice continues to retreat off of the continental shelf, walruses are more often forming large terrestrial haulouts along the Chukchi sea coastline near Point Lay, Cape Lisburne, Icy Cape, Wainwright, and in the Russian Far East. Walruses are very vulnerable to injury from stampedes caused by disturbance events, such as aircraft passing overhead. Females and females with calves are especially vulnerable. The increased energetic costs of fleeing from disturbance events may have profound consequences for a population that already may be forced to travel long distances between foraging and resting areas by the retreating sea ice.

4.5.1.8.1.3. Potential Effects from Subsistence. The potential effects from subsistence are the same as described in Section 4.4.1.8.1.3, with the following additional information for each species/species group below.

Ringed, Spotted, Ribbon, and Bearded Seals. Sections 3.4.2.2 and 4.4.1.8.1.3 offer a detailed explanation of the importance of ice seals in the culture and diet of Alaskan Native subsistence hunters using the Chukchi Sea. The potential effects of subsistence harvests on ice seals are the same as described in Section 4.4.1.8.1.3.

Pacific Walrus. Walruses are an important subsistence resource in coastal villages in Alaska. From 1998-2007, an average of 110 walrus were harvested along the Chukchi Sea coast by the villages of Wainwright, Point Lay, Point Hope, Kivalina, Kotzebue, Buckland, Deering, Shishmaref and Wales (unpublished FWS data, 2008, Jonathon Snyder, pers. commun.). As walruses increase their use of coastal haulouts of the Chukchi Sea, they may become more vulnerable to subsistence hunting and sources of anthropogenic disturbances. Conversely, while walruses may be more available to hunters in some areas, they may become less available in others as changes in sea-ice range and extent create changes in patterns of movement and habitat use. Currently, the size of the Pacific walrus population is unknown and, therefore, a reliable estimate for a sustainable PBR cannot be determined. For more information on subsistence, see Section 4.5.1.12.

Beluga Whale, Killer Whale, and Harbor Porpoise. The Eastern Chukchi Sea stock of beluga whales have been and are hunted by many communities throughout the eastern coast of the Chukchi Sea. The Alaska Beluga Whale Committee coordinates management of the hunt. The PBR is 74 animals for this stock (Angliss and Outlaw, 2008). Annual Alaskan Native subsistence take of Eastern Chukchi Sea beluga stock averaged 65 animals during 1999-2003. This removal is likely an underestimate, as it does not include struck and lost data prior to 1996. There is no evidence that the Eastern Chukchi Sea stock of belugas is declining, and they are considered stable. However, we are aware of no other known potential human-related effects that approach, or could reasonable be predicted to approach, the level of this known removal. This activity also could result in noise and disturbance that may have temporary effects on habitat use. True assessment of the stock relative to optimal sustainable population size is not possible at the time (Angliss and Outlaw, 2008).

The subsistence take of belugas is below PBR, and the population is considered stable (Angliss and Outlaw, 2008). We are not aware of information suggesting there have been any long-term modifications of habitat use due to this form of disturbance. We also emphasize that the hunt is regulated, has limits on take, and does not exceed the PBR rate. There are no reports of killer whale or harbor porpoise subsistence harvest in the Chukchi Sea.

Minke and Gray Whales. The potential effects of subsistence are the same as described in Section 4.4.1.8.1.

4.5.1.8.1.4. Potential Effects from Habitat Loss. This section refers to direct habitat losses as compared to changes in habitats arising from climate change. Climate change effects are described in Section 4.4.1.8.1.7. The potential effects of habitat loss are the same as described in Section 4.4.1.8.1.4, with the following additional information for each species/species group below. Development and production from existing leases, the source of most habitat-related effects, are considered speculative, so habitat-related effects from development and production are presented as low probability events.

Ringed, Spotted, Ribbon, and Bearded Seals. No offshore oil and gas developments exist in the Chukchi Sea sale area. Future development and production would entail product storage and transportation, infrastructure construction and maintenance, platform construction and maintenance, drilling; product collection, production and processing, support vessel and aircraft for personnel, supply, and maintenance that would continue over the duration of production. Some community or industrial developments may occur along the Chukchi Sea; however they are not very common. We anticipate the level of effect to be the same as described in 4.4.1.8.1.4.

Pacific Walrus. Some coastal and nearshore habitat loss may occur from the expansion of human activities in nearshore and coastal areas. Until recently, walruses typically have not used coastal haulouts along the U.S. side of the Chukchi Sea in large numbers. In 2007, a large coastal haulout formed near Cape Lisburne. Additional coastal haulouts have been observed near Point Lay, Icy Cape, and Wainwright. As sea-ice retreats continue, walruses may come ashore and form haulouts in areas not previously identified as walrus habitat. These coastal haulouts are likely to increase in importance for walruses. Loss of access to important coastal haulout areas in the Chukchi Sea on either the Russian or

U.S. side due to disturbance or development could have major impacts on walruses, if the sea ice retreats north of the continental shelf.

Other potential effects are the same as described in Section 4.4.1.8.1.4.

Beluga Whale, Killer Whale, and Harbor Porpoise. Exploration-drilling may occur as a result of oil and gas leases. Unknown amounts of gravel and dredge-fill material may alter benthic habitat and are expected to affect some benthic organisms and some fish species. These activities also may temporarily affect the availability of some local food sources. These activities are not expected to affect food availability over the long term. Displacement or avoidance of habitat may result from the effects of noise and other activities. If development occurs in feeding areas, these sites may be avoided by toothed whales for the duration of operation.

A minor level of effect on some toothed whales is anticipated. Detectable population-level effects on beluga whales are not anticipated. Information regarding killer whale and harbor porpoise numbers, distribution, habitat use, and prey in the Chukchi Sea Planning area are insufficient to determine level of effect.

Minke and Gray Whales. Gray and minke whale habitat loss or degradation may occur in local areas of intensive human activities and facility construction in nearshore and shoal feeding areas of the Chukchi Sea. These would include the obliteration of local benthic sites from dumping of exploration well drill cuttings and muds, and excavation for placing bottom-founded facilities. Effective use of feeding habitats may be decreased due to noise and human activities causing avoidance of or displacement from such areas. Exploration activities could cause temporary avoidance and displacement from localized feeding areas, thereby degrading the effective use of habitat by minke or gray whales. If development should occur, localized feeding sites may be avoided by minke and gray whales for longer periods (years of operation) where production facilities and operations occur in shallow coastal and shoal feeding areas. Abandonment of oil and gas production facilities and infrastructure would allow such feeding sites to become available unless facilities are converted to other uses that maintain noise and other stimuli to which minke and gray whales respond by avoidance.

Natural fluctuations in gray whale abundance can be expected as the population, which is thought to be close to or at carrying capacity (Moore et al., 2001), adjusts to natural and human-caused factors affecting carrying capacity. Depletion of local and regional prey abundance by gray whales in the northern Bering Sea has been correlated with calf production of gray whales (Perryman et al., 2002). Depletion of prey in the northern Bering Sea has been suggested as the stimulus for more gray whales moving into the Chukchi Sea for summer foraging. Effects from arctic warming to Chukchi Sea gray whale prey, distribution, and habitat are uncertain and would be speculative at this time.

Development and production plans would be subject to MMPA compliance, as appropriate. Mitigation measures that ensure minimum adverse effects to gray whales would be imposed by MMS, and specific IHA mitigation measures, terms, and conditions would be applied by NMFS. Development and production would entail a suite of ancillary activities; product storage and transportation; infrastructure construction and maintenance; platform construction and maintenance; drilling; product collection, production and processing; support vessel and aircraft for personnel, supply, and maintenance that would continue over the duration of production. A minor level of effect to some gray whales is anticipated. Detectable population-level effects to gray whales are not anticipated. Information regarding minke whale numbers, distribution, habitat use, and prey in the Chukchi Sea Planning Area are insufficient to determine level of effect.

4.5.1.8.1.5. Potential Effects from Environmental Contaminants. Disposal of drilling muds and cuttings would be as specified under conditions prescribed by an EPA NPDES permit. Exploration drilling muds and cuttings may cause localized contamination of the seafloor. Discharge of drilling muds and cuttings during exploration activities is not expected to cause population-level effects, either directly through contact or indirectly by affecting prey species. Any effects would be localized primarily around the drill rig because of the rapid dilution/deposition of these materials. Contaminants from other sources that may affect marine mammals include organochlorines, pesticides and fire-retardant chemicals. These may enter the Arctic Ocean elsewhere and be carried by ocean and wind currents. Contaminants may interact in a synergistic fashion, although there is little specific information to evaluate these effects in marine mammals.

Ringed, Spotted, Ribbon, and Bearded Seals and Pacific Walrus. The potential effects from environmental contaminants are described in Section 4.4.1.8.1.5. Environmental contamination in the Chukchi Sea could have a larger potential impact on walruses than in the Beaufort Sea. Pacific walruses spend several months a year foraging for benthic invertebrates in the Chukchi Sea. Females and young typically remain in the Chukchi Sea throughout the summer. Any contaminants present could become concentrated in the females' milk and in young calves.

Beluga Whale, Killer Whale, and Harbor Porpoise. Refer to Section 4.4.1.8.1.5 for a discussion of potential effects from contaminants to beluga whales. There is little information available regarding Chukchi Sea killer whales and harbor porpoises. Alaskan beluga whales, including those of the Eastern Chukchi stock, have been found to have relatively high concentrations of mercury, selenium, and silver in their livers. These levels are much higher than those found in ringed and harbor seals, bowhead whales, and walruses in Alaska. These elements accumulate in liver tissue and increase as the whale ages. Uptake and bioaccumulation of these elements are determined by many factors. Animal diet and body size play major roles in the accumulation of contaminants in belugas (Loseto, Stern, and Ferguson, 2008).

Concentrations of PCBs and chlorinated pesticides were found to be higher in the blubber of beluga whales in the Eastern Chukchi stock than the Cook Inlet stock. This is of particular concern to Alaskan Natives, who use belugas for subsistence. Because belugas are not ubiquitous in the Chukchi Seas, but rather tend to be localized at different times of the year the potential exists for contaminates from foreseeable increased anthropogenic activities (including oil spills) to enter and magnify in the food chain and not only affect whales, but those Native Alaskans that eat them.

A variety of ongoing anthropogenic activities in the Arctic potentially may increase contaminates in belugas, including pollution associated with coastal development, icebreaking-ship activities (for research and shipping), and oil and gas development. We are unable to assess the potential effects of contaminants on belugas at this time with the limited data available.

Minke and Gray Whales. The potential effects are the same as described in Section 4.4.1.8.1.

4.5.1.8.1.6. Potential Effects from Petroleum Spills.

Ringed, Spotted, Ribbon, and Bearded Seals. The potential effects from petroleum spills to ice-dependent phocid seals are the same as those described in section 4.4.1.8.1.6. Although no oil or gas production presently occurs in the analysis area, it is reasonable to assume production activities could occur in the foreseeable future. The most likely source for a petroleum spill in the Chukchi Sea continues to be fuel-tanker traffic delivering fuel to villages in the region.

Pacific Walrus. The potential effects from petroleum spills are largely described in Section 4.4.1.8.1. During late spring through early fall, the bulk of the Pacific walrus population congregates in the Chukchi Sea. In the unlikely event of a large spill occurring during this time period, the majority of the Pacific walrus population could be vulnerable to the effects of a spill, which could result in a major population-level effect on walruses.

Beluga Whale, Killer Whale, and Harbor Porpoise. There are two situations in which belugas are at particular risk in the event of a large oil spill in the Chukchi Sea. Because beluga whales in the Alaskan Arctic consistently congregate in shallow coastal or estuarine waters during at spring/summer (i.e., Kotzebue Sound and Kasegaluk Lagoon), where they feed, molt, and brood young, and where subsistence hunting occurs principally during spring. A large or very large oil spill has the potential to significantly affect belugas in these areas during this time.

The other situation would be if a large or very large oil spill occurred while the whales were migrating through the Chukchi Sea traveling through the spring leads and polynyas, particularly if large numbers of females are accompanied by calves. Calves would be particularly vulnerable at this time. The spring migration across the Bering and Chukchi seas and into the Alaska Beaufort Sea depends on open leads occurring offshore. The potential exists for substantial mortality and sublethal effects to a cohort of calves if a large spill occurred during spring migration, or spilled oil concentrated in the polynya system when whales, including calves, were passing through in large numbers and experiencing prolonged contact and exposure to inhalation of volatile components of spilled oil.

Population-level adverse effects from a large spill originating in the Chukchi Sea are difficult to state with any certainty. However, we assume that individuals or small groups could be injured or potentially killed in a large spill. Additionally, spill-response activities (including active attempts to move whales away from oiled areas) could cause short-term changes in local distribution and abundance. Should such an event occur during the subsistence-hunting season, there potentially would be significant effects to the subsistence use of this stock of belugas. The number of belugas or other toothed whales contacting spilled oil would depend on the size, timing, and duration of the spill, the number of whales were near the spill, and if the whales move to avoid contact.

Belugas associate with and use of spring leads and polynyas as a migratory path between wintering and summering grounds. They use Kasegaluk Lagoon extensively. We conservatively anticipate a major level of effect, should a large oil spill occur within or near Kasegaluk Lagoon at such time when females and calves were concentrated there.

Minke and Gray Whales. The potential effects from petroleum spills are the same as described in Section 4.4.1.8.1. Minke whales are known to penetrate loose ice during summer and some minke whales venture north of the Bering Strait into the Chukchi Sea (Leatherwood et al., 1982 as cited in Angliss and Outlaw, 2008).

4.5.1.8.1.7. Cumulative Effects from Global Forces. This section refers to changes in the physical environment brought about by climate change.

Ringed, Spotted, Ribbon, and Bearded Seals. The Cumulative Effects from Global Forces are the same as described in Section 4.4.1.8.1.7.

Pacific Walrus. Loss of sea-ice cover is having profound effects on walrus. Changes in their distribution and use of land-based haulouts are increasingly apparent in the Chukchi Sea. In recent years, researchers on both the Russian and U.S. coastlines of the Chukchi Sea have reported large haulouts forming, which have included unprecedented numbers of females with calves (Anatoly Kochnev, pers. commun. and Joel Garlich-Miller, pers. commun.). Females with calves typically remain in the pack ice, where they more easily can avoid predators and forage without leaving their calves while they traverse long distances. It is unlikely that females with young would come ashore as long as ice is available to them in suitable habitats. In 2006, researchers aboard the USCG icebreaker *Healy* reported nine walrus calves swimming in ice-free waters without adult walruses. At that time, the sea ice had retreated north of the shelf. The researchers hypothesized that the mother-calf pairs had been separated when the sea ice had retreated over waters too deep for the adult walruses to forage (Cooper et al., 2006). These orphan events could become more common, as females are forced to travel further away from their calves in order to forage. Walrus calves spend a minimum of 18-24 months with their mothers and must learn where and how to forage for food. Abandoned calves have very little chance of survival unless they locate other adult walruses.

Walruses are more vulnerable to predation and disturbance at coastal haulouts than they are in the pack ice. Disturbance events cause walruses to stampede into nearshore waters, which may have substantial energetic costs, and leads to injuries and mortalities. Calves are particularly susceptible to trampling during stampedes, when walrus are disturbed from haulouts and rush into nearshore waters. Kochnev 2002 or 2004 has estimated that haulouts of up to 40,000 walrus formed along the Russian coast in summer 2007; he further estimated that as many as 3,000-5,000 walruses may have been killed in stampedes over the season. Walruses at terrestrial haulouts also may be more susceptible to poaching events. Walruses at terrestrial haulouts may have to travel farther to reach foraging grounds and females, particularly females with calves, may become concentrated in nearshore foraging areas, which then may become depleted.

Unlike ice seals, walruses cannot swim continuously for weeks at a time. Large portions of walrus foraging areas simply may become inaccessible to walruses without sea ice to rest on. Walruses may be increasingly energetically stressed as they are forced to swim farther between remaining sea ice and available foraging areas, or between terrestrial haulouts and foraging areas. Grebmeier et al. (2006) have suggested that rising water temperatures and loss of sea ice may be causing a decrease in available benthic prey and an increase in fish species in the northern Bering Sea. If similar changes take place over time in the Chukchi Sea, they also will have major impacts on the walrus population.

Changes in distribution and the timing of migration also may negatively impact walrus-breeding activities. Female walruses tend to remain in herds of females and dependent calves. Female calves may stay with their mother and her group throughout their lives. Walruses give birth in spring while resting in the pack ice far from most predators. In late winter, male walruses join the females near the ice, edge where they initiate courtship displays and breed with females. Changes in sea-ice extent may disrupt these patterns. Moving from sea ice to shore may disrupt these social groups and lead to poorer reproductive success rates.

Beluga Whale, Killer Whale, and Harbor Porpoise. The Cumulative Effects from Global Forces are the same as described in Section 4.4.1.8.1.

Minke and Gray Whales. The Cumulative Effects from Global Forces are the same as described in Section 4.4.1.8.1.

4.5.1.8.2. Mitigation Measures. Mitigation measures imposed under this alternative would be those measures already in place under pre-existing lease sales. See the Sale 193 EIS and the Seismic Survey PEA (USDOI, MMS, 2007d, 2006a) for the specific mitigation measures imposed. Section 4.4.1.6.1.2 contains a summary of existing mitigation measures relevant to all marine mammals.

4.5.1.8.3. Anticipated Effects Under Alternative 1. This section describes the impact to certain marine mammals resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions are described in Section 3.3.6. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures (described in Section 4.5.1.8.2) and the following important factors below are considered in determining the anticipated effects from this alternative.

Timing. Many effects to marine mammals occur during the open-water period, but some activities, such as aircraft operations or icebreaker activity, occur when sea ice is present. The window of time for oil and gas exploration typically includes the open-water period. Production operations, currently considered speculative, would take place year-round, and effects would be possible from a variety of sources throughout the year.

Residence Time and Periodicity. Effects vary based on whether activity in the area is short term or long term and whether it involves passage through an area on a frequent or intermittent basis. For example, during exploration, drillships/rigs could be at a particular location for about 90 days, depending on the site characteristics. Support vessels and aircraft likely would need to make trips between the drillships/rigs and shore to deliver personnel and equipment. Because residence time, location, timing, and periodicity of drillships/rigs and support vessels during exploration could vary, levels of effect also could vary.

Spatial Extent. The lease-sale area is large, and the area explored in any given season is small by comparison. Beyond the footprint of a seismic vessel or drillship, consideration must be given to the area affected by noise, support-vessel traffic, and other secondary factors.

Oil Spills. We recognize that if a large oil spill occurred where there were concentrations of marine mammals, large-scale mortality could occur, representing a major population-level effect. Large spills could arise from a variety of sources, especially during bulk fuel deliveries or other marine accidents. A large spill from a well blowout is described as a very unlikely event in Section 1.1.4.

The extent of mortality that could result from oil spills from oil production (currently viewed as being speculative until a large commercially developable field is discovered) is extremely difficult to estimate. First, it is uncertain that oil would ever be discovered. The potential that a commercial field would be discovered in the Chukchi Sea is ≤10% and about 20% in the Beaufort Sea. Secondly, it is also uncertain that oil would be spilled. As stated in the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a), the likelihood of at least one spill of at least 1,000 bbl (42,000 gal) during the life of the project was estimated to be 8-10%. The multiple-sale EIS and the Sale 195 EA (USDOI, MMS, 2004) explain that the occurrence estimate includes only part of the variability in the arctic effects on the spill rate. During Fiscal Year 2004, MMS procured the study titled *Improvements in the Fault Tree Approach to Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas.* The study included the non-Arctic variability of spill frequency and spill size. An implication from this study is that the chance of one or more large spills increased from 8-10% (USDOI, MMS, 2003a:Section IV.A.4.a (1)) to 21% for Sale 202. The extent of mortality from such an improbable spill would be greatly influenced by the location, volume, trajectory, and timing, as well as the period that oil remains in the environment.

Oil and gas production in the Chukchi Sea is considered speculative but, if it were to occur, a larger number of small spills (<1,000 bbl) could occur. Most of these would be into containment (not the open ocean). In addition, the low probability of an oil spill occurring combined with the uncertainty of the location of the spill make it highly unlikely that numerous chronic small spills or a large oil spill would contact large numbers of marine mammals. For example, 68,000 gal of heating oil were reportedly spilled into the Beaufort Sea near Kaktovik in 1988. No oiled birds or other wildlife were discovered, and the U.S. Coast Guard closed the case.

The MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. For purposes of the following analyses, numerous small spills or large spills from OCS oil and gas activities are considered high effect, low likelihood events and are not considered reasonably foreseeable.

For the same reason, it is difficult to estimate the potential for chronic small spills or a large spill to originate from private, commercial, or State sources with in the Chukchi or Beaufort seas. Increasing vessel traffic in general, and bulk fuel deliveries in particular, appear to present some danger of an oil spill.

The effects from selecting this alternative are separated into direct and indirect effects (Section 4.5.1.8.3.1 and cumulative effects (Section 4.5.1.8.3.2). The terms used to define the level of effect are defined in Section 4.4.1.8.3.

4.5.1.8.3.1. Direct and Indirect Effects Under Alternative 1. No direct or indirect effects are anticipated under this alternative. A lack of direct and indirect effects means there would be no incremental contribution under this alternative to the cumulative effects.

4.5.1.8.3.2. Cumulative Effects Under Alternative 1. The cumulative impacts of selecting the no-action alternative are based on the existing natural environment and current anthropogenic ongoing actions in the Chukchi Sea. This section describes the impact on marine mammals resulting from the incremental impact of the action (which for this alternative is taking no action) and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Past and present actions are described in Section 3.3.6. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures (described in Sections 4.5.1.8.2 and 4.4.1.6.1.2) and the important factors (above) are considered in determining the anticipated effects under this alternative.

Analysis of Alternative 1 forms the environmental baseline for lease sales in the Chukchi Sea. This baseline is the current status of past and present natural and anthropogenic actions on the environment. The baseline also includes anticipated effects from other MMS-authorized activities taking place on existing OCS leases within the sale area.

4.5.1.8.3.2.1. Anticipated Level of Effect from Underwater Noise. Sources of underwater noise in the Chukchi Sea include vessel traffic noise, aircraft noise, seismic survey noise, and exploration drilling noise.

4.5.1.8.3.2.1.1. Effects from Vessel Traffic Noise.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects from vessel traffic noise are the same as described in Section 4.4.1.8.3.2.1.1.

Pacific Walrus. Vessels in open water are less likely to disturb large numbers of walruses, but may displace foraging walruses or disrupt walruses transiting between foraging and resting areas. Vessels traveling nearshore could disturb coastal haulouts. Icebreakers may encounter and disturb walruses, particularly in the spring lead system and the polynyas of the Chukchi Sea. As with tourism and research traffic, both commercial and military large-vessel traffic could disturb large numbers of walruses at coastal haulouts. Vessel disturbance from anticipated increases in tourism, research, shipping, and military vessels could result in chronic disturbances to walruses, which could have moderate effects.

Vessel traffic could disturb walruses at sea, along the ice edge or within spring lead systems, and may interrupt the movements or foraging of walruses by temporarily displacing some animals when the vessels pass through the area. Such traffic is not likely to have more than a short-term (a few hours to a few days) effect on walrus movements or distributions; but the displacement of walruses could have a localized effect on the availability of these animals to subsistence hunters for that season. Icebreaker activity would physically alter some ice habitats. This could temporarily destroy some potential resting habitat in pack-ice areas, or provide access to additional areas by opening up new leads. Repeated disturbance from vessel traffic could have energetic costs and has the potential to separate calves from their mothers. The level of impact would depend on the amount of disturbance. Walruses have a patchy distribution that depends on the location of the pack ice. Large groups of females with calves of the year would be vulnerable to disturbance events in the Chukchi Sea in spring and summer. The ability of females to avoid disturbance events is limited by the young calves' inability to swim long distances.

The reaction of walruses to vessel traffic appears to depend on vessel type, distance, speed, and previous exposure to disturbances. Weather and the length of time that the walruses already have been hauled out also affects the level of response. Brueggeman et al. (1991) reported that 81% of walruses encountered by vessels in the Chukchi Sea exhibited no reaction to ship activities within less than a kilometer, which suggests that walruses may be tolerant of ship activities and movements. However, ice-management operations are expected to have the greatest potential for disturbances to walrus. For example, Brueggeman et al. (1991) reported that walruses moved 20-25 km from active icebreaking operations, where noise levels were near ambient. Conversely, researchers onboard an icebreaker during ice-management operations observed little or no reaction of hauled out walrus groups beyond 0.5 mi (805 m) of the vessel (Garlich-Miller, 2006, pers. commun.). Potential effects from prolonged or repeated disturbance include displacement from preferred feeding areas, increased stress levels, increased energy expenditure, masking of communication, and the impairment of thermoregulation of neonates that are forced to spend too much time in the water.

Beluga Whale, Killer Whale, and Harbor Porpoise. Because of their greater numbers, belugas most likely would be affected by vessel noises. Belugas are sensitive to icebreaker activity. Beluga response to icebreaker noise usually is avoidance. Increased use of icebreakers over an expanding region of activity could expose more whales to frequent short-term exposure to noise potentially earlier and later in the ice-associated period of the year. Icebreakers often are the primary research vessels, and icebreakers attend other vessels in transit during early portions of open-water periods and during the spring beluga whale migration through the spring lead system. These vessels would be relatively free to navigate in areas where disturbance to beluga whale concentrations of cows and calves could occur in the Chukchi Sea lead systems.

Increase in vessel traffic is anticipated to occur for the same reasons as icebreaker activity trends, and involves increases tourism, research, military, and commercial-vessel traffic and supply fuel barges to villages. More frequent encounters with toothed whales are likely to occur where whale habitats overlap vessel-travel corridors. Encounters involve higher potential for injury or mortality from vessel-whale collision or propeller strikes as well as the chronic increasing exposure to vessel noise and presence. A minor level of effect is anticipated.

In other coastal communities, belugas are harvested in the pack-ice leads in early summer. Because the beluga-hunting season for Wainwright and Point Hope takes place under two different conditions (in ice leads and in open water) and hunting is possible at different times over a 6-month period (late March-

Sept.), noise and traffic disturbance would be expected to have lesser effects; however, repeated vessel passes close (within 1-4 km) to both hunters and cetaceans could disturb the whale hunt (USDOI, MMS, 1987c 1990b, 1998, 2003a).

Minke and Gray Whales. Increase in vessel traffic is anticipated to occur and involves increases tourism cruises, research, military, and commercial-vessel traffic and supply fuel barges to villages. More frequent encounters with minke and gray whales are likely to occur where whale habitats overlap vessel-travel corridors. Encounters involve higher potential for injury or mortality from vessel-whale collision or propeller strikes as well as the chronic increasing exposure and potential avoidance of vessel noise and presence. A negligible level of effect to minke and gray whales is anticipated.

4.5.1.8.3.2.1.2. Effects from Aircraft Noise.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects from aircraft noise are the same as described in Section 4.4.1.8.3.2.1.2.

Pacific Walrus. Most aircraft traffic occurs along the coast without altitude or route restrictions for safety reasons. The MMPA requires pilots to avoid disturbing walruses at sea or at coastal haulouts; however, many pilots are unaware of the detrimental effects of flying at low levels over walrus haulouts. The FWS requests that all pilots maintain a minimum 1,500-ft AGL and avoid aggregations of walruses by a minimum of 0.5 mi. Frequent low-level flights associated with freight, intercommunity travel, research studies, and oil and gas operations likely impact walruses at coastal haulouts. As walruses haul out more frequently along the Chukchi Sea coast, unrestricted aircraft activity could result in a minor to moderate level of effect. Any adverse effects are anticipated to continue.

Beluga Whale, Killer Whale, and Harbor Porpoise. Refer to Section 4.4.1.8.1.1.2 for discussion on aircraft effects to beluga whales. Richardson et al. (1995a) suggest that airborne sounds (and visual stimuli) from aircraft may be less relevant to toothed whales than baleen whales, but reactions are variable. For example, beluga responses in offshore waters near Alaska ranged from no overt response to abrupt diving and avoidance, and generally increased with decreasing flight altitude. Reactions to aircraft include diving, tail slapping, or swimming away from the aircraft track. Gray whale mother-calf pairs seem to be sensitive, while migrating gray whale responses are not as detectable. In other cases, both baleen and toothed whales showed no reaction to aircraft overflights. In summary, responsiveness depends on variables, such as the animal's activity at the time of the overflight or altitude level of aircraft, and most animals quickly resume normal activities after the aircraft has left the area. Richardson et al. (1995a) state that there is no indication that single or occasional overflights can cause long-term displacement of cetaceans. A negligible level of impact is anticipated.

Minke and Gray Whales. Refer to the previous paragraph and Section 4.4.1.8.1.1.2 for discussion of aircraft effects to gray whales. A negligible level of effect is anticipated.

4.5.1.8.3.2.1.3. Effects from Seismic-Survey Noise. There are existing Federal leases in OCS portions of the Chukchi Sea, and it is expected that leaseholders and others would conduct 2D/3D seismic and shallow-hazard and site-clearance surveys in the Chukchi Sea to evaluate the potential for oil and gas production in the future. These surveys likely would occur mostly during the open-water period.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects from seismic-survey noise are the same as described in Section 4.4.1.8.3.2.1.3.

Pacific Walrus. Ongoing exploration activities include open-water seismic surveys occurring on areas leased by MMS in the Chukchi Sea during Lease Sale 193. In addition, seismic surveys also are taking place off lease. Based on previous monitoring efforts in the Chukchi Sea, exploration activities (seismic and, particularly, exploratory drilling) are expected to result in the take (Level B harassment) of up to several thousand walruses (Garlich Miller, 2006, pers. commun.). Current seismic operations in the Chukchi Sea are limited to MMS offshore activities, and are further limited to four operators at a given time. Seismic operations occur in open water, where walruses may be passing through but are less likely to be present in large numbers. Seismic operators are required to have marine mammal observers on board to avoid large aggregations of walruses and to shut down if walrus enter the safety zone, identified as the zone where noise levels reach or exceed 180 dB. Effects from seismic activity are expected to be minor due to mitigation measures currently in place. There is very little information on the specific effects of seismic activities on walrus hearing or behavior. Walruses may be affected by seismic surveys through effects on their hearing, disturbance from preferred areas, or in some cases may be drawn to seismic ships during open-water surveys. Some walruses may be temporarily displaced or may experience temporary shifts in hearing thresholds. These effects are expected to be short term and sublethal. Impacts from seismic-survey activities to walruses in the Chukchi Sea are anticipated to be minor.

Beluga Whale, Killer Whale, and Harbor Porpoise. Beluga whales are sensitive to noise and may be displaced from traditional harvest areas by heavy boat traffic or seismic-survey noise. This disturbance response, even if brief, might temporarily interrupt the movements of belugas or temporarily displace some animals when the vessels pass through an area. Such events could interfere with beluga movements to and from the lagoon areas, particularly Kasegaluk Lagoon where Point Lay residents hunt belugas; this harvest is concentrated during a few weeks in early July. Reducing or delaying the use of these habitats by belugas could affect their availability to subsistence hunters. Additionally, there is evidence that belugas will accommodate or acclimate to a particular pattern of noise after extensive exposure, and such acclimation also could affect Iñupiat hunter access. For example, Point Lay residents rely on the harvest of belugas more than any other Chukchi Sea village and, at the present time, they are very successful at herding these animals by boat into Kasegaluk Lagoon where they are then hunted. If noise from boat traffic and seismic-survey activity increased and the belugas acclimated to the noise, there is the possibility that this herding technique would be less successful and the hunt reduced (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998; Huntington and Mymrin, 1996; Huntington, 1999; Mymrin et al, 1999).

In reviewing these life-history patterns of beluga whales and assessing the potential for disturbance from seismic activity, without appropriate mitigation, the potential exists for seismic activities to displace whales from these areas. However, given that existing mitigation measures (and any additional mitigation imposed under the MMPA authorization process) will diminish potential impacts, seismic activity at these areas potentially would result in negligible adverse, but not significant, impacts to beluga whales.

Minke and Gray Whales. There are existing Federal leases (Lease Sales 193) in OCS portions of the Chukchi Sea, and it is expected that leaseholders and others would conduct 2D/3D seismic surveys to evaluate the potential for oil and gas production in the future. These surveys would occur during the open-water period. It is reasonable to expect similar seismic-survey activities in the future. Federal OCS seismic activities are subject to mitigation measures and terms of IHAs designed avoid or minimize effects adverse effects to minke and gray whales. Effects of seismic surveys in relation to existing leases are anticipated to affect some individual whales, to be temporary, nonlethal and no more than minor. Population-level effects cannot be determined at this time as result of insufficient information regarding current distribution and habitat use by these species in the entire Chukchi Planning Area.

4.5.1.8.3.2.1.4. Effects from Exploration Drilling Noise. Currently there is no active drilling in the Chukchi OCS. It is anticipated that drilling on existing OCS leases would occur to develop oil and gas finds. Exploration drilling likely would involve drillships or bottom-founded platforms. Other drilling technologies could be feasible for exploration and if development and production is pursued. In the Chukchi it is estimated that 10 exploration wells could be drilled on the existing leases.

Drilling on OCS leases is anticipated as leaseholders explore and develop potential productive oil and gas finds on existing leases resulting from Lease Sale 193. Exploration drilling likely would involve drillships; however, bottom-founded platforms, and other drilling technologies could be feasible for exploration and if development and production is pursued. In the Chukchi, it is estimated that 8-14 exploration wells could be drilled on the existing leases. If exploration drilling indicates development and production is feasible, drilling would be expected to continue at a rate determined by the number of drill rigs available.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from exploration drilling noise are the same as described in Section 4.4.1.8.3.2.1.4. A negligible level of effect to ice seals is expected to result under Alternative 2.

Pacific Walrus. The noise associated with drilling may displace some walrus from the immediate area. Walruses may be temporarily displaced from important foraging habitats in the Chukchi Sea. We expect that no more than two drilling rigs would be in operation at any given time in the Chukchi Sea. The effects of this displacement depend largely on the position of the drilling rigs but are likely to be no more than minor.

Beluga Whale, Killer Whale, and Harbor Porpoise. Belugas tend to avoid stationary sounds by altering their travel. Belugas possibly habituate to stationary sound sources not associated with hunting. Specific drillship operations, drill location, platform placement and construction, and support activities are subject to further MMS exploration plan (EP) and development and production plan (DPP) assessment and mitigation measures that avoid or minimize adverse effects to toothed whales. Effects of drilling operations can cause deflection of migrating whales from intended travel routes. However, the deflection is transitory after passage of a drillship or platform after an avoidance deflection occurs. Sounds that elicit TTS (no tissue damage, but temporary reduction in hearing sensitivity) in cetaceans have been reported only for belugas and bottlenose dolphins (Finneran et al., 2002, as cited in Southall et al., 2007). In that study, thresholds returned to within ± 2 dB within 4 minutes of exposure. It is unknown if tolerating higher level sound exposure in important habitat for extended periods would result in TTS or PTS (PTS, tissue damage and permanent loss of hearing sensitivity) in belugas whales. Whether belugas could experience TTS or PTS is uncertain at this time. A negligible level of effect is anticipated.

Minke and Gray Whales. There are no drillships or rigs currently active on the Chukchi OCS; however, exploration drilling has occurred there in the past. Gray whale response to stationary sound sources indicates avoidance and behavioral modification that includes altering travel path or deflecting slightly around drill operations (Malme et al., 1984). Gray whales are not present during winter and early spring when ice cover predominates. Large summer feeding concentrations associated with offshore shoals, such as Hanna Shoal, and fall migrating gray whales in the Chukchi Sea could be exposed to the noise introduced to the marine environment, and avoidance or displacement response would be anticipated. Specific drillship operations, drill location, platform placement and construction, and support activities are subject to further MMS EP and DPP assessment and mitigation measures that avoid or minimize adverse effects to gray whales. Effects from drilling operations can cause slight deflection of some migrating whales from original travel route; however, the deflection is transitory after passage of a drillship or platform after an avoidance deflection occurs. Synergistic adverse effects as a result of platform placement and construction, drilling, and other concurrent activities are avoided or minimized by application of mitigation measures that avoid or minimize the footprint of multiple activities relative to one another and to the gray whale biological activities, habitat, and movement. Localized prey concentrations, in part, may be locally avoided by some whales when in close proximity to active drilling operations; however, gray whales, like bowhead whales, may be more likely to tolerate sound when motivated to feed in such areas. Similar tolerance responses of gray whales under similar circumstances are uncertain. It is unknown whether tolerating higher level sound exposure in high-concentration feeding areas results in TTS or PTS in gray whales. Some individuals could experience TTS or PTS, but it is uncertain at this time. A negligible level of effect is anticipated.

Authorized actions account for all the seismic and exploration drilling operations in the Chukchi Sea. Conditions imposed by LOAs or IHAs issued by FWS and NMFS on authorized actions limit the allowable level of take to no more than a negligible adverse effect on marine mammals. In addition, authorized actions may not affect the level of subsistence harvests. Authorized actions would continue to contribute the same relative level of vessel and aircraft activity in the Chukchi Sea. Mitigation measures on exploration activities on existing OCS leases would continue to minimize adverse effects to marine mammals in the Chukchi Sea. The NMFS, FWS, and MMS could decrease impacts by monitoring marine mammal movements and limiting activities in marine mammal habitats.

4.5.1.8.3.2.2. Anticipated Level of Effect from Vessel and Aircraft Disturbance. Vessel and air traffic from government, commercial, or private operations on the North Slope, including some from oil and gas exploration associated with existing OCS leases, will continue into the future. An increase in vessel traffic is anticipated to occur from tourism cruises; research, military, and commercial vessel traffic; and supply fuel barges to villages. Effects from aircraft activity that is not subject to mitigation requirements would continue in nearshore areas, providing habitat for a variety of marine mammals. Current levels of disturbance to pinnipeds and whales from low-level overflights by a wide variety of non-OCS activities are expected to continue.

4.5.1.8.3.2.2.1. Effects from Vessel Disturbance.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from vessel disturbances to ice seals are similar to those described in Section 4.4.1.8.3.2.2.1. A negligible level of effect to ice seals is expected under this alternative.

Pacific Walrus. Due to the tendency of walruses to aggregate in large groups, they are particularly vulnerable to disturbance events. Potential impacts to female walruses and dependent calves are a major concern and merit special consideration. Oil and gas activities that occur during ice-minimum conditions in summer in the Chukchi Sea are likely to come into direct contact with adult females and subadult walruses (Jay et al., 1996). If disturbance causes walruses to abandon preferred feeding areas or interferes with calf rearing, resting, or other activities, then the walrus population could be negatively affected. Walruses will flee haulout locations in response to disturbance from aircraft and ship traffic, although reactions are highly variable (Richardson et al., 1995a). Females with dependent young are considered the least tolerant to disturbances. Brueggeman et al. (1991) reported that 81% of walruses encountered by vessels in the Chukchi Sea exhibited no reaction to ship activities within less than a kilometer, which suggests that walruses may be tolerant of ship activities and movements. However, ice-management operations are expected to have the greatest potential for disturbances to walruses. For example, Brueggeman et al. (1991) reported that walruses moved 20-25 km from active icebreaking operations, where noise levels were near ambient. Conversely, researchers onboard an icebreaker during ice-management operations observed little or no reaction of hauled out walrus groups beyond 0.5 mi (805

m) of the vessel (Garlich-Miller, 2006, pers. commun.). Potential effects from prolonged or repeated disturbance include displacement from preferred feeding areas, increased stress levels, increased energy expenditure, masking of communication, and the impairment of thermoregulation of neonates that are forced to spend too much time in the water (Garlich-Miller, 2006, pers. commun.).

Mitigation measures for ongoing MMS-authorized activities are expected to include vessel-based and/or site-specific monitoring programs. These are intended to avoid interactions with walrus groups and to monitor their response to ongoing activities; establishment of operational buffer zones around observed animals for seismic vessels are intended to reduce incidences of hearing damage; and establishment of operational buffer zones around walrus groups for vessels and aircrafts are intended to reduce disturbance events. Additionally, we assume that the FWS annually will review site-specific operational plans as well as the results of previous monitoring efforts to formulate site-specific mitigation measures. These measures would be incorporated as operational stipulations in an LOA. Research and other vessels operating in the Chukchi Sea also are responsible for adhering to the MMPA by avoiding causing disturbances to marine mammals, including walruses. Other than research vessels, there is little oversight to determine whether or not vessels are adhering to the MMPA. Current disturbance levels may increase as cruise ships and cargo ships increase their traffic through the Chukchi Sea as the ice-free season increases. Current levels of vessel disturbance from all sources in the Chukchi Sea are believed to be minor. It is important to note that a single disturbance event at a large haulout of walruses, particularly if females and calves are present, could result in the death of several thousand walruses.

Beluga Whale, Killer Whale, and Harbor Porpoise. Beluga response to icebreaker noise usually is avoidance. Increased use of icebreakers over an expanding region of activity could expose more toothed whales to more frequent short-term exposure to noise potentially earlier and later in the ice-associated period of the year. Drillships often are attended by an icebreaker in the late fall as ice forms and assists in prolonging the drilling season. Icebreakers often are the primary research vessels, and icebreakers attend other vessels in transit during early portions of open-water periods and during the spring beluga whale migration through the spring lead system. These vessels would be relatively free to navigate in areas where disturbance to beluga whale concentrations of cows and calves could occur in the Chukchi lead systems. Increase in vessel traffic is anticipated to occur for the same reasons as icebreaker activity trends, and involves increases tourism, research, military, and commercial-vessel traffic and supply-fuel barges to villages. More frequent encounters with toothed whales are likely to occur where whale habitats overlap vessel-travel corridors. A minor level of effect is anticipated.

Minke and Gray Whales. More frequent encounters with gray whales are likely to occur where whale habitats overlap vessel-travel corridors. Anticipated effects to minke and gray whales are negligible.

Authorized actions account for some vessel traffic around the Chukchi Sea, and these activities would continue in the future. Current levels of effect are expected to continue. Conditions imposed by LOAs or IHAs issued by the FWS and NMFS ensure that any take associated with authorized actions would be minimized and that there are no effects to the level of subsistence harvests. Additional mitigation measures imposed on exploration activities on existing OCS leases could continue to minimize adverse effects to marine mammals in the Chukchi Sea. The NMFS, FWS, and MMS could decrease impacts by monitoring marine mammal movements and limiting certain vessel activities in marine mammal habitats.

4.5.1.8.3.2.2.2. Effects from Aircraft Disturbance.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects from aircraft disturbances to ice seals are the same as described in 4.4.1.8.3.2.4.

Pacific Walrus. Most aircraft in the Arctic are operated without altitude or route restrictions for safety reasons. The MMPA requires pilots to avoid disturbing walruses at sea or at coastal haulouts; however, many pilots are unaware of the detrimental effects of flying at low levels over walrus haulouts. The FWS requests that all pilots maintain a minimum height of 1,500 ft AGL and 0.5 mi lateral distance near walrus haulouts. Potential impacts to female walruses and dependent calves are a major concern. Oil and gas activities that occur during ice-minimum conditions in summer in the Chukchi Sea are likely to come into direct contact with adult females and subadult walruses (Jay et al., 1996). The MMS-authorized activities are required to maintain a 1,500-ft AGL and to avoid walrus aggregations by a minimum of 0.5 mi, unless safety of the pilot and crew make is at risk (poor visibility at that height, for example). If disturbance causes walruses to abandon preferred feeding areas or interferes with calf rearing, resting, or other activities, then the walrus population could be negatively affected. Walruses will flee haulout locations in response to disturbance from aircraft, although reactions are highly variable (Richardson et al., 1995a). Females with dependent young are considered the least tolerant of disturbances, and walruses in the water are thought to be more tolerant to disturbance stimuli than those hauled out. Helicopters are more likely to elicit responses than fixed-wing aircraft, and walruses are particularly sensitive to changes in engine noise and are more likely to stampede when aircraft turn or bank overhead. Frequent low-level flights associated with freight, intercommunity travel, research studies, and oil and gas operations likely impact walrus at coastal haul outs, but at an unknown level. Any adverse effects are anticipated to continue.

The number of walrus at coastal haulouts that could be exposed to low-level flights associated with OCS oil and gas development is likely to increase as walrus spend more time ashore due to further sea ice retreats, however, MMS-authorized activities are subject to mitigation measures/conditions of an LOA/IHA that avoid or minimize adverse effects. For example, mitigation measures imposed on exploration activities on existing leases must avoid or minimize adverse effects to walrus in the Chukchi Sea by requiring pilots to maintain a minimum height of 1,500 ft AGL and avoid walrus haulouts by a minimum distance of 0.5 mi. As exploration phases occur on existing Chukchi Sea leases, they are subject to mitigation to avoid or minimize effects to marine mammals. Authorized activities are expected to have no more than minor impacts to walrus with mitigation in place.

Beluga Whale, Killer Whale, and Harbor Porpoise. Frequent low-level flights associated with freight, intercommunity travel, research studies, and oil and gas operations likely would impact beluga whales in coastal lagoons, but at an unknown level. Any adverse effects are anticipated to continue. All OCS aircraft operations would be subject to mitigation to avoid or minimize effects to whales. A minor level of effect is anticipated.

Minke and Gray Whales. Increased air traffic from commercial or private aircraft operations on the North Slope is not anticipated to change. Effects from aircraft activity that is not subject to MMS mitigation requirements would continue in nearshore areas providing habitat for some gray and minke whales that are subject to low-level overflights serving by a wide variety of non-OCS activities. Existing sources of aircraft and vessel disturbances are anticipated to result in no more than a minor level of effect on minke and gray whales in the Chukchi Sea.

Oil- and gas-related support for postlease operations is expected to continue, as exploration continues on existing Chukchi Sea leases. **A**uthorized activities are subject to mitigation measures/conditions of an LOA/IHA that avoid or minimize adverse effects. For example, mitigation measures imposed on exploration activities on existing leases must avoid or minimize adverse effects to walrus in the Chukchi Sea by requiring pilots to maintain a minimum height of 1,500 ft AGL and avoid walrus haulouts by a minimum distance of 0.5 mi. As exploration phases occur on existing Chukchi Sea leases, they are subject to MMS mitigation to avoid or minimize effects to marine mammals. Aircraft operations associated with MMS-authorized activities are expected to have no more than a minor level of effect to marine mammals.

4.5.1.8.3.2.3. Anticipated Level of Effect from Subsistence.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects from subsistence to ice seals are the same as described in Section 4.4.1.8.3.2.5.

Pacific Walrus. As walruses increase their use of coastal haulouts, they may become more vulnerable to subsistence hunting and sources of anthropogenic disturbances. Conversely, while walruses may be more available to hunters in some areas, they may become less available in others as changes in sea ice range and extent create changes in patterns of movement and habitat use. The MMS anticipates that the Eskimo Walrus Commission and the FWS will continue to manage the subsistence hunting of walruses to ensure that adverse effects to the walrus population do not occur.

Beluga Whale, Killer Whale, and Harbor Porpoise. Anticipated effects from the closely regulated subsistence harvest of beluga whales are discussed in Section 4.5.1.8.1.3. The harvest of belugas for subsistence purposes would remain the largest known source of mortality and is expected to continue at the current levels until such time subsistence harvest quotas are revisited by the IWC. No adverse effects to belugas from subsistence are anticipated. Killer whales and harbor porpoises are not subject to subsistence harvest in the Chukchi Sea and not expected to be in the foreseeable future. There are no anticipated adverse effects to these species.

Minke and Gray Whales. Gray whales in the Chukchi Sea have not been harvested by Alaskan Natives in the past decade. Minke and gray whales are not subject to Alaskan Native subsistence harvest and are not expected to be so in the future. No adverse effects to these species from subsistence are anticipated.

Authorized activities are anticipated to result in a negligible level of effect on subsistence hunting of marine mammals in the Chukchi Sea. OCS oil and gas activities are not anticipated to impact subsistence hunting of walrus or ice seals. Monitoring and evaluation on OCS oil and gas activities would continue to ensure that effects to beluga whales are negligible and that no unmitigatable actions occur that may affect the subsistence hunting beluga whales.

4.5.1.8.3.2.4. Anticipated Level of Effect from Habitat Loss. This section refers to direct habitat losses as compared to changes in habitats arising from climate change. The anticipated level of effect from climate change is described in Section 4.5.1.8.3.2.7. Sources of habitat loss include community and industrial development.

4.5.1.8.3.2.4.1. Community Development. Some coastal habitat loss may occur as villages expand or are moved to solve ongoing erosion problems along the coast.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects of community development on ice seals are the same as described in Section 4.4.1.8.3.2.6.

Pacific Walrus. Coastal erosion may cause the loss or formation of new habitat for walrus haulouts. Very little is known about factors that may influence walrus selection of terrestrial habitats. The level of effect from potential terrestrial habitat loss is unknown.

Beluga Whale, Killer Whale, and Harbor Porpoise and Minke and Gray Whales. No effects to these whales are anticipated as result of community development along the Chukchi coast.

4.5.1.8.3.2.4.2. Industrial Development. It is largely speculative at this time as to whether development and production would occur on existing leases, and there is a low potential that development and production of economically recoverable resource discoveries could occur. Development and production plans would be subject to MMPA compliance, as appropriate. Development and production would entail a suite of ancillary activities; product storage and transportation; infrastructure construction and maintenance; platform construction and maintenance; drilling; product gathering, production and processing; support vessel and aircraft for personnel, supply, and maintenance that would continue over the duration of production.

Bottom-founded drilling units may cover areas of benthic habitat that support benthic invertebrates used for food by gray whales, walruses, and bearded seals. Some drilling wastes could be discharged near the drilling site. Cuttings from exploratory drilling likely would be released onto the seafloor. These cuttings may contain naturally occurring heavy metals, such as cadmium and lead. However, the effects likely would be negligible, considering the discharge areas are small in relation to the available habitat. Should production occur, companies probably would reinject drilling mud into the seafloor, which mitigates this potential risk.

Disposal of drilling muds and cuttings would be as specified under conditions prescribed by the EPA NPDES permit. Discharge of drilling muds and cuttings during exploration activities is not expected to cause population-level effects, either directly through contact or indirectly by affecting prey species. Exploration drilling muds and cuttings may cover portions of the seafloor and cause localized pollution and inundation of the sea floor. This may impact marine mammals that feed primarily on benthic organisms; however, the areas of sea bottom that are impacted would likely be small in relation to the available habitat.

Ringed, Spotted, Ribbon, and Bearded Seals. There are no existing offshore industrial developments in the Chukchi Sea lease-sale area. Existing lease sales and the subsequent activities would continue. Consequently the anticipated effects of industrial developments on ice seals would be the same as described in Section 4.4.1.8.3.2.4.2.

Pacific Walrus. Exploration activities are not expected to cause habitat loss; however, some temporary disturbance of foraging habitat may occur if, for example, ocean-bottom activities disturb, contaminate, or displace benthic invertebrates. Drilling exploration wells or laying ocean-bottom cables could cause minor impacts to walrus foraging habitat.

Beluga Whale, Killer Whale, and Harbor Porpoise. These activities are not expected to affect food availability over the long term. This is because prey species for belugas, for example, such as arctic cod, have a very broad distribution and toothed whales are able to forage over large areas of the Chukchi Sea. They are not reliant on the abundance of local prey. Such effects would be at a negligible level in relation to the available habitat in the offshore shoals and shallow nearshore habitats in the Chukchi Sea. Habitat loss is not likely to measurably affect the availability of toothed whale prey in the Chukchi Sea. A negligible level of effect on toothed whales is anticipated.

Minke and Gray Whales. Effects from exploration of existing Chukchi Sea OCS leases may cause local, temporary habitat alteration or decreased effective use of habitat by displacing gray or minke whales. Such effects would be negligible in relation to the available minke and gray whale habitat in the offshore shoals and shallow nearshore habitats in the Chukchi Sea.

Bottom-founded drilling units may obliterate small areas of benthic habitat and seafloor that support benthic invertebrates that gray and other baleen whales feed on. Such effects would be negligible in relation to the available habitat in the offshore shoals and shallow nearshore habitats in the Chukchi Sea.

There may be exploration drilling as a result of oil and gas leases in the Chukchi Sea. Cuttings from exploration drilling may be discharged onto the seafloor, which may alter benthic habitat, and are expected to affect some benthic organisms. Bottom-founded drilling units may obliterate small areas of benthic habitat and seafloor that support benthic invertebrates that gray whales, walruses, and bearded seals feed on. These activities also may temporarily affect the availability of some local food sources. Required mitigation measures and conditions will continue to be applied on OCS oil and gas activities on existing leases to ensure effects to marine mammals and their habitats are avoided or minimized. A negligible or minor level of effect is anticipated.

4.5.1.8.3.2.5. Anticipated Level of Effect from Environmental Contaminants. Environmental contaminants may enter the marine environment through the atmosphere, freshwater runoff, accumulations carried in rainwater or ocean currents, or specific localized events such as a spill or disposals of wastes offshore. Some environmental contaminants, such as certain heavy metals or arsenic, may be naturally occurring in some areas or may be introduced by atmospheric transport. Fire-retardant chemicals are believed to have entered the Arctic through atmospheric transport systems. Pesticides and organochlorines are believed to have entered the Arctic through freshwater runoff and atmospheric transport (MacDonald, Harner, and Fife, 2005).

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated level of effect from environmental contaminants is the same as described in Section 4.4.1.8.3.2.7.

Pacific Walrus. There is not enough current information to be able to anticipate trends, if any, in contaminant loads in Pacific walruses. Available information based on samples collected in the 1990s indicated very low levels of contaminants in walruses. Past studies have shown low levels of organochlorine and heavy metals in walruses. Walruses are susceptible to bioaccumulation through ingestion of benthic prey items. Ongoing assessments of contaminant levels on a more regular basis would help to determine whether changes were taking place.

Beluga Whale, Killer Whale, and Harbor Porpoise. Belugas are threatened everywhere by pollution of their environment. Researchers recently demonstrated that mercury levels in beluga muscle tissue reflect biomagnification processes rather than bioaccumulation over time. Researchers found that beluga length defined habitat specificity and the consequent difference in habitat use resulted in different diets and dietary Hg sources (Loseto, Stern, and Ferguson, 2008). Contaminants that enter the sea tend to become concentrated as they move up the food chain and could pose a health risk to belugas. Elsewhere, belugas found dead have contained high levels of organochlorines, lead, and mercury. The population-level effects of the presence of such levels of contamination are unknown. We are unable to determine how environmental contaminants might affect belugas in the Chukchi Sea lease-sale area.

Discharges containing contaminants could be released onto the seafloor and marine environment during the drilling of exploration wells. Exploration drilling on past and existing leases would add incrementally to discharges into the Chukchi Sea. Local sites where releases may occur depend on the number and location of exploration wells. Mitigation measures require that most discharges (cuttings and drilling mud) from production wells be reinjected into an authorized disposal well. Due to prey selection, beluga whales accumulate contaminants to a higher degree than baleen whales such as gray whales.

Concentrations of PCBs, DDT, and other pesticides have declined in the Arctic since the 1980s; however, cetaceans in the Arctic still may be at risk for adverse health effects (Wilson et al., 2005). Temporal trends in the levels of organic pollutants are not obvious. Studies comparing levels of POPs in the 1980s with levels in the 1990s show no apparent change (CDFO, 2000).

Minke and Gray Whales. There could be alterations in gray and minke whale habitat as a result of exploration drilling, including localized pollution and habitat destruction. We refer readers to the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a) for a detailed discussion of drilling muds and other discharges associated with exploration drilling, with probable scenarios regarding the disposal of these substances and for discussion of the potential effects on water quality from their discharge. Any potential adverse effects on baleen whales from discharges are directly related to whether or not any potentially harmful substances are released, if they are released to the marine environment, what their fate in that environment likely is (e.g., different hypothetical fates could include rapid dilution or biomagnification through the food chain) and, thus, whether they are bioavailable to the species of interest.

Effects to minke whales, their habitat use, and habitat selection are uncertain but likely inconsequential for the very localized effects of discharges from 8-14 exploration drill sites on existing leases in relation to habitat availability.

Summary. Exploratory drilling may result in the discharge of cuttings onto the seafloor. The effects of such discharges are expected to be localized to an extremely small proportion of available marine mammal habitat. A negligible direct level of effect is anticipated from environmental contaminants from drill cuttings on beluga, minke, and gray whales in the Chukchi Sea.

The most likely source of contaminants from activities that potentially could affect walruses or other benthic feeders would be from cuttings derived from drilling exploration wells. Cuttings may contain naturally occurring heavy metals, such as cadmium and lead. These potential contaminant releases would be limited by the small number of exploration wells (no more than two exploratory drilling rigs in the Chukchi at any given time). In addition, current and ice gouging activity in the Chukchi Sea would disperse any materials deposited on the ocean bottom relatively quickly. Activities are not anticipated to alter the current status of contaminants available to other marine mammals in the marine environment. Any impacts are anticipated to be negligible.

4.5.1.8.3.2.6. Anticipated Level of Effect from Petroleum Spills. According to oil-spill records, most accidental spills in Alaska happen in harbors or during groundings. Vessel-related spills on the high seas are considered infrequent events. Concern has been expressed about increasing tourism and shipping vessel traffic between the Bering Sea and the North Atlantic, especially vessels with crews unaccustomed or ill-prepared for these remote and dangerous areas. If recent performance in the Antarctic is any indication, vessels transiting the Chukchi Sea during ice periods may be prone to ice-related accidents. The ADEC (2007) reports the highest probability of spills of noncrude products occurs during fuel-transfer operations at remote North Slope villages. Other sources of petroleum spills include contamination from oil and gas exploration or development.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated level of effects from petroleum spills is the same as described in Section 4.4.1.8.3.2.8.

Pacific Walrus. Current trends in oil-spill rates are estimated to continue. The Chukchi Sea is experiencing increases in tourism and shipping traffic between the Bering Sea and the North Atlantic, increases in traffic may lead to increases in the number of spills occurring; this is of particular concern for vessels and crews unaccustomed or ill-prepared to traverse these remote and dangerous areas. Vessels traversing the Chukchi and Beaufort seas during periods when ice is present may be more prone to an accident. The ADEC (2007) has reported that the highest probability of spills of noncrude petroleum products occurs during fuel-transfer operations at villages of the North Slope. The level of impact from a spill would depend on the size of the spill, the type of petroleum product spilled, the success of cleanup efforts, the location, and the time of year. Tankers currently do not transit through the Chukchi Sea, which eliminates the possibility of a tanker spill of crude oil. Diesel fuel typically dissipates within 1-2 days, while crude oil may persist for 7-30 days. In the very unlikely event of a large spill occurring in walrus habitat when walruses are present, with cleanup efforts being largely unsuccessful due to weather or other factors, major population-level effects could occur. A more likely scenario is that current trends in spill rates will continue to have a negligible level of effect on walruses.

Beluga Whale, Killer Whale, and Harbor Porpoise. Potential effects of oil spills on beluga whales are discussed in Section 4.4.1.8.2.4. Current oil spill rates are expected to remain the same under this alternative. No large spills are anticipated to occur during exploration activities in the Alaska Beaufort Sea relative to existing leases. This alternative is anticipated to result in negligible impacts to beluga whales, because petroleum spills are considered infrequent, illegal, or accidental events. Fresh oil spills with high concentrations of volatile aromatic hydrocarbons into marine waters associated with the Chukchi spring lead system concurrent with large numbers of beluga whales migrating through the lead system and fouling of Kasegaluk Lagoon and Kotzebue Sound present the greatest potential for effects to large numbers belugas and vulnerable newborn calves. Spill records indicate accidental oil spills in Alaska occur in harbors and during groundings. Vessel-related spills on the high seas are considered infrequent. Concern has been expressed of increasing tourism and shipping traffic between the Bering Sea and the North Atlantic, especially vessels and crews unaccustomed to or ill-prepared for these remote and dangerous areas, The ADEC (2007) reports the highest probability of spills of refined petroleum products occurs during fuel-transfer operations at remote villages. A moderate level effect could occur.

Minke and Gray Whales. No large spills are anticipated to occur during exploration activities in the Alaska Chukchi Sea relative to existing leases. The OSRA modeling runs predict the probability of such a spill scenario to be very low. The most likely number of spills ≥1,000 bbl is zero (USDOI, MMS, 2003a). The MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. Development/production projects and associated infrastructure for product transport may occur on existing leases in the Beaufort Sea OCS in addition to the Northstar and ongoing Liberty projects or adjacent State of Alaska oil and gas leases. It is anticipated that in the unlikely event of a large oil spill, some individual gray whales may experience injury or mortality as a result of prolonged exposure to freshly spilled oil; however, the number affected likely would be small. Some individual whales could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, localized reduction in prey sources, consumption of petroleum and/or petroleum-contaminated food items, perhaps temporary displacement from feeding/resting areas, and temporary interruption of migration timing and route. Spilled oil, if chemical dispersants are used to break up surface oil and cause it to sink to the bottom, could negatively affect gray whales by contaminating benthic prey, particularly in primary feeding areas (Wursig, 1990; Moore and Clarke, 2002). Bottom muds could be contaminated, and oil deposited on the bottom could be ingested by feeding gray whales. Any perturbation, such as an oil spill, that caused extensive mortality within a high-latitude amphipod population with low fecundity and long generation times would result in a marked decrease in secondary production (Highsmith and Coyle, 1992). Effects of exposure of whales to spilled oil may, but are not anticipated to, result in lethal effects to a few individuals, and most individuals exposed to spilled oil likely would experience a minor level of effect.

Small, chronic petroleum (fuel and oil) spills rapidly dissipate volatile toxic compounds within hours to a few days through evaporation, and residual components rapidly disperse in open waters. Individual whales potentially could be exposed to small fuel oil spills, and this exposure could have a negligible level of effect on health.

No large spills are anticipated to occur during exploration activities in the Chukchi Sea. In the unlikely event of a large oil spill, some individual marine mammals may experience injury or mortality as a result of prolonged exposure to freshly spilled oil; however, the number affected likely would be small. Anticipated effects of exposure of marine mammals to spilled oil may result in lethal effects to a few individuals, and most whales exposed to spilled oil likely would experience temporary, nonlethal effects. A moderate level of effect could occur to toothed whales and walruses, and a minor level of effect to ice seals and minke and gray whales is anticipated.

4.5.1.8.3.2.7. Anticipated Level of Effect from Changes in the Physical Environment. We anticipate that current trends in climate change will continue.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated level of effect from changes in the physical environment is the same as described in Section 4.4.1.8.3.2.9.

Pacific Walrus. Of particular importance to walruses are trends in decreasing sea-ice extent spatially and temporally, affecting benthic invertebrate reproduction and growth. These trends may force walruses into less optimal foraging and resting habitat and decrease the population dramatically. Walruses may have to compete for a limited food supply and expend energy reserves traveling long distances between foraging and resting habitats. Females may not be able to successfully raise young when limited to coastal haulouts where walruses could be subject to ongoing disturbances, hunting pressures, and predation, and that may be far from productive foraging areas. Ongoing habitat changes related to climate change are expected to have major impacts on the walrus population.

Beluga Whale, Killer Whale, and Harbor Porpoise. Potential or predicted effects are discussed in Section 4.4.1.8.1.7. Killer whales and harbor porpoises rarely occur in the Chukchi Sea area. Direct and indirect effects from warming of the Arctic to toothed whales remain speculative as to timing, magnitude, and intensity. To provide an example of the uncertainty in determining effects of arctic warming, we provide the following:

> Habitat change or loss for a highly specialized species or one dependent on a particular ecological condition is critical (Laidre et al., 2008). Belugas appear inextricably linked to loose sea ice pack. While it has been suggested that belugas may select for certain habitats regardless of ice cover (Moore, 2000), the relative importance of sea ice to belugas is unknown. However if belugas move into sea ice to avoid predators (i.e., killer whales) the absence of sea ice could have moderate level effects.

Continuing monitoring and evaluation would allow MMS and others to adjust activities as appropriate to aid in protecting toothed whales. Level of effects of arctic warming cannot be determined at this time.

Minke and Gray Whales. Trends in arctic warming in the Chukchi Sea are anticipated to continue. Effects from warming to minke and gray whales in the Arctic remain speculative as to timing, magnitude, and intensity. Continuing monitoring, evaluation and appropriate crafting of mitigation measures will allow MMS to adjust activities as appropriate to protect gray and minke whales and their habitat. The level of effect from arctic warming to minke and gray whales cannot be determined at this time.

Summary. Effects to marine mammals from climate change include increasing trends in vessel traffic, longer seasons of human activity, and new sea-travel routes. Changes in species distribution and abundance already may be occurring for some species. The distribution of walruses, for example, is changing with changes in the extent and duration of seasonal ice cover. Alternative 1 is not anticipated to have a direct effect on current trends, but continuing trends in climate change may have a major level of effect on some marine mammals in the Chukchi Sea lease-sale area.

We expect exploration of existing Federal leases on the Chukchi OCS to continue. Authorized activities in the Chukchi Sea are not anticipated to have a direct effect on current trends of climate change.

4.5.1.9. Terrestrial Mammals. Terrestrial mammals found along the Chukchi Sea coastal areas include the caribou, muskox, grizzly bear, wolf, wolverine, arctic fox, and red fox. Caribou, muskoxen, grizzly bears, and the furbearers analyzed in this document are very important subsistence resources for local residents in the Proposed Action area.

The principal sources of potential adverse effects to terrestrial mammals in the Chukchi Sea include:

- vessel presence and noise;
- aircraft presence and noise;
- vehicular traffic;
- subsistence;
- petroleum spills;
- habitat loss and degradation;
- seismic airgun noise;
- gravel mining; and
- changes in the physical environment.

These "impact-producing factors" are associated with community development; transportation; tourism; oil and gas exploration and development on private, State, and Federal lands; and climate change. Oil- and gas-exploration activities include vessel presence and noise, aircraft presence and noise, vehicular traffic, and seismic activity. Several established oil and gas developments exist in the Chukchi Sea Proposed area such as the Endicott, Northstar and Oooguruk wells. Further production of oil or gas from existing leases in the Chukchi and Chukchi seas is speculative. Seismic-survey activities in the Chukchi Sea continue under existing leases.

The marine and terrestrial systems in the northwestern Arctic are closely linked by seasonal and spatial interactions. While much of the area is perceived to be pristine, a number of past and existing sources of harm exist, along with an increasing number of threats to the terrestrial components of the ecosystem. Furthermore there are several projected environmental changes that will affect terrestrial mammals in the project area for centuries into the future, regardless of whether or not the proposed lease sales are held. While minimizing some of these effects could maintain the present condition of most mammal populations, some environmental influences are outside human control. Accordingly, some terrestrial mammal populations should become scarcer or extirpated within the next 40 years. Given the anticipated adverse effects from reasonably foreseeable and speculative future events (Section 4.2), Alternative 1 (No Lease Sale) still would result in a moderate cumulative effect on most terrestrial mammals in the Proposed Action area. Furbearer species often move out onto the sea ice during the winter months to scavenge polar bear kills or to hunt seal pups. Consequently, terrestrial mammal species showing a significant amount of sea-ice use likely would experience very light to moderate impacts in the foreseeable future. Climate-induced changes to the terrestrial vegetative community most likely would affect the seasonal foraging and movement patterns of ungulates in the northwestern Arctic, most notably caribou and muskox.

If Lease Sales 212 and 221 were not conducted, the cumulative effects under Alternative 1 would consist of combining the existing status of terrestrial mammal resources with those impacts anticipated under the reasonably foreseeable and speculative future events. An overview of the consequences includes:

- The most important impacts to terrestrial mammals is expected to arise from continued climate change and the loss of nearshore winter sea ice habitat changes that could affect migrations, foraging, and/or reproduction in ungulates and their predators. A warming climate may tip the interspecific competitive advantage in favor of red foxes instead of arctic foxes, and grizzly bears instead of polar bears in the coastal and inland areas. Caribou seem to have little difficulty adapting to willow-dominated rangelands; however, muskoxen generally prefer graminoid/shrub-dominated landscapes. While caribou easily cope with deeper snowpacks by cratering or moving to another area, the more sedentary muskox does not cope as well and may experience higher incidents of winterkill because of greater restrictions on accessible wintering ranges.
- Climate-induced changes to the benthos in the marine environment conceivably could lead to conditions favoring large populations of salmonids. Larger returns of salmon into the streams might provide the riparian systems with a seasonal surge in nutrients that could lead to increased terrestrial productivity with the capability of supporting larger numbers of herbivores and carnivores.
- Seismic surveys and other post lease exploration activities for existing OCS leases in the Chukchi Sea require specific mitigation or avoidance measures that reduce future impacts to terrestrial mammals to no more than a negligible level.
- Climate-related changes will continue to occur to terrestrial mammal habitat along the Chukchi Sea, perhaps to a greater extent than all other anticipated effects combined.

More attention to minimizing these effects could reduce anthropogenic sources of stress or mortality to terrestrial mammals near the Chukchi Sea. Some of these mammalian populations are subject to influences or harm well outside the proposed action area, such as calving areas, migration corridors, and wintering areas that have contaminated or altered habitats or an increased human harvest or predation. The long-term effects of these changes are difficult to analyze, much less predict. We anticipate that existing trends will continue, and selection of Alternative 1 would result in negligible effects on terrestrial mammals.

4.5.1.9.1. Potential Effects to Terrestrial Mammals.

4.5.1.9.1.1. Potential Effects from Vessel Presence and Noise. Vessel traffic is expected to increase in the Proposed Action areas in the Chukchi Sea as a result of a longer ice-free period in the Arctic shipping lanes. This increase in traffic is not expected to result in any significant impacts to caribou, muskoxen, or grizzly bears. While there is evidence of furbearers using areas of sea ice for hunting and scavenging during the winter, no detailed studies have been performed along the Chukchi Sea to determine foraging distances, success rates, or importance of the sea ice to terrestrial furbearers. Based on the level of existing knowledge, vessel activity and noise in the Chukchi Sea analysis area is expected to have negligible impacts on terrestrial mammals.

4.5.1.9.1.2. Potential Effects from Aircraft Presence and Noise. Aircraft flying under 1,000 ft have been known to frighten caribou and muskoxen, forcing herds and individuals to scatter, separating cows from calves, and possibly causing individuals to injure themselves during the panic. While grizzly bears do not aggregate in the sense that ungulates do, they too have been known to panic when approached by low-flying aircraft. In these instances the tendency is for a grizzly to seek out the nearest cover such as willows, so that they may hide until the perceived threat passes. In a situation such as this, it is conceivable that a female grizzly could become separated from her cubs. As with caribou and muskoxen, such a separation from their parent would most likely result in the death of the offspring.

There is a gap in our understanding pertaining to the effects of aircraft on furbearers; however, for the most part we must assume that wolves and wolverines exhibit much the same behavior as do grizzly bears. Arctic and red foxes are known to readily habituate to aircraft presence, noise, and associated activity.

4.5.1.9.1.3. Potential Effects from Vehicular Traffic. Caribou, muskoxen, grizzly bears, and most furbearers are keenly sensitive to the use of vehicles in their surroundings. As with aircraft, vehicles have the tendency to frighten most terrestrial mammals into a panic (Stokowski and LaPoint, 2000). Once panicked, some individuals may injure themselves trying to escape, or become separated from offspring or a herd. Consequently, an individual animal may or may not show signs of the sub-lethal effects of vehicular disturbance that often results in an overall decrease in an individual animal's fitness.

A secondary effect of vehicular traffic is the ability to hunt over a much larger area than would otherwise be feasible. The increased efficiency in hunting could lead to the overharvest or unauthorized killing of some game species (Lee, 2008; Halpin, 2008; McLellan, 1990) in areas that would otherwise experience less hunting pressure, access, or success.

Oil- and gas-related vehicular traffic is strictly regulated by industry operators in developed locations near or adjacent to developed areas or those proposed for development, and is normally brief. Vehicle use by the local citizenry living along the Chukchi Sea is unregulated. Regulated vehicular activity in the proposed action areas creates temporary disturbances along existing transportation corridors. The effects of unregulated private vehicle use creates disturbances greatly exceeds those of regulated vehicle us in the area impacted, the duration of impacts, and the magnitude of the impacts.

4.5.1.9.1.4. Potential Effects from Subsistence. The relationship between subsistence and terrestrial mammal populations is covered in Section 3.4.2. The impacts from subsistence have not resulted in any documented population-level effects on terrestrial mammals in the Proposed Action area.

4.5.1.9.1.5. Potential Effects from Petroleum Spills. In the event of an oil spill, a few terrestrial mammals may be exposed to oil along the coastline. If such an event were to occur, an animal's fur could become oiled, losing its insulative value. A possible side effect of such an oiling might be a decrease in an individual animals overall health or ability to thermoregulate. Other potential effects could occur through prolonged inhalation of the fumes from an oil slick, leading to the development of lesions on the lining of the lungs or eye irritation; or through ingestion of contaminated food items which could lead to kidney or liver damage.

While caribou and muskoxen might accidentally consume oil by grazing on oiled plants, grizzlies and furbearers may ingest it by scavenging on an oiled carcass or by predating oiled prey animals. The potential effects to terrestrial mammals from ingesting crude oil could be lethal, based on studies where cattle were exposed to oil (Merck Manual, 2005); however no conclusive studies have been conducted in the proposed action area to shed light on this possibility.

4.5.1.9.1.6. Potential Effects from Habitat Loss and Degradation. The most important impacts to terrestrial mammals likely would arise from climate change induced changes in vegetation and the loss of nearshore winter sea ice. Habitat changes that may affect foraging, migrations, and reproduction strategies in ungulates and predators. A warming climate may tip the interspecific competitive advantage in favor of red foxes instead of arctic foxes, and grizzly bears instead of polar bears. Caribou may have difficulty adapting to shrub or tree-dominated rangelands; muskoxen generally prefer graminoid/shrub-dominated landscapes. While caribou easily cope with deeper snowpacks by cratering, muskox do not cope as well and may experience higher incidents of winter kill because of decreases in accessible wintering ranges.

Climate-induced changes to the benthos in the marine environment conceivably could lead to conditions favoring large populations of anadromous fishes (ACIA, 2004). Larger returns of anadromous fishes into the streams could provide the riparian systems with a seasonal surge in nutrients that could lead to increased terrestrial productivity over the course of several decades. The result might be and improved capability of supporting larger numbers of terrestrial fauna. Gunn (1995) stated that the most likely warming climates will result in decreased caribou and muskox populations because of an increase in the magnitude and frequency of severe weather events.

Another development that may occur as a result of warming temperatures may be the melting of the permafrost and the ensuing release of sequestered carbon and nitrogen into the local ecological communities. In such a situation, and with longer growing seasons, the vegetative community may respond with increased production or a shift that could support vegetation from lower latitudes. Another effect from thawing permafrost may be soil subsidence that would allow sea water to flood into areas of the Arctic Coastal Plain, potentially destroying large blocks of crucial habitat.

Regardless, climate-related changes will continue to occur to terrestrial mammal habitat along the Chukchi Sea, perhaps to a lesser or greater extent and any scenarios that are put forth in this section are only speculative possibilities and based on expectations derived from existing models.

4.5.1.9.1.7. Potential Effects from Seismic Noise. Seismic activity has not been shown to present any identifiable impacts to terrestrial mammals other than when conducted onshore or perhaps during the winter in offshore or nearshore areas. In these instances, the activity by people would be the main contribution factor rather than the noise produced by the actual seismic-surveying equipment. Consequently, any impacts from ongoing seismic surveys would be transient and of negligible immediate effect on terrestrial mammals.

4.5.1.9.1.8. Potential Effects from Gravel Mining. Gravel is mined locally from deposits in the foothills of the Brooks Range and used as construction material for man-made islands, foundations, etc. Harding (1976) found that 78% of the grizzly bear den sites in his study in the Canadian Northwest Territory were situated in steep stream or lake banks and 13% were located in slumped lake or channel banks. Most of the dens were located under clumps of alder or willow. McLoughlin, Cluff, and Messier (2002) found that barren ground grizzlies in the Central Arctic excavated dens under dwarf birch more than any other plant species. Their conclusions agree with those of previous studies (Harding, 1976) in that the preferred substrate for grizzly dens is sandy soils that sometimes had a clay/silt/cobble content with a slope of about 25%. They went on to suggest that gravel could be too loose for structurally sound dens.

Gravel mining has the potential to disrupt den construction if performed during May through October (McLoughlin, Cluff, and Messier, 2002). If mining activities occur during the October through April timeframe, the chance exists that grizzlies may be awakened from their sleep and driven away or unintentionally killed by heavy equipment.

4.5.1.9.1.9. Cumulative Effects from Global Forces. The Cumulative Effects from Global Forces were described in Section 4.4.1.9.1.6 and will not be repeated here.

4.5.1.9.2. Mitigation Measures. The following mitigation measures are in effect to protect terrestrial mammals during Federal and State seismic activities and exploration drilling operations in the Chukchi Sea.

- Whenever vessels are in the marine environment, there is a possibility of a fuel or toxic-substance spill. The FWS requires that wildlife hazing equipment (including Breco buoys or similar equipment) be prestaged and readily accessible by personnel trained in their use, either on the vessel, at Point Lay or Wainwright, or on an onsite oil-spill-response vessel, to ensure rapid deployment in the event of a spill. This requirement should suffice in cleaning up any oil spills before terrestrial mammals can encounter a spill.
- Aircraft supporting drilling operations will avoid operating below 1,500 feet above sea level to the maximum extent practicable (Alaska Dept of Natural Resources 1999). If weather prevents attaining this altitude, aircraft will use pre-designated flight routes. Predesignated flight routes will be established by the lessee and MMS, in collaboration with the Alaska Dept. of Fish and Game, during review of the EP. Route or altitude deviations for emergencies or human safety shall be reported within 24 hours to MMS.
- In accordance with the State of Alaska, Department of Natural Resources 1999 Final Finding of the Director, no exploration or production activities may be conducted within ½ mile of occupied grizzly bear dens without alternative mitigation measures approved by Alaska Department of Fish & Game. Occupied den sites must be reported to Alaska Department of Fish & Game as they are discovered and avoided by a ½ mile buffer.
- Develop and implement bear action plans as described in the State of Alaska, Department of Natural Resources 1999 Final Finding of the Director.

4.5.1.9.3. Anticipated Effects Under Alternative 1.

Terms used to define a level of effect. We used the terms negligible, minor, moderate, and major to describe the relative degree or anticipated level of effect of an action on terrestrial mammals. Following each term below are the general characteristics we used to determine the anticipated level of effect. For all terms, best professional judgment was used to estimate population size when current or precise numbers were not known.

Negligible: Localized short-term disturbance or habitat effect experienced during one season that is not anticipated to accumulate across 1 year. No mortality is anticipated. Mitigation measures implemented fully and effectively or not necessary.

Minor: Widespread annual or chronic disturbances or habitat effects not anticipated to accumulate across one year or localized effects that are anticipated to persist for more than 1 year. Anticipated or potential mortality is estimated or measured in terms of individuals or <1% of the local postbreeding population. Mitigation measures are implemented on some, but not all, impacting activities, indicating that some adverse effects are avoidable. Unmitigatable or unavoidable adverse effects are short term and localized.

Moderate: Widespread annual or chronic disturbances or habitat effects anticipated to persist for more than 1 year, but less than a decade. Anticipated or potential mortality is estimated or measured in terms of tens or low hundreds of individuals or <5% of the local postbreeding population, which may produce a short-term population-level effect. Mitigation measures are implemented for a small proportion of similar impacting activities, but more widespread implementation for similar activities would likely be effective in reducing the level of avoidable adverse effects. Unmitigatable or unavoidable adverse effects are short term but more widespread.

Major: Widespread annual or chronic disturbance or habitat effect experienced during one season that would be anticipated to persist for a decade or longer. Anticipated or potential mortality is estimated or measured in terms of hundreds or thousands of individuals or <10% of the local postbreeding population, which could produce a long-term population-level effect. Mitigation measures are implemented for limited activities, but more widespread implementation for similar activities would be effective in reducing the level of avoidable adverse effects. Unmitigatable or unavoidable adverse effects are widespread and long lasting.

4.5.1.9.3.1. Direct and Indirect Effects Under Alternative 1. Oil spills may result in the ingestion, inhalation, or exposure of terrestrial mammals to crude oil. What information we do have suggests that physiological stress or damage may occur as an effect of contacting or ingesting crude oil. Ingesting contaminated food items has been linked to liver damage, kidney damage, and respiratory damage in some cases.

Alternative 1, the no-action alternative, would not reduce the ongoing levels of oil and gas exploration and activity in the Proposed Action area. Terrestrial mammal species in the area will continue to be impacted by climate change, increasing vessel and aircraft traffic, subsistence, ongoing seismic surveys, etc. Consequently, the temporary displacement of a small number of caribou, muskoxen, grizzly bears, and furbearers from preferred habitats could occur.

Chronic disturbances can have moderate effects over time; however, existing mitigation is expected to moderate potential impacts to terrestrial mammals. Disturbances that do occur are expected to be transient, producing negligible levels of impacts on the fitness and survival of most terrestrial mammal species. Offshore seismic activity should have no effect on terrestrial mammals, while the levels effect from onshore seismic activity would be negligible. Vibroseis activities are temporary and may displace the occasional terrestrial scavenger or hunter on the sea ice. Both vibroseis and seismic surveys should have no impacts on grizzly bears, caribou, or muskoxen in the Proposed Action area.

Vessel traffic in the Chukchi Sea is assumed to present a negligible level of impact during the ice-free season. Activity from icebreakers may pose a moderate level of impact to furbearers foraging on the sea ice by cutting off their movement routes onto and from the sea ice. Vehicular traffic associated with offshore oil and gas exploration may include snowmachines, rollagons, snowcats, ATV's, and automobiles in some areas. Considering the stringent regulations governing vehicle use by the oil and gas industry, only transient disturbances with negligible effect levels are expected under Alternative 1. At this time, it is likely that unregulated vehicle use poses a moderate threat to some terrestrial mammal species in the Proposed Action area.

Aircraft traffic has been identified as a strong source of disturbance to caribou, muskoxen, grizzly bears, etc. Studies have indicated maintaining an altitude no less than 1,000 ft should greatly mitigate any adverse effects to terrestrial mammals might otherwise occur. For this reason, industry-driven and -regulated aircraft operation in the Proposed Action area is expected to have a negligible level of effect on terrestrial mammal populations. Unregulated aircraft use by individuals is expected to have a moderate level of effect on terrestrial mammals.

4.5.1.9.3.2. Cumulative Effects Under Alternative 1. Terrestrial mammals would continue to be exposed to a variety of potential negative effects, including disturbances, habitat loss, and shifts in predator populations during the reasonably foreseeable future. The greatest source of adverse effects for terrestrial mammal species in the Proposed Action area is most likely to be climate change. Other smaller scale sources of disturbance include vehicular traffic, subsistence, sport hunting, and aircraft.

Important areas include calving grounds, riparian habitat, denning habitat, migration routes, and barrier islands, where some ungulates become stranded after breakup. Barrier islands and coastlines also provide important habitat away from the swarms of biting insects that plague the wetter areas in the western Arctic. While existing oil and gas exploration activities in the Chukchi Sea area may increase numbers of some activities (e.g., vessel or aircraft trips) that could impact terrestrial mammals, the incremental effects of those additional impacts to terrestrial mammals around the Chukchi Sea should be negligible.

Climate change will exacerbate the ongoing erosion of arctic coastlines and barrier islands through increased storm waves/tidal surges, increased snow deposition, and larger storm events (Gunn, 1995). If winter snowpacks deepen, the winter range for caribou and muskoxen may decrease, because they are adapted for wind-scoured areas or areas with shallow snow depths where they can graze. Warming trends may result in unforeseen changes in vegetation cover and growing seasons. These vegetative changes could elicit adaptive behavioral changes in terrestrial mammals to allow them to respond to the changed environment. Gunn and Skogland (1997) support the opinion that changes in seasonality, weather, and vegetation could affect caribou populations. However to what degree caribou will be affected remains unclear at present.

Climate change is expected to have major effects on grizzly bears in the northwestern Arctic, because the marine food web is expected to shift from benthic consumption and production, to pelagic consumption and production. In this scenario, larger salmon runs could result in a greater affinity between grizzlies and salmon-spawning streams. Moreover, because >80% of the grizzly diet is composed of vegetative matter, a warming climate might result in increased primary production, providing sufficient precipitation occurs coincidentally to allow for increased plant growth. Speculatively, such a situation could provide a larger food base for many species in the Proposed Action areas.

During winter, wolves, wolverines, and red and arctic foxes often hunt or scavenge on the sea ice. Climate change is expected to have major effects on furbearers in this project area. As warming increases and the ice recedes from the coasts for greater lengths of time, foraging time on the ice might decrease, and these species would move onshore for hunting and scavenging. Climate change could force furbearers to hunt and scavenge in onshore areas with greater frequency during winter. Furthermore, the range of red foxes has been expanding from the Brooks Range towards the arctic coasts such that there is a complete overlap between arctic fox and red fox species' ranges on the coastal plains. Conceivably, arctic fox populations may enter a decline in the Proposed Action area, as the warming trends continue and red fox population populations increase.

Increased ATV, snowmachine, and aircraft travel likely would continue to occur in the analysis areas. Vehicle use in existing oil and gas extraction areas is tightly controlled, unlike the use of vehicles by private citizens living along the Chukchi Sea.

Ultimately, terrestrial mammal populations along the Chukchi Sea may not respond to climate change in the same manner as marine mammals. Many of the species present also occur in latitudes farther south, so they are probably capable of adapting to a warming climate up to a point.

Ongoing changes in the climate, unrestricted ATV and snowmachine use by private citizens, and subsistence hunting in the Proposed Action areas are expected to have major levels of adverse effects on terrestrial mammal populations.

4.5.1.9.3.2.1. Anticipated Level of Effect from Vessel Presence and Noise. Vessel activity in the offshore zones is expected to increase in support of existing lease developments in and along the Chukchi Sea. This type of activity, while increasing, occurs in habitats that are only useable to grizzly bears and terrestrial furbearers during the months when landfast ice develops. Icebreakers may produce temporary lead systems which could then isolate the occasional terrestrial predator hunting or scavenging on the ice. However we conclude that there is a low likelihood of such a scenario occurring and that it is very unlikely that such an event would result in the mortality of a terrestrial mammal. Existing vessel presence and noise is expected to result in a negligible level of effects on terrestrial mammals in the Proposed Action area.

4.5.1.9.3.2.2. Anticipated Level of Effect from Aircraft Presence and Noise. The numbers of aircraft operating in the Proposed Action area is anticipated to increase to support exploration and development activities on existing leases. Consequently the amount of aircraft-related disturbances to terrestrial mammals also is expected to increase. Existing aircraft presence and noise are expected to continue to have a negligible level of effects on terrestrial mammal species.

4.5.1.9.3.2.3. Anticipated Level of Effect from Vehicular Traffic. The use of off-road vehicles and development of new transportation corridors to support existing operations may have a negligible level of impact on terrestrial mammals in the Proposed Action area. However, in the larger context, the impacts associated with off-road vehicle use could develop into moderate levels of impact over the region as a whole, because ATV use allows hunters to access underexploited groups of animals with less effort, disturbing them. Vehicular traffic is expected to result in moderate levels of effects to terrestrial mammal species.

4.5.1.9.3.2.4. Anticipated Level of Effect from Subsistence. The current levels of subsistence hunting in the region are expected to continue into the future. Moderate levels of effects to terrestrial mammal populations are expected to continue.

4.5.1.9.3.2.5. Anticipated Level of Effect from Petroleum Spills. Relatively few oil spills have occurred in the Proposed Action area. Based on our current knowledge of the Proposed Action area, there have been no deaths to terrestrial mammals from oil spills under existing levels of oil and gas production. Continued negligible effects to terrestrial mammals from petroleum spills are anticipated.

4.5.1.9.3.2.6. Anticipated Level of Effect from Habitat Loss. The Arctic Coastal Plain is very sparsely populated with indigenous communities located along the coasts. No new communities or major construction projects currently are being proposed or planned outside of the existing communities. Some development could occur as a result of the Liberty project and from the development of existing oil and gas leases in the area. However, the preponderance of development would occur in the offshore or nearshore areas, not in habitat that is used for caribou or muskoxen. Grizzly bears, wolves, and other furbearers could use some of the nearshore and offshore areas on a seasonal basis; however, studies suggest most terrestrial predators easily habituate to industrial activity so long as they are not harassed. The exception to this rule is the wolverine, which is not known to habituate very well to manmade developments. Wolverines occur in such small numbers that they should not be greatly affected by development that has occurred and continues to occur in the planning area. Negligible effects from community and other industrial development in terrestrial mammal habitat are expected to occur.

4.5.1.9.3.2.7. Anticipated Level of Effect from Seismic. Seismic activities are used to locate and delineate potential oil and gas resources. Most seismic activity on land is done during winter. Offshore surveys on submerged State and Federal lands are conducted by vessels during the open-water period.

The State of Alaska is considering leasing additional State-owned tide- and submerged lands lying between the Canadian border and Point Barrow. Oil and gas development in nearshore waters under State jurisdiction would not appreciably add to the current negligible levels of disturbance to terrestrial mammals from seismic activity along the Chukchi Sea coast. Seismic activity is anticipated to result in a negligible effect to terrestrial mammal species.

4.5.1.9.3.2.8. Anticipated Level of Effects from Gravel Mining. Gravel will continue to be mined locally from deposits in the foothills of the Brooks Range. McLoughlin, Cluff, and Messier (2002) suggested gravel alone could be too loose for structurally sound dens, without shrub root systems to reinforce denning sites.

Gravel mining has the potential to disrupt grizzly bear den construction if performed during May through October (McLoughlin, Cluff, and Messier, 2002). If mining activities occur during the October through April timeframe, the chance exists that grizzly bears may be awakened from their sleep and driven away or unintentionally killed by heavy equipment. Existing mitigation, as outlined by the State of Alaska (ADNR, 1999), should prevent any industry-related disturbances or mortalities to grizzly bears from occurring. Gravel mining is anticipated to result in negligible levels of effects to terrestrial mammal species.

4.5.1.9.3.2.9. Anticipated Level of Effect from Changes in the Physical Environment. Section 3.2.3 describes the ongoing effects from changes in oceanographic processes and sea-ice distribution, duration of snow and ice cover, distribution of wetlands and lakes, and sea level rise. Sections 3.3.8 and 4.4.1.10 described existing and predicted vegetation changes in the Proposed Action area. These changes in the physical environment may affect terrestrial mammal populations throughout the Arctic.

Some of these expected changes could benefit terrestrial mammals using habitats along the Chukchi Sea coast. An increase in productivity from a longer growing season could increase the amount of forage plants available for consumption by herbivores such as caribou and muskoxen. Terrestrial carnivores may benefit from larger returns of salmon in certain areas, and new populations of salmon in others. If the number of salmon spawning areas increases, the landscape eventually may support more bears and furbearers. In contrast, increased storm events and snow depths could create additional energetic demands on herbivores and predators in the region. In particular, a deeper snowpack might prevent caribou or muskoxen from reaching winter foods hidden beneath the snow.

Under Alternative 1, ongoing exploration and development from previous and future Federal and State lease sales will continue unabated. Under this and all other scenarios, the ongoing climatic changes in the physical environment will continue to occur in the Proposed Action area. These changes are detectable in snow depth, coincidence of precipitation, ice formation and quality (Section 3.2.4); in weather patterns and climate (Section 3.2.2); coastal erosion; hydrology (Section 3.2.5); air quality (Section 3.2.6); and changes in soil nutrient balance through losses of carbon and nitrogen sequestered in the frozen soils. Changes in the physical environment are expected to result in a major level of effect to terrestrial mammal species throughout northern Alaska, including the Proposed Action area.

Climatic change could have stochastic or habitat effects on many species that may surpass the impacts of other activities. For purposes of analysis, we assume most of the obvious trends are anticipated to continue. Continued climate change is anticipated to result in major effects on terrestrial mammal species.

4.5.1.10. Vegetation and Wetlands. Tundra vegetation and palustrine wetland loss occurs as facilities are developed, directly covering the area within the individual project footprint. Secondary impacts occur from altered hydrology associated with these facilities, flooding areas and drying others. Altering the hydrology of vegetation and wetlands for extended periods of time usually results in a shift in the vegetation complex and often times introduces noxious weeds or vegetative communities with an overall lesser value than the naturally occurring system.

Hundreds of acres on the North Slope have been filled by oil and gas infrastructure (fill pads, pipelines, roads, gravel, pits, etc.), with the majority of the activity occurring adjacent to the Beaufort Sea. Along the Chukchi Sea Coast, community development (residences, schools, airports, roads, landfills, etc.) accounts for the majority of the onshore disturbance. Four coastal communities exist along the Chukchi Sea coastline (Point Hope, Point Lay, Wainwright, and Barrow).

4.5.1.10.1. Potential Effects to Vegetation and Wetlands. Vegetation and wetlands in the Chukchi Sea are subject to the same potential effects described for vegetation and wetlands in the Beaufort Sea (Sections 4.4.1.10). These potential effects are not repeated here.

4.5.1.10.2. Mitigation Measures. For a list of suggested mitigation measures see Section 4.4.1.5. Mitigation measures could be implemented on a site-specific basis when feasible, to ensure that tundra vegetation and wetlands would be protected from direct impacts to the greatest extent practicable. The necessity for and effectiveness of mitigation measures would depend on the specific activities proposed and the particular location involved.

4.5.1.10.3. Anticipated Effects Under Alternative 1. The anticipated effects on vegetation and wetlands are assumed to be the same as those already described in Section 4.4.1.10, with the exception of the geographic location of the lease sales. The general level of activity associated with the scenario already described above is considered to be the same for analysis purposes (See Table 4.4.1.10-1). The closest industrial development of size southeast of the Chukchi Sea proposed lease areas is the Red Dog Mine Port Site near Kivalina, and existing industrial development (Kuparuk and Prudhoe Bay fields) are east of Teshekpuk Lake. The majority of existing development is directly adjacent to the Beaufort Sea and not the Chukchi Sea at this time. Development and production resulting from Lease Sales 212 and 221 are considered speculative. At present, there is not enough information to determine the location of where development and production adjacent to the Chukchi Sea would occur. Should development and production activity occur, the initial development of facilities and supporting infrastructure would be addressed in more detail at that time. In general terms, anticipated effects to vegetation and wetlands resulting from construction activities and discharges and oil spills would be the same as already described in Section 4.4.1.10. Mitigation measures could be implemented on a site-specific basis when feasible to ensure that tundra vegetation and wetlands would be protected from direct impacts to the greatest extent practicable. The necessity for and effectiveness of the potential mitigation measures would be dependent on the specific activities proposed and the particular location involved.

4.5.1.10.4. Conclusions - Effects Under Alternative 1.

4.5.1.10.4.1. Direct and Indirect Effects Under Alternative 1. There would be no direct or indirect impacts to vegetation and wetlands in the project area from Lease Sales 212 or 221 if they were not held.

4.5.1.10.4.2. Cumulative Effects Under Alternative 1. There would be no cumulative impacts to vegetation and wetlands in the project area from Lease Sales 212 or 221 if they were not held.

4.5.1.11. Economy.

Effects Definitions and Levels. As described in Section 4.4.1.3.11.

4.5.1.11.1. Direct and Indirect Effects Under Alternative 1. Without the action of the typical Chukchi sale, there would be delayed or no increases in NSB property taxes that would average <4% above the level of NSB revenues without the sales in the peak years. In the early years of production, there would be delayed or no increases in revenues to the State of Alaska of <0.02% above the same level without the sale. There would be delayed or no increases in revenues to the Federal Government of <0.02% above the level without the sale in the peak years of production. For the NSB, State of Alaska, and the Federal Government, the increases would not taper off to even smaller percentages in the later years of production. There would be delayed or no change in total employment and personal income <0.9% over the baseline for the NSB and the rest of Alaska for each of the three major phases of OCS activity. Without the typical Chukchi sale there would be delayed or no contribution to extending the lifespan of the Trans-Alaska Pipeline.

Without a Chukchi lease sale there would be a continuation of global warming. During the span of the 30 years of potential activity following a lease sale we assume global warming would continue. We assume that global warming would cause sea levels to rise and melting of permafrost to some degree. If this were a slight degree there would be no effects on the economy in the NSB. However, if sea levels were to rise enough and melting of permafrost was enough, the effects on the economy in the NSB could be catastrophic. The communities of the North Slope are for the most part near sea level. Only slight changes in the sea level could flood the communities. Longer ice-free periods could cause greater coastal erosion and eventually erode the foundations of structures of the coastal communities. The villages of Shishmaref and Kivalina, Alaska are already facing the serious issues of coastal erosion due to longer ice-free periods. Warming of the earth could affect continuous permafrost and thus affect the foundations of buildings. The solution to these problems is to rebuild the communities on higher ground with construction technology adapted to the changed permafrost conditions. This would probably cost in the tens and hundreds of millions of dollars. These costs would be a severe and perhaps devastating shock to the economy in the NSB. Global warming could cause these effects in other communities in Alaska that are coastal and/or have permafrost. Other communities without these conditions are less likely to have these effects. For instance, Anchorage is on Cook Inlet and some of its low lying area close to sea level would be affected. Most of the city is on higher ground and would probably not be affected by the rise in sea level. Anchorage does not have permafrost so it would no be affected by changes in permafrost.

4.5.1.12. Subsistence Harvest Patterns and Resources.

Summary. There would be no direct or indirect impacts to subsistence resources or harvests in the project area from Lease Sales 212 or 221 if they were not held. Without proposed mitigation in place, cumulative effects on subsistence resources and harvests from noise and disturbance would be major. To a large extent existing stipulations and required mitigation have in the past mitigated such potential effects and may continue to do so. With an MMS approved industry Adaptive Management Mitigation Plan (AMMP) in place, effects would be reduced to moderate. Additionally, stipulated measures for seismic-survey permits and mitigation accompanying NMFS Incidental Harassment Authority (IHA) plans generally ensure that acceptable levels of whale monitoring will occur. Together, these measures should ensure that no unmitigable adverse effects to subsistence-harvest patterns, resources, or practices will occur. Cumulative impacts from a large oil spill, when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together would be considered major effects. If present rates of climate change continue, impacts to subsistence resources and subsistence harvests would be expected to be major (USDOI, MMS, 2007d).

Introduction. In the following analysis, we describe the potential effects to subsistence harvests and resources from a variety of existing sources. We then describe mitigation measures that would avoid or minimize some of these impacts.

The past and present condition of subsistence harvests and resources that potentially could be affected by the proposed Chukchi Sea lease sales were described in the discussion for the Beaufort Sea no-action alternative in Section 4.4.1.12, as well as the historic and present status of oil and gas development and other human activities on the North Slope and adjacent offshore areas (see Section 3.4.2). This is the baseline condition against which future impacts were evaluated. In the case of the no-action alternative, the environmental consequence would be how the resource would be affected by reasonably foreseeable future events that did not include any lease sales proposed in this EIS.

Impact Assessment Overview. The coastal environment of the Chukchi Sea contains important populations of whales, pinnipeds, fishes, and birds valued by subsistence hunters in the region. In the Chukchi Sea, pivotal habitats include the Chukchi polynya open-water lead system (important to migrating whales, other sea mammals, and birds); the shores and offshore waters of Capes Lisburne, Lewis, and Thompson (for seabirds); Ledyard Bay (for seabirds); Skull Cliff Kelp Beds (important marine habitat); Kasegaluk Lagoon (for nonsalmonid anadromous fish; birds, beluga whales, and spotted seals); Peard Bay (for birds, anadromous fish, spotted seals, and belugas); Kuk River Inlet (for anadromous fish); Pitmega River and Thetis Creek deltas (for birds); and Point Hope Spit (for migrating birds). Cape Lisburne is an important walrus haulout site—the only major haulout site on the eastern Chukchi coast (Braund and Burnham, 1984). All of these biological resources and their subsistence harvests could be affected by the effects agents discussed above.

Factors Affecting Subsistence-Harvest Patterns and Resources. To understand effects on subsistence-harvest patterns in Barrow, Wainwright, Point Lay, and Point Hope, it is important to recognize three major conditions for these North Slope communities: (1) they rely heavily on sea mammals, particularly bowhead and beluga whales, walruses, bearded seals, caribou, and fish in the annual average harvest; (2) community subsistence-hunting ranges overlap for many species harvested; and (3) subsistence hunting and fishing are central cultural values in the Inupiat way of life (See also Section 4.4.1.12).

Subsistence land use and harvest patterns often are different among villages because of differences in access to game and fish, village size, and traditional patterns of use. For example, bowhead whales generally are accessible to hunters only at Point Hope, Wainwright, and Barrow; cliff-nesting seabirds and eggs are available only near Point Hope. Barrow, situated where the Chukchi and Beaufort seas meet, has access to resource bases from each environment (Becker, 1987).

Because primary subsistence resources are migratory, the extent of potential impacts from oil exploration on subsistence hunting largely depends on the time of year that specific activity occurs and the location. Subsistence activities are concentrated in time and space. Should exploration activities be coincident in time and space such that subsistence animals are frightened away or hunter access to the animals is hindered, the subsistence-hunting effort may not provide the expected returns (Becker, 1987). For example, drilling or seismic-survey activities that coincide in time and space with the use of the lead system by these animals and subsistence hunters could have potential detrimental effects (Braund and Burnham, 1984). The spring lead system in the Chukchi Sea is the only dependable open water available in spring; it is vital to subsistence hunters who hunt bowhead and beluga whales in the leads and seals, walruses, and other marine mammals that inhabit the retreating ice (Becker, 1987; USDOI, MMS, 1987c, 1990b, 1997, 2003a, 2004).

Cultural Importance of Subsistence. The cultural importance of subsistence was discussed in Section 4.4.1.12, Beaufort Sea Alternative 1.

4.5.1.12.1. Potential Effects to Subsistence Harvests and Resources. This analysis is organized by types of effects and by subsistence resource, and discusses effects on subsistence-harvest patterns from (1) vessel and aircraft noise and disturbance, (2) oil spills, (3) seismic surveys, (4) habitat loss, (5) other sources, (6) production activity, and (7) climate change. Analytical descriptions of affected resources and species in addition to indigenous Iñupiat knowledge concerning effects are described in detail. Chukchi Sea Alternative 1 discussion mirrors the Beaufort Sea Alternative 1 discussion, except where subsistence resources or practices vary greatly from those in the Beaufort Sea Planning Area.

Access to subsistence resources, subsistence hunting, and the use of subsistence resources could be affected by reductions in subsistence resources and changes in subsistence-resource-distribution patterns. These changes could occur as a result of oil spills and noise and disturbance from seismic surveys; aircraft and vessel traffic; drilling activities; pipeline construction; structure placement; and support-base, pump-station, and gravel- and ice-road construction. The following analysis examines the effects of each of these disturbance agents on the subsistence resources harvested by the Iñupiat living in the communities near the Chukchi Sea multiple-sale area. The Beaufort Sea Planning Area includes the marine subsistence-resource areas of Barrow, Wainwright, Point Lay, and Point Hope and this analysis includes the marine and terrestrial resources harvested by their residents.

Many of the effects on subsistence harvests and practices are the indirect result of increased wage employment made available through projects and services funded by the NSB. Wage employment has led to an upgrading of hunting technology; alternatively, it has constricted the total time available for hunting. Currently, diminished household income reduced by the loss of high earnings from the NSB Capital Improvements Projects (CIP) period in the early to mid-1980s, tends to encourage subsistence-hunting activity and to foster an increase in harvest levels and an expansion of subsistence-harvest areas for many subsistence resources (Pedersen, 1997).

Offshore, local residents consistently have indicated that whales and other marine mammals are very sensitive to noise, and that they have been disturbed from their normal patterns of behavior by past seismic and drilling activities. Because of these perturbations, whales also can become less predictable and more dangerous to those who hunt them. Whalers from Barrow, Wainwright, and Point Hope have been especially vocal on this issue. See also Section 4.4.1.12, Beaufort Sea Alternative 1.

Effects Definitions and Effects Levels. Effects levels and definitions for subsistence resources in practices are discussed in Section 4.4.1.12, Beaufort Sea Alternative 1.

4.5.1.12.1.1. Potential Effects from Vessel Disturbance. Potential effects from vessel disturbance were discussed in Section 4.4.1.12.1.1.

In the Chukchi Sea Planning Area, even a brief disturbance response from vessel noise temporarily might interrupt the movements of belugas or temporarily displace some animals when vessels pass through an area. Such events could interfere especially with beluga movements to and from the lagoon areas, particularly Kasegaluk Lagoon where the community of Point Lay hunts belugas; this harvest is concentrated during a few weeks in early July. Reducing or delaying the use of these habitats by belugas could affect their availability to subsistence hunters. Additionally, there is evidence that belugas will accommodate or acclimate to a particular pattern of noise after extensive exposure, and such acclimation also could affect Iñupiat hunter access. Point Lay residents rely on the harvest of belugas more than any other Chukchi Sea village and, at the present time, they are very successful at herding these animals by boat into Kasegaluk Lagoon where they are then hunted. If noise from boat-traffic activity increased and the belugas acclimated to the noise, there is the possibility that this herding technique would be less successful and the hunt reduced (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998a; USDOI, BLM, 2005).

Oil and gas activities that occur during ice-minimum conditions in summer in the Chukchi Sea are likely to come into direct contact with adult females and subadult walruses (Jay et al., 1996). If disturbance causes walruses to abandon preferred feeding areas or interferes with calf rearing, resting, or other activities, then the walrus population could be negatively affected. Walruses will flee haulout locations in response to disturbance from ship traffic, although reactions are highly variable (Richardson et al., 1995a). Females with dependent young are considered the least tolerant of disturbances. Brueggeman et al. (1991) reported that 81% of walruses encountered by vessels in the Chukchi Sea exhibited no reaction to ship activities within less than a kilometer, which suggests that walruses may be tolerant of ship activities and movements. However, ice-management operations are expected to have the greatest potential for disturbances to walruses. For example, Brueggeman et al. (1991) reported that walruses moved 20-25 km from active icebreaking operations, where noise levels were near ambient. Conversely, researchers onboard an icebreaker during ice-management operations observed little or no reaction of hauled out walrus groups beyond 0.5 mi (805 m) of the vessel (Garlich-Miller, 2006, pers. commun.). Overall, noise and disturbance from vessel activity is expected to have localized, short-term effects that could cause some disruption to the walrus harvest, but would not cause walruses to become unavailable to subsistence hunters (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998a; USDOI, BLM, 2005).

Vessel traffic associated with past or ongoing oil activities is not a major source of impacts to polar bears, because they 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. Icebreaker noise would result in short-term, local displacement on polar bear migrations and distributions and such localized, short-term effects would cause some disruption to the subsistence harvest but would not cause polar bears to become unavailable to subsistence hunters (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998a; USDOI, BLM, 2005).

4.5.1.12.1.2. Potential Effects from Aircraft Disturbance. Potential effects from aircraft disturbance were discussed in Section 4.4.1.12.1.2.

The primary source of noise and disturbance would come from air traffic along the coast of the Chukchi Sea Planning Area, specifically from helicopters and other aircraft associated with ongoing onshore oil exploration activities. Such events could interfere especially with beluga movements to and from the lagoon areas, particularly Kasegaluk Lagoon where the community of Point Lay hunts belugas; this harvest is concentrated during a few weeks in early July. Reducing or delaying the use of these habitats by belugas could affect their availability to subsistence hunters.

Walruses will flee haulout locations in response to disturbance from aircraft although reactions are highly variable (Richardson et al., 1995a). Females with dependent young are considered the least tolerant of disturbances. Helicopters are more likely to elicit responses than fixed-wing aircraft, and walruses are particularly sensitive to changes in engine noise and are more likely to stampede when aircraft turn or bank overhead. Researchers conducting aerial surveys for walrus in sea ice habitats have reported little reaction to aircraft above 1,000 ft (305 m). Overall, noise and disturbance from aircraft is expected to cause some disruption to the walrus harvest but would not cause walruses to become unavailable to subsistence hunters (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998a; USDOI, BLM, 2005).

4.5.1.12.1.3. Potential Effects from Discharges. Potential effects from discharges were discussed in Section 4.4.1.12.1.3.

4.5.1.12.1.4. Potential Effects from Oil-Spills.

4.5.1.12.1.4.1. Large Oil Spills. Potential effects from large oil spills were discussed in Section 4.4.1.12.1.4.1.

In the Chukchi Sea Planning Area, Kasegaluk Lagoon, Peard Bay, colonies at Cape Thompson and Cape Lisburne, the open-water spring-lead system, 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. Up to 45% of the estimated Pacific Flyway population of Pacific brant could be affected if an oil spill reached Kasegaluk Lagoon. Effects could range from direct mortality of approximately 60,000 brant to sublethal effects on an equal or smaller number of brant. The loss of up to 45% of the Pacific Flyway population would have conspicuous population-level effects. The situation with brant is similar to a wide variety of waterfowl and shorebirds that use similar areas of the Chukchi Sea.

A spill originating within the Chukchi Sea region could produce indirect impacts felt by communities remote from the sale area and far removed from the spill. Essentially, concerns about subsistence harvests and subsistence food consumption would be shared by all Iñupiat and Yup'ik Eskimo communities in the Chukchi (including indigenous people on the Russian Chukchi Sea coast) and Bering seas adjacent to the migratory corridor used by whales and other migrating species.

4.5.1.12.1.4.2. Small Oil Spills. Potential effects from small oil spills were discussed in Section 4.4.1.12.1.4.2.

Specific Effects from Oil-Spill Response and Cleanup. Potential effects from oil-spill response and cleanup were discussed in Section 4.4.1.12.1.4.2.2.

4.5.1.12.1.5. Potential Effects from Seismic-Surveys. Potential effects from seismic surveys were discussed in Section 4.4.1.12.1.5.

Beluga whales are sensitive to noise and may be displaced from traditional harvest areas by heavy boat traffic or seismic-survey noise. This disturbance response, even if brief, temporarily might interrupt the movements of belugas or temporarily displace some animals when the vessels pass through an area. In the Chukchi Sea Planning Area, such events could interfere especially with beluga movements to and from the lagoon areas, particularly Kasegaluk Lagoon where Point Lay hunts belugas; this harvest is concentrated during a few weeks in early July. Reducing or delaying the use of these habitats by belugas could affect their availability to subsistence hunters. Additionally, there is evidence that belugas will accommodate or acclimate to a particular pattern of noise after extensive exposure, and such acclimation also could affect Iñupiat hunter access. Point Lay residents rely on the harvest of belugas more than any other Chukchi Sea village and, at the present time, they are very successful at herding these animals by boat into Kasegaluk Lagoon where they are then hunted. If noise from boat traffic and seismic-survey activity increased and the belugas acclimated to the noise, there is the possibility that this herding technique would be less successful and the hunt reduced (Braund and Burnham, 1984; USDOI, MMS, 1987c 1995a, 1998a; Huntington and Mymrin, 1996; Huntington, 1999; Mymrin et al., 1999).

In other coastal communities, belugas are harvested in the pack-ice leads in the early summer. Because the beluga-hunting season for Wainwright and Point Hope takes place under two different conditions (in ice leads and in open water) and hunting is possible at different times over a 6-month period (late March-September), noise and traffic disturbance would be expected to have lesser effects; still, repeated vessel passes close (within 1-4 km) to both hunters and cetaceans could disturb the whale hunt (USDOI, MMS, 1987c, 1990b, 1998a, 2003a).

Impacts to walrus subsistence-harvest activities are most likely to occur during summer when the animals migrate from the Bering Sea into the Chukchi Sea. Walrus hunting is concentrated in each community's subsistence-resource area during the open-water months, primarily from late May and early June through the end of August. Peard Bay is preferred by Barrow and Wainwright residents to harvest walruses. Helicopter traffic and seismic-survey noise at this time could disturb walruses resting on ice pans, although it is not expected to affect walrus migration or distribution patterns. The common method used to hunt walruses is to approach the herds as they rest on ice pans in the broken-ice margin of the pack ice. If increased seismic-survey noise caused the dispersal of these herds, hunting success of local residents could be detrimentally affected. Noise and disturbance from seismic-survey boats and other vessels could be a problem, if boat traffic moved near marine mammal haulout areas. Because seismic-survey activities are unlikely to occur until after July 1 and must avoid areas with ice concentrations, conflicts with the subsistence walrus hunt are not expected. The walrus hunt is much more important to Chukchi Sea subsistence communities. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on walrus, seals, and polar bears (USDOI, MMS 1987c, 1990a, 1995a, 1998a, 2003a).

4.5.1.12.1.6. Potential Effects from Habitat Loss. Potential effects from habitat loss were discussed in Section 4.4.1.12.1.6.

4.5.1.12.1.7. Potential Effects from Onshore Development. Potential effects from onshore development were discussed in Section 4.4.1.12.1.7.

4.5.1.12.1.8. Potential Effects from Production Activities. Potential effects from production activities were discussed in Section 4.4.1.12.6.8.

4.5.1.12.1.9. Potential Effects from Climate Change. Potential effects from climate change were discussed in Section 4.4.1.12.1.9.

Permafrost thawing will continue to damage roads and buildings and contribute to eroding coastlines and increase building and maintenance costs. In the Chukchi Sea region, the Kotzebue hospital had to be relocated because it was sinking into the ground (ARCUS, 1997). Sea level rise and flooding will threaten buildings, roads, and power lines along low arctic coastlines and, combined with thawing permafrost, it can cause serious erosion. Shore erosion in Shishmaref, Kivalina, Wainwright, and Barrow has become increasingly severe in recent years, as sea-ice formation occurs later, allowing wave action from storms to cause greater damage to the shoreline. Eventually, some of these communities will be forced to relocate (NRC, 2003b; Smith, 2000; Brown, 2003; Schneider, 2001; Crary, 2002; USDOI, BLM, 2002; Hopkins, 2003; *NewScientist*, 2001; *Anchorage Daily News*, 2002, 1993; UNEP, 2002; EPA, 1998; National Assessment Synthesis Team, 2000; Groat, 2001; Vorosmarty et al., 2001; Environment Canada, 1997; IPCC, 2001b; General Accountability Office, 2003; UNEP, 2005; Smith, 2006; Callaway, 2007).

Every community in the Arctic potentially is affected by the anticipated climactic shift, and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of coastal communities in the Beaufort and Chukchi seas, including Russian coastal communities in

Chukotka (NRC, 2003b, ACIA, 2004; USDOI, BLM, 2005; Parmesan and Galbraith, 2004; The Wildlife Society, 2004; UNEP, 2005; Callaway, 2007).

4.5.1.12.2. Mitigation Measures. In place Federal and State of Alaska mitigation measures and their effectiveness were discussed in Section 4.4.1.12.2.

4.5.1.12.3. Traditional Knowledge on Effects from Vessel and Aircraft Disturbance, Discharges, Large Oil Spills and Cleanup, Small Oil Spills, Seismic Surveys, Other Sources, and Climate Change. See Sections 3.4.2.8 and 4.4.1.12.3 for a discussion of these effects as they apply to both Chukchi and Beaufort Sea subsistence communities.

4.5.1.12.4. Anticipated Effects Under Alternative 1. The potential effects to subsistence-harvest patterns were described in Sections 4.4.1.12.1. This section describes the impact on subsistence-harvest patterns resulting from the incremental impact of this action, the no-action alternative, and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such actions. Past and present cumulative actions are described below as they have impacted affected subsistence-harvest patterns. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures are described in Section 4.4.1.12.2.

General Effects. Exploration activities typically occur during the open-water period. This largely eliminates potential effects during spring migration for marine mammals important to the subsistence hunt, unless exploration vessels traverse the spring lead system. Effects are possible during open-water periods, where activities potentially could affect marine mammal species or the subsistence hunt for these species. Production operations would take place year-round, and effects would be possible from a variety of sources throughout the year. A discussion of effects in terms of the following general factors: (1) timing, (2) residence time and periodicity, (3) spatial extent, (4) environmental factors, and (5) oil spills, appears in Section 4.4.1.12.3. A Summary of specific effects also appears in Section 4.4.1.12.

4.5.1.12.4.1. Anticipated Effects From Vessel Disturbance. The potential effects to subsistence-harvest patterns from vessel disturbance were described in Sections 4.4.1.12.1.1 and Cumulative Past and Present Actions in Section 4.4.1.12.4.1.

4.5.1.12.4.2. Anticipated Effects From Aircraft Disturbance. The potential effects to subsistence-harvest patterns from aircraft disturbance were described in Sections 4.4.1.12.1.2 and Cumulative Past and Present Actions in Section 4.4.1.12.4.2.

Cumulative Past and Present Actions. Increased air traffic and vessel activities in the Chukchi Sea could impact the beluga harvest by causing beluga whales to become locally unavailable for certain critical periods.

4.5.1.12.4.3. Anticipated Effects From Discharges. The potential effects to subsistence-harvest patterns from discharges were described in Sections 4.4.1.12.1.3 and Cumulative Past and Present Actions in Section 4.4.1.12.4.3.

4.5.1.12.4.4. Anticipated Effects From Large Oil Spills. The potential effects to subsistence-harvest patterns from large oil spills were described in Sections 4.4.1.12.1.4.1.

Cumulative Past and Present Actions. In the Chukchi Sea the active-ice, or ice-flaw zone is an important habitat for marine mammals such as bowhead and beluga whales, walruses, seals, and other marine mammals. Seals, walruses, and beluga whales would be most vulnerable to spills contacting this zone; polar bears would be most vulnerable to spills contacting the flaw zone or the coast. Offshore spills obviously would pose a higher risk to marine mammals than onshore spills but, along the coast of the Chukchi Sea Planning Area, some aggregations of seals and walruses and a small number of polar bears could be contaminated by onshore spills that reach marine waters and could suffer lethal or sublethal effects. The most noticeable effects of potential oil spills from offshore oil activities would be through contamination of seals, walruses, and polar bears, with lesser effects on beluga whales (USDOI, MMS, 2007d).

4.5.1.12.4.5. Anticipated Effects From Small Oil Spills. The potential effects to subsistence-harvest patterns from small oil spills were described in Sections 4.4.1.12.1.4.2.

4.5.1.12.4.6. Anticipated Effects From Oil-Spill Response and Cleanup. The potential effects to subsistence-harvest patterns from oil-spill response and cleanup disturbance were previously described in Sections 4.4.1.12.6.4.3.

4.5.1.12.9.7. Anticipated Effects From Seismic Surveys. The potential effects to subsistence-harvest patterns from seismic surveys were described in Sections 4.4.1.12.1.5.

Cumulative Past and Present Actions. Multiple marine seismic surveys (2D, 3D, high-resolution site-clearance, and ocean-bottom-cable [OBC] surveys) have occurred and will occur in both the Chukchi and Beaufort seas, both on- and offshore. There also are a number of nonoil- and gas-related scientific seismic survey that have been and will be conducted in and near the Beaufort and Chukchi Sea Planning Areas (USDOI, MMS, 2006a).

Given the growing interest of oil and gas companies to explore and develop oil and gas resources on the Arctic Ocean OCS, there is the potential that seismic surveys will continue for sometime in the Chukchi and Beaufort seas. Surveys beyond 2008 depend on: (1) the amount of data that is collected in 2006 and 2007; (2) what the data indicate about the subsurface geology; and (3) the results of Beaufort Sea Sale 202 and Chukchi Sea Sale 193. Potential seismic-survey activity beyond 2006 was addressed in the final EIS for the OCS Oil and Gas Leasing Program, 2007-2012 (USDOI, MMS, 2006a).

4.5.1.12.4.8. Anticipated Effects From Habitat Loss. The potential effects to subsistence-harvest patterns from habitat loss were described in Sections 4.4.1.12.1.6.

Development on the scale of Prudhoe Bay in the Chukchi Sea region has not occurred, and consequent habitat destruction is not presently an issue, except possibly in the vicinity of the Red Dog Mine near Kivalina and chronic habitat contamination from industrial pollution in many coastal areas on the Russia Chukotka coast (USDOI, MMS, 2003a; Berger, 1988; Chance and Andreeva, 1995; USDOI, MMS, 2007d).

4.5.1.12.4.9. Anticipated Effects From Onshore Development. The potential effects to subsistence-harvest patterns from onshore development were described in Sections 4.4.1.12.1.7.

A major concern regarding land management in the western Arctic is that the same pattern of incremental, piecemeal development that has occurred in the central Arctic will be repeated as industry moves westward. In the absence of a comprehensive conservation strategy, expanding industrial development over the next 25-50 years may have significant impacts on individual animal populations, subsistence use opportunities, and the integrity of the greater ecosystem. The Western Arctic Caribou herd (WAH) can be considered a “keystone” population, in that it provides critical resources for many other species sharing the ecosystem and is an important subsistence resource for as many as 40 Native villages within the herd's annual range (Schoen and Senner, 2003). Therefore, careful consideration must be given to the impact of potential developments to this herd. Cumulative impacts to caribou could be reduced by not allowing leasing in the most sensitive areas; by consolidating facilities (especially reducing the number of roads); by reducing the footprint of development; by prohibiting roads between fields; and by restricting surface and air traffic, humans on foot, and other activities during the calving season. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, grizzly bears, and arctic foxes on the North Slope of Alaska and not affect overall distribution and abundance (USDOI, MMS, 2003a; USDOI, BLM, 2004).

As part of the fieldwork protocol for a 1984 MMS technical report entitled *Barrow Arch Socioeconomic and Sociocultural Description*, researchers asked people in various Chukchi Sea villages their opinions on building land links between local communities and other regions of the North Slope. The majority of the people interviewed opposed land links to villages because (1) they appreciated the quality of life afforded them by semi-isolation, (2) they believed that roads would have a negative impact on wildlife resources, and (3) they worried that road access would increase liquor imports into "dry" villages (ACI, Courtnage, Braund, 1984).

Traditional knowledge as related by some hunters in northwestern Alaska affirms that construction and operation of the Red Dog Mine Port Site has affected the subsistence harvest of belugas in the Chukchi Sea around the Port Site. The total harvest of beluga whales by hunters from Kivalina dropped off between 1984 and 1987, before construction began at the Port Site and has continued to be relatively low. In other marine waters of Alaska, belugas have tended to adapt to industrial and transportation noises after they have learned such noises do not represent a direct threat (Huntington and Mymrin, 1996). Reports by Kivalina hunters indicate that either belugas of both spring and summer stocks have not yet become acclimated to structures or activities at the Red Dog Port Site or that other factors have reduced Kivalina's beluga harvest since construction began in the late 1980s. While data from the Beaufort Sea and Cook Inlet indicate that the presence and operation of marine transportation facilities have not caused long-term avoidance by belugas, the Kivalina combined spring and summer subsistence harvest declined about the time the facilities were constructed and have remained below preconstruction levels in most years since then. Other factors figuring into the decline of the beluga hunt could include long-term changes in ice conditions, beluga mass mortality reported in Siberian waters, and changes in beluga response to increased noise and activity (U.S. Army Corps of Engineers, 2005; Huntington, 1999).

4.5.1.12.4.10. Anticipated Effects From Production Activities. The potential effects to subsistence-harvest patterns from production activities were described in Sections 4.4.1.12.1.8.

Cumulative Past and Present Actions. Current development in and adjacent to the Prudhoe Bay and Kuparuk oilfields is primarily to the east of North Slope communities and their associated subsistence areas, although the subsistence-use area of Nuiqsut does extend into areas of existing development. Future lease sales and projected development in the National Petroleum Reserve-Alaska could extend development to the west into subsistence-use areas of the communities of Barrow, Wainwright, Point Lay, and Atqasuk. Because little baseline biological, habitat, or subsistence-harvest data have preceded oil development on the North Slope, it is difficult to disassociate the cumulative effects of oil development in the region from the relatively recent processes of significant local social change (see the Section 4.5.1.12.4.9 discussion of Onshore Development above; USDOI, BLM, 2004).

4.5.1.12.4.11. Anticipated Effects From Climate Change. The potential effects to subsistence-harvest patterns from climate change were described in Section 4.4.1.12.1.9.

Cumulative Past and Present Actions. Climate change and the associated effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue (NRC 2003a, ACIA 2004). Every community in the Arctic potentially is affected by the anticipated climactic shift, and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of Barrow, Wainwright, Point Lay, and Point Hope. If the loss of permafrost, and conditions beneficial to the maintenance of permafrost, arise as predicted, there could be synergistic cumulative effects on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of freshwater, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their populations, shifting the populations to places with better subsistence hunting, and causing a loss or dispersal of community (NRC 2003a, ACIA 2004; USDOI, BLM, 2005; USDOI, MMS, 2006b).

Walruses, ringed seals, other ice-dependent pinnipeds, and polar bears have been identified as being particularly vulnerable to the impacts of continued climate change; the potential cumulative effects on them are a primary concern and warrant continued close attention and effective mitigation practices. The main effects of concern to polar bears are climate change, potential overharvest in the Russian Arctic, and oil and fuel spills (USDOI, MMS, 2003a, 2007d).

If the present rates of climate change continue, changes in diversity and abundance to arctic flora and fauna could be significant. Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet could be expected. Increased climate changes are likely to continue to affect subsistence activities; additional losses of traditional subsistence-harvest areas would occur, and traditional subsistence resources might no longer be available for harvest (e.g., some species of migratory birds). Subsistence users would continue to travel farther to harvest resources but are unlikely to cease subsistence harvests, given the strong cultural continuity and value of subsistence activities (Johannessen, Shalina, and Miles, 1999; IPCC, 2001b; NRC, 2003a; NMFS, 2005; USDOI, BLM, 2005).

4.5.1.12.5. Traditional Knowledge on Cumulative Effects. Traditional knowledge from potential effects on subsistence-harvest patterns appears in Section 4.4.1.12.5.

Public testimonies contain a wealth of traditional knowledge. Transcripts from public hearings for MMS Beaufort and Chukchi Sea lease sales can be found at:
http://www.mms.gov/alaska/ref/publichearingsChukchi/PublicHearings.htm and
http://www.mms.gov/alaska/ref/PublicHearingsArctic/PublicHearings.htm. These files contain 25 years of public testimony related to activities on the OCS, as well as onshore. These sites are incorporated by reference, and the quoted passages below come from these two sources (USDOI, MMS, 2008). For another valuable summary of North Slope testimony on North Slope oil development activities see the Native Voices section to Miller, Smith, and Miller's (1993) *Oil in Arctic Waters: The Untold Story of Offshore Drilling in Alaska* (USDOI, MMS, 2007d).

Native bowhead and beluga whale hunters in the Chukchi Sea communities of Wainwright, Point Lay and Point Hope maintain that they, too, will be affected by cumulative impacts. Anxiety about the possibility of ongoing and future nearshore and offshore oil exploration and development activity is in itself an accumulating effect (NRC, 2003a:148).

4.5.1.12.6. Direct and Indirect Effects Under Alternative 1.

Conclusion. There would be no direct or indirect impacts to subsistence resources or harvests in the project area from Lease Sales 212 or 221 if they were not held.

4.5.1.12.7. Cumulative Effects Under Alternative 1.

Ongoing activities in the Arctic region are summarized in Section 4.2.1 and include: (1) ongoing maintenance and development projects in local communities; (2) onshore oil and gas infrastructure development; (3) passenger, research, and industry-support aircraft activities; (4) local boat traffic, barge resupply to local communities, research vessel traffic, industry-support vessel activities (mostly in support of seismic surveys), an increasing U.S. Coast Guard presence, and vessel traffic from increasing Arctic ecotourism. Ongoing actions include: (1) development and production activities at Endicott, Northstar, Badami, and Alpine; (2) recent leasing from Beaufort Lease Sales 195 and 202; (3) State leasing; and (4) onshore leasing activity in the NPR-A. Other projects include BP's restart of the Liberty Development Project east of Endicott; Pioneer Natural Resources Co.'s development of its North Slope Oooguruk field in the shallow waters of the Beaufort Sea approximately 8 mi northwest of the Kuparuk River unit; and the Nikaitchug Development Project also in State waters off the Colville Delta. In Canadian waters, Devon Canada Corporation is planning to do exploratory drilling off the Mackenzie River Delta in and GX Technology Corporation will conduct a 2D seismic survey in the Mackenzie River Delta area (USDOI, MMS, 2006a).

In the Chukchi Sea, west of the North Slope industrial complex and outside the southern boundary of the Proposed Action area, the major industrial developments have been and continue to be associated with Red Dog Mine and the Delong Mountain Terminal (DMT). These facilities are included in the cumulative activities scenario, because about 250 barge lightering trips per year are needed to transfer 1.5 million tons of concentrate to bulk cargo ships anchored 6 mi offshore. About 27 cargo ships are loaded each year. These activities have the potential to affect biological resources of concern (e.g., marine mammals and marine birds) that migrate just offshore of the facilities into the marine waters of the Planning Area (USDOI, MMS, 2006a).

Summary. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources, could change if oil development reduces the availability of resources or alters their distribution patterns. Cumulative effects to bowhead whales and other marine mammals is a serious concern. If increased noise affected whales and caused them to deflect from their normal migration route, they could be displaced from traditional hunting areas, and the traditional bowhead whale harvest could be adversely affected. The same could be true for beluga whales, walruses, and seals (USDOI, MMS, 2003a). The disruption of bowhead whale harvests could result from any potential diversion of the whale migration farther offshore, or from other behavior changes by the animals—making them more skittish, for example—in reaction to OCS activities. The greater the degree of activity onshore and oil and gas development in Federal, State, and Canadian waters, as measured by increases in seismic noise, vessel traffic, east-to-west development, Canadian activities in the Mackenzie Delta, or some other metric, the more probable and more pronounced cumulative effects are likely to be. If the IWC considers the threat of industrialization large enough, it could reduce the Alaska bowhead whale quota to protect the stock. This quota reduction would have a serious subsistence and cultural effect on the Iñupiat communities of the North Slope as well as to Iñupiat in other communities who receive whale meat from the harvest (USDOI, BLM and MMS, 1998).

Onshore development in the Beaufort Sea region already has caused increased regulation of subsistence hunting, reduced access to hunting and fishing areas, altered habitat, and intensified competition from nonsubsistence hunters for fish and wildlife (Haynes and Pedersen, 1989), but such onshore impacts are still speculative in the Chukchi Sea region. Additive impacts that could affect subsistence resources include potential oil spills; seismic noise; road and air traffic disturbance; and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Diverting animals from their usual and accustomed locations, or building facilities in proximity to those locations, could compel resource harvesters to travel further to avoid development areas. Harvest of subsistence resources in areas farther from the local subsistence communities would require increased effort, risk, and cost on the part of subsistence users. Increasing onshore areas open for leasing and exploration would lead to development in previously closed areas, leading to concentrating subsistence-harvest efforts in the undeveloped areas and increasing the potential for conflict over harvest areas within a community (USDOI, BLM, 2005).

If a large oil spill occurred and affected any part of the bowhead whale's migration route, it could taint this culturally important resource. Any actual or perceived disruption of the bowhead whale harvest from oil spills and any actual or perceived tainting anywhere during the bowhead's spring migration, summer feeding, and fall migration, could disrupt the bowhead hunt for an entire season, even though whales still would be available. In fact, even if whales were available for the spring and fall seasons, traditional cultural concerns of tainting could make bowheads less desirable and alter or stop the subsistence harvest in Barrow, Wainwright, and Point Hope, and the beluga whale hunt in Point Lay for up to two seasons. Concerns over the safety of subsistence foods could persist for many years past any actual harvest disruption. This would be a major adverse effect. In terms of other species, this same concern also would extend to walruses, seals, polar bears, fish, and birds.

If the present rates of climate change continue, changes in diversity and abundance to arctic flora and fauna could be significant. Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet could be expected. Increased climate changes are likely to continue to affect subsistence activities; additional losses of traditional subsistence harvest areas would occur and traditional subsistence resources might no longer be available for harvest (e.g., some species of migratory birds). Subsistence users would continue to travel farther to harvest resources but are unlikely to cease subsistence harvests, given the strong cultural continuity and value of subsistence activities (Johannessen, Shalina, and Miles, 1999; IPCC, 2001b; NRC, 2003a; NMFS, 2005; USDOI, BLM, 2005).

Conclusion. Without proposed mitigation in place, cumulative effects on subsistence resources and harvests from noise and disturbance would be major. To a large extent, existing stipulations and required mitigation, in the past, have mitigated such potential effects and may continue to do so. With an MMS-approved industry AMMP in place, effects would be reduced to moderate. Additionally, stipulated measures for seismic-survey permits and mitigation accompanying NMFS IHA plans generally ensure that acceptable levels of whale monitoring will occur. Together, these measures should ensure that no unmitigable adverse effects to subsistence-harvest patterns, resources, or practices will occur. Cumulative impacts from a large oil spill, when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together, would be considered major effects. If present rates of climate change continue, impacts to subsistence resources and subsistence harvests are expected to be major (USDOI, MMS, 20097d).

4.5.1.13. Sociocultural Systems.

Summary. There would be no direct or indirect impacts to sociocultural systems in the project area from Lease Sales 212 or 221 if they were not held. Cumulative effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from on- and offshore exploration, development, and production activities; small changes in population and employment; and disruption of subsistence-harvest patterns from seismic-noise disturbance, oil spills and oil-spill cleanup, and climate change. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to periodically disrupt ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources; such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems. However, if a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

For 2D and 3D seismic surveys in the Chukchi Sea region, effects to sociocultural systems are expected to be minimal. Effects to social well-being (social systems) would be noticeable because of concern over deflection of bowhead and beluga whales and walruses due to seismic-survey activities and the attendant effects on the subsistence harvest. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If the deflection actually occurs, effects could be major (USDOI, MMS, 2007d).

If a large spill contacted and extensively oiled coastal habitat, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Such impacts would be considered major. All subsistence whaling communities and other communities that trade for and receive whale products and other resources from the whaling communities could be affected. A large spill anywhere within the habitat of bowhead whales or other important marine mammal subsistence resources could have multiyear impacts on the harvest of these species by all communities that use them. In the event of a large oil spill, many harvest areas and some subsistence resources would become unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. In addition, harvests could be affected by the IWC, which could decide to limit harvest quotas in response to a perceived threat to the bowhead whale population (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

Beyond the impacts of a large spill, long-term deflection of whale migratory routes or increased skittishness of whales due to increasing seismic surveys and industrialization in the Beaufort and Chukchi seas would make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated, although a predominant concern continues to be potential disruption associated from seismic-survey noise on subsistence-harvest patterns, particularly on the bowhead whale—a pivotal species to the Iñupiat culture. Such disruptions could impact sharing networks, subsistence task groups, and crew structures, as well as cause disruptions of the central Iñupiat cultural value: subsistence as a way of life. These disruptions also could cause a breakdown in family ties, the community's sense of well-being and could damage sharing linkages with other communities. Such disruptions could seriously curtail community activities and traditional practices for harvesting,

sharing, and processing subsistence resources—a major impact on sociocultural systems (USDOI, MMS, 2006a).
Onshore, because Nuiqsut is relatively close to oil-development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community—a major effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. This same potential exists for the communities of Barrow, Atqasuk, and Kaktovik as Chukchi Sea areawide leasing, exploration, and development proceeds on- and offshore. Impacts of this magnitude to Wainwright, Point Lay, and Point Hope remain speculative because of the lack of industrial development on the Chukchi Sea coastline.

Because of impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope peoples would experience cultural stresses as well as impacts to population, employment, and local infrastructure. The termination of oil activity could result in the outmigration of non-Iñupiat people from the North Slope, along with some Iñupiat who may depend on higher levels of medical support or other infrastructure and services than may be available in a fiscally constrained, postoil-production environment. If subsistence livelihoods are disrupted, Iñupiat communities could face increased poverty, drug and alcohol abuse, and other social problems resulting from a loss of relationship to subsistence resources, the inability to support a productive family unit, and a dependence on nonsubsistence foods (Langdon, 1995, Peterson and Johnson, 1995, National Assessment Synthesis Team, 2000, IPCC, 2001b).

Introduction. In the following analysis, we describe the potential effects to sociocultural systems from a variety of existing sources. We then describe mitigation measures that would avoid or minimize some of these impacts.

The past and present condition of sociocultural systems that potentially could be affected by the proposed Chukchi Sea lease sales were described in the discussion for the Beaufort Sea Alternative 1 in Section 4.4.1.13, as well as the historic and present status of oil and gas development and other human activities on the North Slope and adjacent offshore areas (see Section 3). This is the baseline condition against which future impacts were evaluated. In the case of the no-action alternative, the environmental consequence would be how the resource would be affected by reasonably foreseeable future events that did not include any lease sales proposed under this EIS.

Impact Assessment Overview. The coastal communities of the Chukchi Sea—Barrow, Wainwright, Point Lay, and Point Hope—participate in subsistence harvests of marine and terrestrial resources in the region. These resources, subsistence practices, and the sociocultural systems that comprise these communities could be affected by the effects agents discussed above.

This discussion is concerned with those communities that potentially could be affected by past and ongoing exploration, development, and production activities in the Chukchi Sea region. These include the communities of Barrow, Wainwright, Point Lay, and Point Hope. The primary aspects of the sociocultural systems covered in this analysis are (1) social organization, (2) cultural values, (3) institutional organization, and (4) subsistence and social health as described in Section 3. These three aspects were previous discussed in Section 4.4.1.13.3 for the Beaufort Sea no-action alternative. Additionally, the onshore past and present impact discussion for Beaufort Sea coastal communities would not apply to Chukchi Sea coastal communities, because onshore development in the region has not yet occurred.

Factors Affecting Sociocultural Systems. See Beaufort Sea Alternative 1 Section 4.4.1.13.3 for an in-depth discussion of factors affecting sociocultural systems.

Subsistence and Social Health. Stress would occur if a village were not successful in the bowhead whale harvest, with potential disruption of sharing networks and task groups. This stress could disrupt the community's social organization, but likely would not displace the long-term social processes of whaling and sharing, if it did not occur often. Other more successful villages would share with a village having an unsuccessful whaling season. There have been few unsuccessful whaling seasons for Chukchi Sea coastal communities, although the village of Point Hope did fail to take a whale in the Spring 2007 bowhead whale hunt, and this failure has put stress on the community.

See also Section 4.4.1.15, Environmental Justice for an assessment of North Slope human health conditions and impacts.

4.5.1.13.1. Potential Effects to Sociocultural Systems. For purposes of analysis, it is assumed that effects on social organization and cultural values could be brought about at the community level by increased population, by increased employment, and by effects on subsistence-harvest patterns predominantly from (1) vessel and aircraft noise and disturbance, (2) oil spills, (3) seismic surveys, (4) habitat loss, (5) other sources, (6) production activity, and (7) climate change. Analytical descriptions of affected resources and species in addition to indigenous Inupiat knowledge concerning effects are described in detail (USDOI, MMS, 2003a, 2007d). By and large, the Chukchi Sea Alternative 1 discussion mirrors the Beaufort Sea Alternative 1 discussion, except where sociocultural systems or subsistence practices vary greatly from the Beaufort Sea Planning Area.

Effects Definitions and Effects Levels. Effects levels and definitions for sociocultural systems were discussed in Section 4.4.1.13 of the Beaufort Sea no-action alternative.

4.5.1.13.1.1. Potential Effects from Disturbance. Potential disturbance effects to sociocultural systems were discussed in Section 4.4.1.13.1.1 of the Beaufort Sea no-action alternative. Potential disturbance effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.1-2.

4.5.1.13.1.2. Potential Effects from Oil Spills.

Large Oil Spills. Potential effects to sociocultural systems from large oil spills were discussed in Section 4.4.1.13.1.2 of the Beaufort Sea no-action alternative. Potential effects to subsistence resources and practices from large oil spills were previously discussed in Section 4.4.1.12.1.4.1.

A spill originating within the Chukchi Sea region could produce indirect impacts felt by communities remote from the sale area and far removed from the spill. Essentially, concerns about subsistence harvests and subsistence food consumption would be shared by all Iñupiat and Yup'ik Eskimo communities in the Chukchi (including indigenous people on the Russian Chukchi Sea coast) and Bering seas adjacent to the migratory corridor used by whales and other migrating species.

4.5.1.13.1.3. Potential Effects from Oil-Spill Response and Cleanup. Potential effects to sociocultural systems from oil-spill response and cleanup were discussed in Section 4.4.1.13.1.3 of the Beaufort Sea no-action alternative. Potential effects to subsistence resources and practices from large oil spills were discussed in Section 4.4.1.12.1.4.1.

4.5.1.13.1.4. Potential Effects from Seismic-Surveys. Potential effects to sociocultural systems from seismic surveys were discussed in Section 4.4.1.13.1.4 of the Beaufort Sea no-action alternative.

Potential seismic-survey effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.5.

Effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from noise disturbance produce by seismic-exploration activities. Because the seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of personnel and equipment for seismic exploration (USDOI, MMS, 2006a,b, 2007d).

However, the possible long-term deflection of whale migration routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive. The more predominant issue associated with potential impacts to sociocultural systems is the potential disruption of seismic-survey noise on subsistence harvest patterns, particularly those involving the bowhead and beluga whales and walruses, which are pivotal species to the Iñupiat culture in the region. Noise and disturbance from seismic-survey boats and other vessels could be a problem, if boat traffic moved near marine mammal haulout areas. Because seismic-survey activities are unlikely to occur until after July 1 and must avoid areas with ice concentrations, conflicts with the subsistence walrus hunt are not expected. The walrus hunt is much more important to Chukchi Sea subsistence communities. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on walruses, seals, and polar bears (USDOI, MMS 1987c, 1990a, 1995a, 1998a, 2003a).

4.5.1.13.1.5. Potential Effects from Habitat Loss. Potential effects to sociocultural systems from habitat loss were discussed in Section 4.4.1.13.1.5 of the Beaufort Sea no-action alternative. Potential habitat loss effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.6.

4.5.1.13.1.6. Potential Effects from Onshore Development. Potential effects to sociocultural systems from onshore development were discussed in Section 4.4.1.13.1.6 of the Beaufort Sea no-action alternative. Potential onshore development effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.7.

4.5.1.13.1.7. Potential Effects from Production Activities. Potential effects to sociocultural systems from production activity were discussed in Section 4.4.1.13.1.7 of the Beaufort Sea no-action alternative. Potential production activity effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.8.

4.5.1.13.1.8. Potential Effects from Climate Change. Potential effects to sociocultural systems from climate change were discussed in Section 4.4.1.13.1.8 of the Beaufort Sea no-action alternative. Potential climate change effects to subsistence resources and practices were discussed in Section 4.4.1.12.1.9.

Permafrost thawing will continue to damage roads and buildings and contribute to eroding coastlines and increase building and maintenance costs. In the Chukchi Sea region, the Kotzebue hospital had to be relocated because it was sinking into the ground (ARCUS, 1997). Sea level rise and flooding will threaten buildings, roads, and power lines along low Arctic coastlines and, combined with thawing permafrost, it can cause serious erosion. Shore erosion in Shishmaref, Kivalina, Wainwright, and Barrow has become increasingly severe in recent years, as sea-ice formation occurs later, allowing wave action from storms to cause greater damage to the shoreline. Eventually, some of these communities will be forced to relocate (NRC, 2003b; Smith, 2000; Brown, 2003; Schneider, 2001; Crary, 2002; USDOI, BLM, 2002; Hopkins, 2003; *NewScientist*, 2001; *Anchorage Daily News*, 2002, 1993; UNEP, 2002; EPA, 1998; National Assessment Synthesis Team, 2000; Groat, 2001; Vorosmarty et al., 2001; Environment Canada, 1997; IPCC, 2001b; General Accountability Office, 2003; UNEP, 2005; Smith, 2006; Callaway, 2007)..

Every community in the Arctic is potentially affected by the anticipated climactic shift, and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of coastal communities in the Beaufort and Chukchi seas, including Russian coastal communities in Chukotka (NRC 2003b, ACIA 2004; USDOI, BLM, 2005; Parmesan and Galbraith, 2004; The Wildlife Society, 2004; UNEP, 2005; Callaway, 2007).

4.5.1.13.2. Mitigation Measures. Applicable in-place stipulations and other mitigation measures and the discussion of effectiveness of mitigating measures for sociocultural systems would be similar to the discussion for subsistence-harvest patterns previously discussed in Section 4.4.1.12.2.

4.5.1.13.3. Traditional Knowledge on Effects from Vessel and Aircraft Disturbance, Discharges, Large Oil Spills and Cleanup, Small Oil Spills, Seismic Surveys, Other Sources, and Climate Change. Traditional Knowledge on these effects, as it applies to both Chukchi and Beaufort Sea subsistence communities, appears in Section 4.4.1.12.3. Sociocultural-specific traditional knowledge as it applies to Chukchi Sea communities was discussed in Section 4.4.1.13.3 of the Beaufort Sea no-action alternative.

4.5.1.13.4. Anticipated Effects Under Alternative 1. Anticipated effects to sociocultural systems were discussed in Section 4.4.1.13.4 of the Beaufort Sea no-action alternative. Potential effects to sociocultural systems were described in Sections 4.4.1.13.1.1-8. The potential effects to subsistence-harvest patterns were described in Sections 4.4.1.12.1.1-9. This section describes the impact to sociocultural systems resulting from the incremental impact of this action and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such actions. Past and present cumulative actions are described below as they have impacted specifically affected sociocultural systems. Reasonably foreseeable future actions are described in Section 4.2. To the extent that these actions impacted subsistence practices, they would have consequent impacts on sociocultural systems. These consequences are discussed in the cumulative past and present action discussions below for specific impactors. Mitigation measures are described in Sections 4.4.1.12.2 and 4.5.1.13.2.

4.5.1.13.4.1. Anticipated Effects from Disturbance. Potential effects to sociocultural systems from disturbance were discussed in Section 4.4.1.13.4.1. See also the general discussion on anticipated effects to sociocultural systems in Section 4.5.1.13.4 above.

Cumulative Past and Present Actions. Cumulative past and present actions related to vessel and aircraft disturbance effects to subsistence resources and practices were discussed in Sections 4.4.1.12.4.1 and 4.4.1.12.4.2. These actions would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

4.5.1.13.4.2. Anticipated Effects from Discharges. Potential effects from discharges to subsistence resources and practices were discussed in Section 4.4.1.12.1.3. These actions would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

Cumulative Past and Present Actions. Cumulative past and present actions related to effects of discharges on subsistence resources and practices were discussed in Section 4.4.1.12.4.3. These actions would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

4.5.1.13.4.3. Anticipated Effects from Large Oil Spills. Potential effects to sociocultural systems from large oil spills were discussed in Section 4.4.1.13.1.2. See also the general discussion on anticipated effects to sociocultural systems in Section 4.5.1.13.4 above.

Cumulative Past and Present Actions. Cumulative effects from large oil spills to subsistence resources and practices were discussed in Section 4.4.1.12.4.4 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

In the Chukchi Sea the active-ice, or ice-flaw zone is an important habitat for marine mammals such as bowhead and beluga whales, walruses, seals, and other marine mammals. Seals, walruses, and beluga whales would be most vulnerable to spills contacting this zone; polar bears would be most vulnerable to spills contacting the flaw zone or the coast. Offshore spills obviously would pose a higher risk to marine mammals than onshore spills, but along the coast of the Chukchi Sea Planning Area, some aggregations of seals and walruses and a small number of polar bears could be contaminated by onshore spills that reach marine waters and could suffer lethal or sublethal effects. The most noticeable effects of potential oil spills from offshore oil activities would be through contamination of seals, walruses, and polar bears, with lesser effects on beluga whales (USDOI, MMS, 2007d).

4.5.1.12.4.4. Anticipated Effects from Small Oil Spills. Anticipated effects from small oil spills to subsistence resources and practices were discussed in Section 4.4.1.12.4.5. See also the discussion on anticipated effects to sociocultural systems from large oil spills in Section 4.5.1.13.4.3 above.

Cumulative Past and Present Actions. Cumulative effects from small oil spills to subsistence resources and practices were discussed in Section 4.4.1.4.5 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

4.5.1.13.4.5. Anticipated Effects from Oil-Spill Response and Cleanup. Potential effects to sociocultural systems from oil-spill response and cleanup were discussed in Section 4.4.1.13.1.3. See also the general discussion on anticipated effects to sociocultural systems in Section 4.5.1.13.4 above.

Cumulative Past and Present Actions. Cumulative effects from oil-spill response and cleanup to subsistence resources and practices were discussed in Section 4.4.1.12.4.6.

4.5.1.13.4.6. Anticipated Effects from Seismic Surveys. Potential effects from seismic surveys to sociocultural systems were discussed in Section 4.4.1.13.4.6.

Cumulative Past and Present Actions. Cumulative effects from seismic surveys to subsistence resources and practices were discussed in Section 4.4.1.12.4.7 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

4.5.1.12.4.7. Anticipated Effects from Habitat Loss. Anticipated effects from habitat loss to subsistence resources and practices were discussed in Section 4.4.1.12.4.8.

Cumulative Past and Present Actions. Cumulative effects from habitat loss on subsistence resources and practices were discussed in Sections 4.4.1.12.4.8 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

Development on the scale of Prudhoe Bay in the Chukchi Sea region has not occurred, and consequent habitat destruction presently is not an issue, except possibly in the vicinity of the Red Dog Mine near Kivalina and chronic habitat contamination from industrial pollution in many coastal areas on the Russia Chukotka coast (USDOI, MMS, 2003a, 2007d; Berger, 1988; Chance and Andreeva, 19953).

4.5.1.13.4.8. Anticipated Effects from Onshore Development. Potential effects from onshore development on sociocultural systems were discussed in Section 4.4.1.13.4.8.

Cumulative Past and Present Actions. Cumulative effects from onshore development on subsistence resources and practices were discussed in Section 4.4.1.12.4.9 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

A major concern regarding land management in the western Arctic is that the same pattern of incremental, piecemeal development that has occurred in the central Arctic will be repeated as industry moves westward. In the absence of a comprehensive conservation strategy, expanding industrial development over the next 25-50 years may have significant impacts on individual animal populations, subsistence use opportunities, and the integrity of the greater ecosystem. The Western Arctic Caribou herd can be considered a "keystone" population, in that it provides critical resources for many other species sharing the ecosystem and is an important subsistence resource for as many as 40 Native villages within the herd's annual range (Schoen and Senner, 2003). Therefore, careful consideration must be given to the impact of potential developments to this herd. Cumulative impacts to caribou could be reduced by not allowing leasing in the most sensitive areas; by consolidating facilities (especially reducing the number of roads); by reducing the footprint of development; by prohibiting roads between fields; and by restricting surface and air traffic, humans on foot, and other activities during the calving season. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, grizzly bears, and arctic foxes on the North Slope of Alaska and not affect overall distribution and abundance (USDOI, MMS, 2003a; USDOI, BLM, 2004b)

As part of the fieldwork protocol for a 1984 MMS technical report entitled *Barrow Arch Socioeconomic and Sociocultural Description*, researchers asked people in various Chukchi Sea villages their opinions on building land links between local communities and other regions of the North Slope. The majority of the people interviewed opposed land links to villages because (1) they appreciated the quality of life afforded them by semi-isolation, (2) they believed that roads would have a negative impact on wildlife resources, and (3) they worried that road access would increase liquor imports into "dry" villages (ACI, Courtnage, Braund, 1984).

Traditional knowledge as related by some hunters in northwestern Alaska affirms that construction and operation of the Red Dog Mine Port Site has affected the subsistence harvest of belugas in the Chukchi Sea around the Port Site. The total harvest of beluga whales by hunters from Kivalina dropped off between 1984 and 1987, before construction began at the Port Site and has continued to be relatively low. In other marine waters of Alaska, belugas have tended to adapt to industrial and transportation noises after they have learned such noises do not represent a direct threat (Huntington and Mymrin 1996). Reports by Kivalina hunters indicate that either belugas of both spring and summer stocks have not yet become acclimated to structures or activities at the Red Dog Port Site or that other factors have reduced Kivalina's beluga harvest since construction began in the late 1980s. While data from the Beaufort Sea and Cook Inlet indicate that the presence and operation of marine transportation facilities have not caused long-term avoidance by belugas, the Kivalina combined spring and summer subsistence harvest declined about the time the facilities were constructed and have remained below preconstruction levels in most years since then. Other factors figuring into the decline of the beluga hunt could include: long-term changes in ice conditions, beluga mass mortality reported in Siberian waters, and changes in beluga response to increased noise and activity (U.S. Army Corps of Engineers, 2005; Huntington, 1999).

4.5.1.13.4.9. Anticipated Effects from Production Activities. Potential effects from production activity to sociocultural systems were discussed in Section 4.4.1.13.4.9.

Cumulative Past and Present Actions. Cumulative effects from production activity to subsistence resources and practices were discussed in Section 4.4.1.12.4.10 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices. See onshore effects discussion above in Section 4.5.1.13.4.8.

4.5.1.13.4.10. Anticipated Effects from Climate Change. Potential effects from climate change to sociocultural systems were discussed in Section 4.4.1.13.4.8.

Cumulative Past and Present Actions. Cumulative effects from climate change on subsistence resources and practices were discussed in Section 4.4.1.12.4.11 and would be expected to impact sociocultural systems to the extent they adversely impacted subsistence harvests and practices.

Because of rapid and long-term impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope communities would experience significant and long-term cultural stresses in addition to major impacts on population, employment, and local infrastructure. If subsistence livelihoods are disrupted, communities in the Arctic could face increased poverty, drug and alcohol abuse, and other social problems. As stated by Parson et al. (2001): "It is possible that projected climate change will overwhelm the available responses. It is also realistic to expect that some general assistance could be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts" (Langdon, 1995; Peterson and Johnson, 1995; National Assessment Synthesis Team, 2000; IPCC, 2001b; Callaway et al., 1999; ARCUS, 1997; USDOI, MMS, 2006a,b, 2007c).

Changes in climate regimes could result in changes to species diversity, numbers and distribution of Arctic-adapted species, vegetation coverage and type, and the physical structure of the landscape that could be significant. Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet could be expected (Johannessen et al., 1999; IPCC, 2001b; NRC, 2003a; USDOI, MMS, 2006a,b, 2007c).

If the landscape becomes less hospitable for human occupation, people may move to new locations on the North Slope, leave the area for either urban Alaska or High Arctic Canada, or adapt to the new conditions with a combination of reduced subsistence resources and increased dependence on outside sources of food and supplies. Community stresses could increase as a result, and traditional knowledge of the landscape, environment, and resources would be devalued if conditions change rapidly, reducing the influence of experienced elders in the communities. Reduced levels of stratospheric ozone could continue to allow higher levels of UV exposure to northern peoples, lowering immune system function and increasing the likelihood that residents would suffer increased incidences of skin cancer and cataracts (ACIA 2004; USDOI, BLM, 2005).

Climate change and the associated effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue (NRC, 2003a, ACIA, 2004). Every community in the Arctic is potentially affected by the anticipated climactic shift, and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of Barrow, Wainwright, Point Lay, and Point Hope. If the loss of permafrost, and conditions beneficial to the maintenance of permafrost, arise as predicted, there could be synergistic cumulative effects on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of freshwater, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their populations, shifting the populations to places with better subsistence hunting, and causing a loss or dispersal of community (NRC, 2003a, ACIA, 2004; USDOI, BLM, 2005; USDOI, MMS, 2006b).

4.5.1.13.5. Traditional Knowledge on Cumulative Effects. Traditional knowledge relating to cumulative effects to subsistence resources and practices was discussed in Section 4.4.1.12.5. Traditional knowledge relating to individual impact effects to sociocultural systems was discussed in Section 4.4.1.13.5.

4.5.1.13.6. Direct and Indirect Effects Under Alternative 1.

Conclusion. There would be no direct or indirect impacts to sociocultural systems in the project area from Lease Sales 212 or 221 if they were not held.

4.5.1.13.7. Cumulative Effects Under Alternative 1.

Future MMS Sales 209 and 217 in the Beaufort Sea and ongoing projects in the region are summarized in Section 4.2.1; the same activities would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

In the Chukchi Sea, west of the North Slope industrial complex and outside the southern boundary of the Proposed Action area, the major industrial developments have been and continue to be associated with Red Dog Mine and the Delong Mountain Terminal. These facilities are included in the cumulative activities scenario, because about 250 barge lightering trips per year are needed to transfer 1.5 million tons of concentrate to bulk cargo ships anchored 6 mi offshore. About 27 cargo ships are loaded each year. These activities have the potential to affect biological resources of concern (e.g., marine mammals and marine birds) that migrate just offshore of the facilities into the marine waters of the Planning Area (USDOI, MMS, 2006a).

Summary. Effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from small changes in population and employment, seismic-survey disturbance, onshore actions, and periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Effects from these sources are not expected to displace ongoing sociocultural systems, but community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill (USDOI, MMS, 2003a).

Offshore exploration and development in the Beaufort Sea is expected to increase, with lease sales planned for the near future by MMS and the State of Alaska in the offshore. Effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope might result from seismic-exploration activities. Because the seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of people and equipment for seismic exploration. However, the possible long-term deflection of whale migratory routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated; however, seismic activity of the magnitude proposed has not been approached in the region since the 1980s (USDOI, MMS, 2006a; USDOI, BLM, 2005).

While it is unknown exactly how much of the offshore area will be leased in these future sales, several ship-based exploratory seismic operations have been conducted during the open water seasons in 2006 and 2007, resulting in conflicts with marine mammal hunters, and concerns over the fall whaling harvest. Should offshore activity lead to a considerable decrease in success in fall whaling, it would contribute to major negative effects to the North Slope Iñupiat peoples' identity and could have culture-wide effects (USDOI, BLM, 2005).

Onshore, continuing oil and gas leasing and development, as well as ongoing changes in the arctic climate, will have impacts on Iñupiat sociocultural systems in the foreseeable future. Development is being considered for the Northeast NPR-A, the planning area for Alpine Field Satellites development, and further exploration and delineation activity is ongoing in previously leased areas south of Teshekpuk Lake. If oil and gas activities were to continue in areas already leased, Nuiqsut residents would be increasingly isolated from their subsistence resources and would be encircled by development. This problem could be exacerbated if gas development caused development to extend into the foothills of the Brooks Range. Cumulative effects could include changes to social organization, and impacts to cultural values and general community welfare (e.g., health and education). Changes to social organization potentially could occur as a result of changes in population, employment, subsistence-harvest patterns, social bonds, and cultural values. In addition, the increase in income in NSB communities could potentially result in an increase in social problems, such as drug and alcohol abuse and violence, as well as increasing conflicts from wealth disparities (USDOI, BLM, 2005).

Overall, cumulative impacts to the sociocultural characteristics of North Slope communities could lead to changes to community structure, cultural values and community health and welfare—changes that actually predate oil and gas development on the North Slope. However, change in community sociocultural characteristics has continued during the period of oil development. As the area impacted by oil development in the future increases, especially in proximity to local communities, cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, and Atqasuk are currently dependent on subsistence caribou harvest from the Central Arctic Herd and Teshekpuk Lake Herd; additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns (including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources), social bonds, and cultural values (USDOI, BLM, 2004b; USDOI, MMS, 2006b).

Onshore, the abandonment of oil fields and the related loss of revenue would no doubt have serious effects on the entire State of Alaska. However, the collapse of commercial enterprise is seen as inevitable and is common over the history of the Iñupiat. Commercial whaling served the same markets as petrochemicals do today, and the Iñupiat survived by returning to the land. Fur trapping collapsed and the Iñupiat people adapted. Based on this historic demonstration of their resiliency, it would appear that the Iñupiat may be at less risk from the decline of industry than they are in the face of an expanding and unchecked industry. Nevertheless, worldwide data suggest a consistent pattern of marked increases in stress, social problems, and emigration under circumstances of sudden or severe economic depression. Data from Inupiat populations has shown that economic depression correlates strongly with epidemic rates of suicide (Travis, 1985). In the event of oil field abandonment, the Iñupiat likely would be employed to assist in the removal and demobilization of the infrastructure, while at the same time continuing their subsistence pursuits (USDOI, BLM, 2005).

Additionally, areas of importance to subsistence users, including areas surrounding subsistence camps, critical habitat for subsistence species, and large concentrations of historic and prehistoric cultural resources, could be impacted by oil and gas activities and could increase anxiety in Barrow, Wainwright, Point Lay, and Point Hope (USDOI, BLM, 2005).

We may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. The NSB already is experiencing problems in the social health and well-being of its communities, and additional development, including offshore oil development on the North Slope, would further disrupt them. Health and social-services' programs have tried to respond to alcohol and drug problems with treatment programs and shelters for wives and families of abusive spouses, in addition to providing greater emphasis on recreational programs and services. These programs, however, sometimes do not have enough money, and NSB city governments cannot help as much now that they get less money from the State. Based on experiences after the *Exxon Valdez* spill, Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other lower paying community jobs (USDOI, MMS, 2006b).

Not all sociocultural changes are negative. It is anticipated that there will be a doubling of the population on the North Slope by the year 2040. As long as core Iñupiat values continue to be passed from generation to generation, as they currently are, an increase in the Iñupiat population results in a strengthening of the culture as a whole. At the same time, revenues from NSB taxation on oil development produce positive impacts come from higher incomes, better health care, improved housing, and improved infrastructure and educational facilities, although these impacts may primarily benefit younger individuals who are generally more accepting of change (NRC, 2003a). Iñupiat culture as an adaptive mechanism is a powerful means of self-directed social, political, and cultural change capable of sustaining the Iñupiat through adverse circumstances, as it has for centuries guided them through resource shortages, inter- and intra-group social conflicts, and environmental changes (USDOI, BLM, 2005).

Health issues caused by persistent and short-term pollution could shorten life spans of elders, who are the key repositories of traditional and cultural knowledge in the communities. Health issues from increased injuries as a result of the need to travel further over rough terrain to support families with subsistence foods could reduce community involvement with employment, tax the community health infrastructure, encourage outmigration, and lead to increases in substance abuse and depression in those no longer able to participate in subsistence activities. Cuts in funding for services would increase the severity of the problem of delivery of health services, as well as maintaining health and hygiene infrastructure (e.g., fresh water, sewers, and washeteria) (USDOI, MMS, 2006b). See also the human health discussion in the Environmental Justice analysis in Section 4.4.1.15.

Any realistic analysis of cumulative effects on the North Slope needs to consider both onshore and offshore effects. Although onshore and offshore cumulative effects are difficult to separate, most cumulative effects are thought to result from onshore development. To date, no comprehensive onshore monitoring or baseline data gathering has ever been undertaken by responsible Federal and State agencies and industry; the most obvious cumulative effects have occurred and continue to occur onshore, as oil-field development expands westward from the initial Prudhoe Bay/Deadhorse area of development.

Proposed and ongoing studies that will contribute to a more comprehensive understanding of cumulative and human health effects to the Native population of the North Slope are discussed in the Environmental Justice cumulative effects analysis Section 4.4.1.15.6.8 (USDOI, MMS, 2006b); for a general discussion of Environmental Justice, see Section 4.4.1.15.

Conclusion. Cumulative effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from on- and offshore exploration, development and production activities; small changes in population and employment; and disruption of subsistence-harvest patterns from seismic noise disturbance, oil spills and oil-spill cleanup, and climate change. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to periodically disrupt ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources; such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems. However, if a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

In this cumulative analysis, the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down (USDOI, MMS, 2003a).

For 2D and 3D seismic surveys in the Chukchi Sea region, effects to sociocultural systems are expected to be minimal. Effects to social well-being (social systems) would be noticeable because of concern over deflection of the bowhead and beluga whales and walruses due to seismic-survey activities and the attendant effects on the subsistence harvest. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If the deflection actually occurs, effects could be major (USDOI, MMS, 2007d).

At the regional level, offshore effects to sociocultural systems from routine activities from exploration, development and production, and decommissioning (abandonment), would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate effect. At the local level, effects from routine development could exceed a major level of effect. Additionally, effects from a large oil spill would exceed a major level of effect, because noticeable disruption in excess of 2 years could occur from a large spill when combined with cleanup activities. The effects of this disruption would last beyond the period of cleanup and would represent a chronic disruption of social organization, cultural values, and institutional organization. The effects would have a tendency to displace existing social patterns. State and Federal mitigation measures should prove effective in ameliorating many of the cumulative effect discussed. Social systems will successfully respond and adapt to the change brought about by the introduction of these activities. If development and production occur, the accommodation response in itself could represent major impacts to social systems.

On and offshore, as the area impacted by oil development in the future increases, especially in proximity to local communities; cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, and Atqasuk are currently dependent on subsistence caribou harvest from the Central Arctic Caribou Herd and the Teshekpuk Lake Caribou Herd; additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns, including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources; social bonds; and cultural values. If oil and gas development occurs near the north shore of Teshekpuk Lake, and is connected by roads and pipelines to the Alpine field, an important subsistence use area used by residents of Nuiqsut, Barrow, and Atqasuk could be avoided by subsistence users. Traffic that occurred north and south of Nuiqsut could isolate the community from subsistence resource harvest areas and could prevent residents from using their homelands, subsistence cabins and camps, and unspoiled open areas for resource harvests and pursuits. This would further degrade the quality of life and connection of people with their land and environment (USDOI, BLM, 2004b; USDOI, BLM and MMS, 1998).

Industrialization clearly displaces subsistence users from traditional use areas even if no legal impediments to access are imposed (NSB, 2003). Essentially, potential effects include disturbance of traditional use and archaeological sites, such as hunting, fishing, and whaling camps, by construction and the increased possibility for vandalism. Any effects to these resources would have a corresponding and proportional effect on cultural value. If development occurred in areas containing concentrations of subsistence cabins, camps, and traditional use sites and subsistence resources experienced only minor impacts, subsistence users would be displaced and impacts would be expected to be far greater. The BLM expects its subsistence stipulations to mitigate potential exploration and development conflicts with subsistence cabins, camps, and use sites (USDOI, BLM and MMS, 2003; USDOI, MMS, 2007d).

If a large spill contacted and extensively oiled coastal habitat, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Such impacts would be considered major. All subsistence whaling communities and other communities that trade for and receive whale products and other resources from the whaling communities could be affected. A large spill anywhere within the habitat of bowhead whales or other important marine mammal subsistence resources could have multiyear impacts on the harvest of these species by all communities that use them. In the event of a large oil spill, many harvest areas and some subsistence resources would become unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. In addition, harvests could be affected by the IWC, which could decide to limit harvest quotas in response to a perceived threat to the bowhead whale population (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

Beyond the impacts of a large spill, long-term deflection of whale migratory routes or increased skittishness of whales due to increasing seismic surveys and industrialization in the Beaufort and Chukchi seas would make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of have bowheads have been demonstrated although a predominant concern continues to be potential disruption associated from seismic survey noise on subsistence-harvest patterns, particularly on the bowhead whale—a pivotal species to the Iñupiat culture. Such disruptions could impact sharing networks, subsistence task groups, and crew structures, as well as cause disruptions of the central Iñupiat cultural value: subsistence as a way of life. These disruptions also could cause a breakdown in family ties, the community's sense of well-being, and could damage sharing linkages with other communities. Such disruptions could seriously curtail community activities and traditional practices for harvesting, sharing, and processing subsistence resources—a major impact on sociocultural systems
(USDOI, MMS, 2006a).

Onshore, because Nuiqsut is relatively close to oil development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community—a major effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. This same potential exists for the communities of Barrow, Atqasuk, and Kaktovik as Beaufort Sea areawide leasing, exploration, and development proceeds on- and offshore. Impacts of this magnitude to Wainwright, Point Lay, and Point Hope remain speculative because of the lack of industrial development on the Chukchi Sea coastline. Without proposed mitigation in place, cumulative effects on subsistence resources and harvests from noise and disturbance would be major. To a large extent existing stipulations and required mitigation, in the past, have mitigated such potential effects and may continue to do so. With an MMS approved industry AMMP in place, effects would be reduced to moderate. Additionally, stipulated measures for seismic-survey permits and mitigation accompanying NMFS IHA plans generally ensure that acceptable levels of whale monitoring will occur. Together, these measures should ensure that no unmitigable adverse effects to subsistence-harvest patterns, resources, or practices will occur. Any potential effects to subsistence resources and subsistence harvests and consequent impacts on sociocultural systems are expected to be mitigated substantially, though not eliminated (USDOI, MMS, 2003a, 2004, 2006b).

Because of impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope peoples would experience cultural stresses, as well as impacts to population, employment, and local infrastructure. The termination of oil activity could result in the outmigration of non-Iñupiat people from the North Slope, along with some Iñupiat who may depend on higher levels of medical support or other infrastructure and services than may be available in a fiscally constrained, postoil-production environment. If subsistence livelihoods are disrupted, Iñupiat communities could face increased poverty, drug and alcohol abuse, and other social problems resulting from a loss of relationship to subsistence resources, the inability to support a productive family unit, and a dependence on non-subsistence foods (Langdon, 1995, Peterson and Johnson, 1995, National Assessment Synthesis Team, 2000, IPCC, 2001b).

As stated by Parson et al. (2001): “It is possible that projected climate change will overwhelm the available responses.” It also is realistic to expect that some general assistance could be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts. If present rates of climate change continue, impacts to subsistence resources and subsistence harvests—and consequent impacts on sociocultural systems—would be expected to be major (USDOI, MMS, 2006b, 2007d).

4.5.1.14. Archaeological Resources. For a discussion of effects on archaeological resources in the Chukchi Sea Planning Area, see the regional discussion in Section 4.4.1.14, Effects from Beaufort Sea Alternative 1—No Lease Sale. This discussion provides an archaeological resources effects analysis for both the Beaufort and Chukchi Sea Planning Areas.

4.5.1.15. Environmental Justice. For a discussion of Environmental Justice effects on potentially affected Alaskan Native coastal communities in the Chukchi Sea Planning Area, see the regional discussion in Section 4.4.1.15, Effects from Beaufort Sea Alternative 1—No Lease Sale. This discussion provides an EJ analysis for both the Beaufort and Chukchi Sea Planning Areas.

4.5.1.15.1. Factors Affecting Environmental Justice.

The factors affecting health in the Chukchi Seas coastal communities are much the same as those affecting Beaufort Sea communities. One important difference, however, is that in the Beaufort Sea region much of the activity supporting development could occur using existing onshore industrial facilities, while in the Chukchi Sea region exploration and development activities may require transport of equipment and personnel through existing infrastructure in Wainwright or Barrow, and the construction of a shore base near Wainwright. This could impact health through: (1) a general increase in acculturative stress and change, as described in section 4.4.1.3.13; (2) an increased transient worker population in and near villages, increasing the burden on local services (police, EMS personnel, local services) and infrastructure (water and sanitation systems, roads, and runways); (3) increased noise and disturbance in otherwise isolated villages; (4) the possibility of increased illicit drug and alcohol trafficking associated with a large flux of nonresident workers through the villages; (5) the creation of new roads and infrastructure to the villages (to service pipelines), leading to increased contact with larger urban areas in the state, and the potential for increased hunting pressure on subsistence resources in the region; (6) economic changes related to increased commerce in impacted villages, the potential for inflation, local hire for work on and in shore bases or other facilities located near the village, indirect employment in businesses supporting oil and gas activities, and business opportunities for village and/or regional corporations; and (7) potential impacts on subsistence from the construction, operation, and habitat loss associated with onshore facilities supporting OCS development in the Chukchi. For additional discussion on factors affecting EJ see Section 4.4.1.16.3.

4.5.1.15.2. Potential Effects from Disturbance.

Effects on public health from disturbance in the Chukchi Sea region would be similar to those discussed for the Beaufort Sea region, with the following distinctions. Noise levels related to exploration, development, and productions activities—particularly the staging activities that could occur in and near Wainwright and Barrow—could add considerably to noise levels in the village. Noise is associated with a number of adverse health effects. Noise causes psychological effects, including annoyance, stress, and anxiety, and sleep disturbance, which can cause and exacerbate psychosocial problems as well (Passchier-Vermeer and Passchier, 2000). Noise causes cognitive delay and school problems in children (Stansfeld, 2005; Clark et al., 2006). Noise exposure has also been associated with physiologic effects and adverse health outcomes, the most significant of which include hypertension and cardiovascular disease. The strongest associations have been with aircraft and airport noise (Jarup et. al., 2008; Passchier-Vermeer and Passchier, 2000). Increased air traffic in villages would present a health problem if: (a) it occurred during typical sleep hours; (b) it contributed substantially to noise levels in schools during school hours; or (c) it increased to levels above recommended health-based safety thresholds based on a 24-hour average. The EPA has established 24-hour average noise thresholds as follows: 45 decibels indoors and 55 decibels outdoors are the upper limits of noise that permit normal activity (sleeping, conversing, working) without interference; 70 decibels is the threshold beyond which chronic exposure may cause hearing loss (EPA, 2007). For additional discussion on potential affects from disturbance see Section 4.4.1.16.4.1.

4.5.1.15.3. Potential Effects from Discharges.

Effects on public health from discharges in the Chukchi Sea region would be similar to those discussed for the Beaufort Sea region, with the following distinctions. The Chukchi environment is different from the Beaufort environment, and there is less information regarding ocean currents, climate and weather patterns, baseline water quality, benthic flora and fauna, and biology and ecology. As discussed above, these factors influence the dispersion, weathering, bioavailability, and bioaccumulation of contaminants. Consequently, the risks posed by discharges to the public health of Chukchi Sea coastal residents and subsistence users cannot be estimated with certainty. For additional discussion on potential effects from discharges see Section 4.4.1.16.4.2.

4.5.1.15.4. Potential Effects from Oil Spills.

A spill originating within the Chukchi Sea region could produce indirect impacts felt by communities remote from the sale area and far removed from the spill. Essentially, concerns about subsistence harvests and subsistence food consumption would be shared by all Inupiat and Yup'ik Eskimo communities in the Chukchi (including indigenous people on the Russian Chukchi Sea coast) and Bering Seas adjacent to the migratory corridor used by whales and other migrating species. The lack of any well established and extensive onshore infrastructure and oil-spill response capacity such as is found in the Beaufort Sea region could compromise the efficacy of the response to a large spill in the Chukchi Sea region. The harsher weather conditions and movement of pack ice in the Chukchi Sea would also present novel challenges for oil-spill cleanup, and could increase the risk of public health problems resulting from exposure to contaminants. For additional discussion on potential effects from oil spills see Section 4.4.1.16.4.3.

4.5.1.15.5. Potential Effects from Oil-Spill Response and Cleanup.

Cleanup efforts for a large oil spill could call for 60 to 190 cleanup workers. Potential effects in the Chukchi Sea region could differ from those in the Beaufort Sea region in that the influx of personnel for response would be more likely to pass through local villages. Whether the personnel required for response to a large spill would be accommodated in an enclave such as a shore base or an offshore production facility or in local villages is uncertain. The impacts of such an influx on health are analyzed in the potential effects discussion above. For additional discussion on potential effects from oil-spill response and cleanup see Section 4.4.1.16.4.4.

4.5.1.15.6. Potential Effects of Economic, Employment, and Demographic Change

Potential effects from economic, employment, and demographic change in the Chukchi Sea region would exhibit certain differences from the Beaufort Sea region. The possibility of a shore base near Wainwright could have localized economic effects on this community. Potential effects include: (1) influx and pass-through of nonresident workers; (2) immigration to the community by non-Native workers (and although it is anticipated that most workers would be housed in an enclave outside of the town, it is noted that according to a recent count there were 31 vacant houses in Wainwright, which could house workers from outside the region); (3) wear and tear on local infrastructure, roads, water and sewer systems, and airstrips; (4) inflation secondary to commerce generated by incoming workers; (5) new business opportunities for local residents and Native corporations; and, (6) employment opportunities for residents associated with the shore base and operations-support needs.

The health effects benefits and risks associated with economic, employment, and demographic change would be similar to those addressed for the Beaufort Sea region above; key findings are summarized here, relative to a potential shore base near Wainwright. Few studies have monitored or investigated the effects of industrial enclaves on small, isolated communities, but there are a number of potential health concerns. One recent study found a trend toward increased arrest rates and increased EMS calls proportional to the number of active gas wells within a certain radius of a community (Ecosystem Resource Group, 2007). Problems with drugs and alcohol for Arctic indigenous communities near industrial camps has been reported elsewhere, as well, though the likelihood is dependent on alcohol policies and the proximity and ease of access between the community and the enclave (Gibson and Klinck, 2005; North Slave Metis Association, 2002). In Nuiqsut, residents have commented that the ice road that now connects the community with Alpine and the Alaska road system in winter (a feature desired by many residents), is now commonly used to bring drugs and alcohol into the community, compromising the efficacy of the local prohibition ordinance, and increasing psychosocial problems and the risk of injury (CIT) There are several likely mechanisms for these observed changes. The rapid influx of nonresident personnel to or through a community could exacerbate tensions and disrupt social cohesion, intensifying psychosocial health problems by: (1) A rapid infusion of income (through Native corporation revenues, employment, and support businesses) coupled with immigration of workers earning high wages, increasing inflation and economic disparity, and exacerbating stress and tension in the community: (2) the influx of nonresidents (workers or recreational visitors on ice to or through a village associated with or lying near a shore based enclave can exacerbate cross-cultural tensions and disrupt social cohesion: (3) the flow of nonresident workers to and through a community can overstress local law enforcement and EMS staffing, compromising the efficacy of local alcohol prohibition ordinances; and finally (4) the influx of nonresident workers to or through a community also increases the likelihood of infectious disease transmission, and would be particularly serious for a disease such as HIV, which is markedly less common in the NSB than in urban areas of Alaska or the U.S.; this has commonly been recognized as an unintended consequence of industrial development in and near indigenous communities (IFC, 2007; Utzinger et al., 2005).

For additional discussion on the potential effects of economic, employment, and demographic change see Section 4.4.1.16.4.9.

4.5.1.15.7. Potential Effects from Climate Change.

Potential public health effects from climate change are similar to those expected in the Beaufort Sea region. In the Chukchi Sea region, changes in the biological and physical environment that could profoundly shape the health of the region are already apparent and are likely to accelerate in coming decades (ACIA, 2005; IPCC, 2007). Shore erosion in Shishmaref, Kivalina, Wainwright, and Barrow has become increasingly severe in recent years, as sea-ice formation occurs later, allowing wave action from storms to cause greater damage to the shoreline. The NSB, Department of Wildlife Management notes more frequent reports of species not commonly seen in the Chukchi Sea region, such as humpback, fin, and minke whales and narwhals in recent years, which may indicate that new species are entering the region from the Bering or Beaufort seas, a situation that could relate to climate change (Rosa, pers. comm., 2008). The biological significance of these reports, as far as the stability of the ecosystem and how these changes might interact with oil and gas activities, is not known. For additional discussion on the potential effects from climate change see Section 4.4.1.16.4.11.

4.5.1.15.8. Mitigation Measures.

For a discussion of EJ-related mitigation measures see Section 4.4.1.16.12.

4.5.1.15.9. Anticipated Effects from Disturbance.

Cumulative Past and Present Actions. Effects on from disturbance on public health in the Chukchi Sea region would be similar to effects for the Beaufort Sea region. The baseline ambient noise levels in villages that will be used for staging for Chukchi Sea operations would experience an increase in noise levels, primarily due to aircraft; this would be a concern in Wainwright, and to some extent in Barrow, based on the anticipated staging and shore base operations in those communities. Aircraft noise is associated with cognitive delay in children, hypertension, cardiovascular disease, sleep disturbance, and annoyance. If increase in vessel noise levels offshore were to compromise Point Lay's beluga hunt, nutritional health problems and the risk of diabetes and related nutritional diseases would increase in proportion to the severity and longevity of the harvest problems. For additional discussion on the anticipated effects from disturbance related to cumulative past and present actions see Section 4.4.1.16.14.

4.5.1.15.10. Anticipated Effects from Discharges.

Cumulative Past and Present Actions. Differences in discharge-related health effects from the Beaufort Sea region would relate to the notable differences in the Chukchi Sea environment, such as ocean currents, temperatures, benthic ecology, and macrofauna biology. These characteristics could influence the reactions that drive bioavailability, the distribution, and the fate of discharges. There are relatively few baseline data on which to rely in the Chukchi Sea region. For additional discussion the anticipated effects from discharges related to cumulative past and present actions see Section 4.4.1.16.15.

4.5.1.15.11. Anticipated Effects from Oil Spills.

Cumulative Past and Present Actions. Effects for the Chukchi Sea region would be similar to the Beaufort Sea region although there are notable differences in the environment that could affect the fate and distribution of oil and the specific subsistence impacts. For example, in the Chukchi Sea region, the active-ice, or ice-flaw zone is an important habitat for marine mammals, such as bowhead and beluga whales, walrus, seals, and other marine mammals. Seals, walrus, and beluga whales would be most vulnerable to spills contacting this zone, and polar bears would be most vulnerable to spills contacting the flaw zone or the coast. For additional discussion the anticipated effects from oil spills related to cumulative past and present actions see Section 4.4.1.16.16.

4.5.1.15.12. Anticipated Effects from Oil-Spill Response and Cleanup.

Cumulative Past and Present Actions. Effects from oil-spill response in the Chukchi Sea region could differ from those in the Beaufort Sea region in that the influx of personnel for response would be more likely to pass through local villages. Whether the personnel required for response to a large spill would be accommodated in an enclave such as a shore base or an offshore production facility or in local villages is uncertain and would influence the type and degree of effects to public health. For additional discussion the anticipated effects from oil-spill response and cleanup related to cumulative past and present actions see Section 4.4.1.16.17.

4.5.1.15.13. Anticipated Effects from Seismic Surveys.

Cumulative Past and Present Actions. The anticipated public health effects from seismic surveys differ from the Beaufort Sea region to the extent that walrus and beluga whales figure more prominently in Chukchi Sea region's subsistence round though bowhead whales are now (with the recent quoted extended to Point Lay) hunted in all NSB Chukchi communities. Historically, Point Lay residents rely on the harvest of belugas more than any other village in the region and hunt by herding the animals into Kasegaluk Lagoon. Though there is some evidence of belugas acclimating to some boat noise, if noise from boat traffic and seismic-survey activity increased past a threshold point, there is the possibility that this herding technique would be less successful and the hunt reduced (Braund and Burnham, 1984; USDOI, MMS, 1987c, 1995a, 1998; Huntington and Mymrin, 1996; Huntington, 1999; Mymrin, 1999). Decreased harvest success would contribute incrementally to psychosocial health problems, as well as compromising the protective effects of a traditional diet and compromising nutritional health and food security; mitigation could reduce the adverse effects of decreased harvest, but would not be expected to eliminate them entirely. For additional discussion on the anticipated effects from seismic surveys related to cumulative past and present actions see Section 4.4.1.16.19.

4.5.1.15.14. Anticipated Effects from Economic, Employment, and Demographic Change.

Anticipated public health effects from economic, employment, and demographic changes in the Chukchi Sea region would occur primarily from oil and gas exploration and development operations. Exploration activities would initially be staged mostly out of Barrow and Wainwright. Future development and production operations would necessitate a shore base, which would likely be built near Wainwright (USDOI, MMS, 2007). It is unlikely (but not certain) under this scenario that large numbers of nonresident workers would immigrate to Wainwright although there are vacant housing units which could be occupied. It is likely that many workers would be housed at an enclave separated from the village. In the case of Nuiqsut, an ice road was constructed between the village and the CPF/work camp, and the village now hosts oil and gas-related workers at a camp located in the village. It is not known if a similar scenario would be desired by Wainwright or industry. As discussed in the potential effects discussion above, the general large increase in flow of nonresident workers to and through Wainwright and a potential shore base create the potential for substantial health effects. Unless police and EMS staffing were increased, current levels of police presence would not be adequate to ensure public safety and to enforce drug and alcohol trafficking laws. This could compromise the efficacy of local alcohol ordinances and lead to more problems with drugs and alcohol in the community. Large-scale economic change—such as could occur if the village corporation develops business agreements with industry, residents find local temporary or permanent employment, and influx creates inflation—could create considerable economic disparity in the community which might increase tensions and exacerbate social problems. Influx and industrial work camps near indigenous communities have also unfortunately sometimes been associated with the spread of infectious diseases, with sexually transmitted infections being a particular concern. Because the prevalence of HIV infection in the region is far lower than urban areas of the State or the U.S., there is a risk that a large influx of workers could trigger an increase in HIV rates. For additional discussion on the anticipated effects from economic, employment, and demographic change see Section 4.4.1.16.22.

4.5.1.15.15. Anticipated Effects from Climate Change.

The anticipated public health effects from climate change in the Chukchi Sea region would occur from altered availability and distribution of subsistence resources. This alteration in distribution and in the species of resources available to hunters, would impact dietary health. It could become more difficult to harvest subsistence resources because of less reliable ice conditions and more unstable ocean ice and weather conditions, which would affect nutrition, food security, and nutritionally related chronic illness. Infrastructure damage (such as damage to water and sewer systems) from melting permafrost would compromise basic public health and safety. If accelerated erosion leads to the need to relocate a village, the health effects of relocation could be major. For more discussion on the anticipated effects from climate change see Section 4.4.1.16.24.

4.5.1.15.16. Direct and Indirect Effects Under Alternative 1.

Conclusion. In the Chukchi Sea, there would be no direct or indirect impacts to EJ or public health if Lease Sales 212 and 221 were not conducted.

4.5.2. Alternative 2, Chukchi Sea Proposed Action for Sales 212 and 221.

Chukchi Sea Alternative 2, the Proposed Action for Sales 212 and 221, would offer for lease the entire program area as scheduled in the 2007-2012 5-Year Program. The program area encompasses 7,326 whole or partial blocks that cover approximately 40,192,866 acres (about 16.1 million hectares). This area, minus any blocks currently leased at the time of the sale, would be offered in the proposed sales.

4.5.2.1. Water Quality.

Summary. The activities associated with petroleum exploitation resulting from proposed Sales 212 and 221 would be unlikely to have any substantial effects on water quality. A large oil spill ≥1,000 bbl (42,000 gal) is unlikely to occur. However, if a large spill were to occur, it would not cause significant long-term degradation of the quality of Chukchi Sea water. Concentrations of hydrocarbons in water would be less than the acute criterion within 3 days of spillage, and concentrations above the chronic criterion likely would persist <30 days.

Small oil spills would not have degradational effects on the overall water quality of the Chukchi Sea. The small spills would degrade the water quality locally for a relatively short period of time, though frequent small spills in an area could result in local, chronic contamination. The concentrations of any of the various types of hydrocarbons in the water column generally are quite low or below detection limits.

Drilling muds and cuttings and other discharges associated with exploration drilling would have little effect on the overall water quality of the Chukchi Sea. Within a distance of between 100 and 200 m (100-200 yd) from the discharge point, the turbidity caused by suspended-particulate matter in the discharged muds and cuttings would dilute to levels that are less than the chronic criteria (100-1,000 ppm) and within the range associated with the variability of naturally occurring suspended-particulate matter concentrations. Mixing in the water column would reduce the toxicity of the drilling muds, which are already required by the EPA to be practically nontoxic (EPA, 2006b), to levels that would not be harmful to organisms in the water column. In general, the amounts of additives in the other discharges would likely be relatively small and diluted with seawater several hundred to several thousand times before being discharged into the receiving waters. The potential effects in any of the areas where there are permitted discharges would be temporary.

Produced waters from a production platform likely would be injected into underlying formations. Even if discharged, produced waters would not be expected to degrade the quality of Chukchi Sea water. The other routine discharges associated with oil production would not cause any substantial degradation of Chukchi Sea water quality. Discharges associated with production activities will require an individual NPDES permit.

Overall, any effects on water quality from the proposed lease sales would be temporary due to dilution. The level of impact on water quality would be minor locally and negligible regionally, due to the requirements of EPA and State of Alaska water quality criteria. Proposed mitigation measures would not reduce effects further.

4.5.2.1.1. Direct and Indirect Effects Under Alternative 2. This section assesses the possible/probable impacts associated with oil and gas exploration activities in the Chukchi Sea. Water quality is a term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. To develop the assessment of impacts to water quality, we considered the assessment scenario (Section 2.4), the impacts associated with those activities described within the scenario and historical trends in the regulatory compliance and industry. Oil and gas drilling generates a wide range of waste materials related to the drilling process, equipment operations and maintenance, and personnel housing. The proportions and amounts of discharged wastes can change considerably during the lifecycle of postlease exploration, development and operations activities.

Water Quality Criteria. The EPA's Ocean Discharge Criteria (40 CFR § 125) sets forth specific determinations of unreasonable degradation that must be made prior to EPA approving permit actions. Unreasonable degradation of the marine environment is defined (40 CFR § 125.121[e]) as follows:

- Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities;
- threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or
- loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge.

Determination of impacts to water quality resulting from marine discharges is based on consideration of the following 10 criteria (40 CFR § 125.122):

- The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged.
- The potential transport of such pollutants by biological, physical, or chemical processes.
- The composition and vulnerability of the biological communities that may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the ESA, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain.
- The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the lifecycle of an organism.
- The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs.
- The potential impacts on human health through direct and indirect pathways.
- Existing or potential recreational and commercial fishing, including finfishing and shellfishing.
- Any applicable requirements of an approved Coastal Zone Management Plan.
- Such other factors relating to the effects of the discharge as may be appropriate.
- Marine water quality criteria developed pursuant to Section 304(a)(1) (33 U.S.C. § 1342) of the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act) of 1972.

Federally promulgated water quality standards regarding toxic substances, including human-health criteria and aquatic-life criteria, are found at 40 CFR § 131. The State of Alaska, Department of Environmental Conservation (ADEC, 2008) water quality criterion states:

> An effluent discharged to a water may not impart chronic toxicity to aquatic organisms, expressed as 1.0 chronic toxic unit, at the point of discharge, or if the department authorizes a mixing zone in a permit, approval, or certification, at or beyond the mixing zone boundary, based on the minimum effluent dilution achieved in the mixing zone. If the department determines that an effluent has reasonable potential to cause or contribute to exceedance of the whole effluent toxicity limit, the department will require whole effluent toxicity testing as a condition of a permit, approval, or certification.

A "mixing zone" is the area adjacent to a discharge or activity in the water where receiving water may not meet all the water quality standards or criteria; wastes and water are given an area to mix so that the water quality standards or criteria are met at the mixing-zone boundaries. In determining whether to authorize a mixing zone, the ADEC (2008) will consider:

- the characteristics of the receiving water, including biological, chemical, and physical characteristics such as volume, flow rate, and flushing and mixing characteristics;
- the characteristics of the effluent, including volume, flow rate, dispersion, and quality after treatment;
- the effects, if any, including cumulative effects of multiple discharges and diffuse, nonpoint source inputs, that the discharge will have on the uses of the receiving water;
- any additional measures that would mitigate potential adverse effects to the aquatic resources present; and
- any other factors the department finds must be considered to determine whether a mixing zone will comply with this section.

4.5.2.1.1.1. Effects from Exploration and Development. The principal method for controlling discharges is through Section 402 (33 U.S.C. § 1342) of the Clean Water Act, which establishes a National Pollutant Discharge Elimination System (NPDES) (Laws, 1987). The general NPDES permit AKG280000 (EPA, 2006b) for the offshore areas of Alaska located in the Beaufort Sea, Chukchi Sea, Hope Basin, and Norton Basin authorizes discharges from oil and gas exploration facilities. This permit does not apply to development and production facilities, which require individual permits.

The following exploratory discharges are permitted under the Arctic general permit: drilling fluids and drilling cuttings; deck drainage; sanitary wastes; domestic wastes; desalination unit wastes; blowout-preventer fluid; boiler blowdown; fire-control-system test water; noncontact cooling water; uncontaminated ballast water; bilge water; excess cement slurry; mud, cuttings and cement at seafloor; and test fluids. The Arctic general permit restricts the seasons of operation, discharge depths and areas of operation, and has monitoring requirements and other conditions.

4.5.2.1.1.1.1. Drilling Muds and Cuttings. Drilling muds are mixtures of water and natural and manmade additives that are pumped downhole to (1) cool the rapidly rotating drill bit, (2) lubricate the drill pipe as it turns, (3) carry rock cuttings to the surface, and (4) provide well control and spill prevention. Different properties may be required of the drilling fluid, depending on the drilling conditions. For example, a higher density fluid may be needed in high-pressure zones, and a more temperature-resistant fluid may be desired in high-temperature conditions. Drilling muds and cuttings are the most important and voluminous discharge during exploration drilling.

The discharge rate of drilling fluids (muds) and cuttings during well-drilling operations is quite variable. The volume of rock cuttings produced from drilling primarily is a function of the depth of the well and the diameter of the wellbore. The Arctic general NPDES permit AKG280000 (EPA, 2006b) limits the flow of drilling fluids and drilling cuttings to the following:

- 1,000 bbl (42,000 gal) per hour in water depth >40 m (131 ft),
- 750 bbl (31,500 gal) per hour in water depth between 20 and 40 m (66-131 ft),
- 500 bbl (21,000 gal) per hour in water depths between 5 and 20 m (16-66 ft).

Drilling muds and cuttings discharged into the Chukchi Sea would increase the turbidity of the water column and the rate of accumulation of particulate matter on the seafloor near the drilling unit. The EPA and ADEC water quality criteria for turbidity specific to aquatic life both specify that increased turbidity should not reduce the depth of the compensation point for photosynthetic activity by more than 10%. In addition, the Alaska criteria state that increased turbidity "may not reduce the maximum secchi disk depth by more than 10%."

The discharge of drilling muds at the surface ensures dispersion and limits the duration and amount of exposure to organisms (NRC, 1983). When released into the water column, the drilling mud and cutting discharges tend to separate into upper and lower plumes (Menzie, 1982). The upper plume contains the solids separated from the material of the lower plume and kept in suspension by turbulence. Most of the solids in the discharge, more than 90%, descend rapidly (within 1 hour) to the seafloor in the lower plume. The heaviest materials (for example, barite particles and cuttings) accumulate closest to the discharge point, and the lighter mud components settle farther away. Small particles of drilling mud—up to several centimeters in diameter—also may settle to the seafloor immediately following a discharge but would disperse within a day (NRC, 1983).

Typical bulk constituents of drilling muds are water, barite, bentonite (a clay mineral), lignosulfonate, and lignite. In the drilling muds, the amount of barite would be about 75% of dry mud weight, bentonite about 2%, and lignite about 1.4%, with no other constituent over a fraction of a percent. These constituents are generally nontoxic to marine organisms at the dilutions reached shortly after discharge (NRC, 1983). Barium discharged in the drilling mud may persist in the marine sediments in deeper waters, however, and the concentrations may be more than 100 times greater than the concentrations that occur naturally in marine sediments. Natural concentrations of barium in Beaufort Sea coastal sediments range from 185-745 ppm (Crecelius et al., 1991). The barium in drilling mud is in the form of barite (barium sulfate). Barite has a low solubility and relatively high specific gravity, making it useful as a material to add weight to a drilling mud.

The current NPDES permit for the Arctic, AKG280000 (EPA, 2006b), allows discharge of exploration muds with only negligible toxicity as measured by 96-hour lethal concentration for 50% of test organisms (LC_{50}) tests. Toxicity is the inverse of the LC_{50}; as the LC_{50} value increases, the toxicity associated with the substance decreases. For example, a substance with an LC_{50} of 1 million ppm is less toxic than a substance with an LC_{50} of 3,000 ppm. The classification of relative toxicity of chemicals to marine organisms proposed by the IMCO/FAO/UNESCO/WHO, reported in Neff (1991), provides a means of qualitatively assessing relative toxicities. Concentrations <1 ppm are classified as very toxic; 1-100 ppm are toxic; 100-1,000 ppm are moderately toxic; 1,000-10,000 ppm are slightly toxic; and >10,000 ppm are practically nontoxic. The current permit requires LC_{50} >30,000 ppm in discharged muds (concentration at which half the test organisms die within 4 days) and discharges are prohibited in open water <5 m (16 ft) deep. Discharges are not allowed shoreward of the 20-m (66-ft) isobath in broken-ice conditions unless prediluted to a 9:1 ratio of seawater to drilling fluids and cuttings. Discharges are also prohibited below stable ice. The EPA estimates that these restrictions should ensure protection of water quality and human health.

The exploration and development scenarios described in Section 2.4 presuppose that 80% of the drilling mud would be reconditioned and reused. The total discharges from all estimated exploration wells are given in Table B-2. The discharge of exploratory drilling muds is expected to have minor local effects and negligible regional effects. Treatment and disposal of waste products from production wells (drilling muds, rock cuttings, and produced water) in the subsurface through injection wells is anticipated. Hence, production discharge is not anticipated.

4.5.2.1.1.1.2. Other Discharges.

Deck Drainage. Deck drainage refers to any waste resulting from platform washing; deck washing; spillage; rainwater; and runoff from curbs, gutters, and drains, including drip pans and wash areas. This also could include pollutants, such as detergents used in platform and equipment washing, oil, grease, and drilling fluids spilled during normal operations.

In addition to oil, various other chemicals used in drilling operations may be present in deck drainages. The chemicals may include drilling fluids, ethylene glycol, lubricants, fuels, biocides, surfactants, detergents, corrosion inhibitors, cleaners, solvents, paint cleaners, bleach, dispersants, coagulants, and any other chemical used in the daily operations of the facility (Kramme, 1985). A typical facility is equipped with drip pans and gutters to collect deck and drilling-flow drainage. The drainage is collected in a sump where the water and oil are separated by a gravity separation process. Oil in the sump tank is recovered and transferred to shore via pipeline or reinjected to the formation. The water from the sump is discharged to the ocean via a skim pile.

Deck-drainage discharges are not continuous and they vary considerably in volume. At times of platform washdowns, the discharges are of relatively low volume and are anticipated. During rainfall, very large volumes of deck drainage may be discharged in a very short time period. Deck drainage is a concern particularly in areas with high precipitation; however, the low arctic temperatures prevent high volumes of deck drainage due to the prolonged winter months, and precipitation drainage is expected to occur only during the open-water (summer) months.

Sanitary and Domestic Wastes. While some platforms discharge sanitary and domestic wastes separately, many combine these waste streams prior to discharge. Sanitary waste is human body waste discharged from toilets and urinals. It consists of secondary treated chlorinated effluent. Domestic waste (gray water) refers to materials discharged from sinks, showers, laundries, safety showers, eyewash stations, and galleys. Gray water can include kitchen solids, detergents, cleansers, oil, and grease. Domestic waste also includes solid materials such as paper and cardboard, which must be disposed of properly.

The concentration of sanitary wastes varies widely with time, occupancy, platform characteristics, and operational situation. Pollutants of concern in untreated sanitary waste include biological oxygen demand (BOD), total suspended solids, fecal coliform, and residual chlorine. Average monthly limits of these pollutants permitted for discharge under the Arctic general NPDES permit AKG280000 are 30 milligrams per liter (mg/L) (30 ppm), 30 mg/L (30 ppm), 100 colonies/100 milliliters (mL) and 0.5 mg/L (0.5 ppm), respectively (EPA, 2006b).

There are two alternatives for handling of sanitary wastes from offshore facilities. The wastes can be treated at the offshore location, or they can be retained and transported to shore facilities for treatment. Because of the remote areas of operation and storage limitations, most offshore facilities usually treat and discharge sanitary wastes at the source. The treatment systems presently in use may be categorized as physical/chemical or biological.

These discharges are expected to represent only small pollutant loadings when properly designed and functioning equipment is used. Dispersion in the receiving waters would further decrease the concentration of any contaminants.

Produced Waters. Just as for muds and cuttings from production wells, the discharge of produced waters is not anticipated. Instead, produced waters are expected to be injected back into underlying formations, as described in Section 2.4. Historically, produced waters constituted the largest source of substances discharged into the marine environment. These waters are part of the oil/gas/water mixture produced from the wells and contain (1) a variety of substances dissolved from the geologic formations through which they migrated and in which they became trapped and (2) the soluble fractions of any hydrocarbons they might have encountered. The mixtures produced from the wells may also contain substances added to the waters injected into the producing formations and may contain chemicals added during the oil/gas/water separation process (Veil et al., 2004).

Additives to the injection waters might include flocculants, oxygen scavengers, biocides, cleansers, and corrosion inhibitors; the types and amounts of additives used would depend on the reservoir and production conditions. A variety of chemicals also may be added to the oil/water separation process to aid in separating the oil and gas from the water. The most commonly used types of compounds added to the production stream include scale inhibitors, emulsion breakers, biocides, and corrosion inhibitors. These chemicals can pose concerns related to aquatic toxicity. However, these substances may undergo reactions that reduce their toxicities before they are discharged or injected. In addition, corrosion inhibitors can form more stable emulsions, thus making oil/water separation less efficient (Veil et al., 2004).

Over the life of a field, the volume of formation waters produced may be equal to 20-150% of the oil-output volume (Collins et al., 1983). As oil is pumped from a field, the ratio of water to oil being produced increases. Prudhoe Bay oil production began in 1969 and reached full production in 1977 with the completion of the TAPS. The ratio of water to oil for Prudhoe Bay in 1978 was <0.003. In 2004, the ratio was 6.18 and the ratio of total water produced to total oil produced for Prudhoe Bay is 0.68 after 36 years of production (Alaska Oil and Gas Conservation Commission, 2005).

Characteristics of the Produced Waters. The toxicity of produced waters is mainly caused by hydrocarbons (Brown et al., 1992). The treatment process removes suspended oil particles from the waters, but the effluent contains hydrocarbons that are dissolved or held in colloidal suspension. The treated produced waters contain the more soluble, low-molecular weight (LMW) saturated and aromatic hydrocarbons. On this basis, the analysis of the effects of produced-water discharges focuses on nonvolatile hydrocarbons (called oil and grease by the EPA) and total aromatic hydrocarbons, two of the characteristics that can be related to water quality criteria. Other characteristics of the produced waters discussed in this section are based on those features that also can be related to water quality criteria or compared to existing parameters in the water column. These characteristics include toxicity, pH, salinity, biological oxygen demand, and metal concentrations.

Water Quality Criteria for Hydrocarbons. The State of Alaska water quality criteria for marine water uses (ADEC, 2008), specific to the growth and propagation of fish, shellfish, aquatic life, and wildlife, state that total hydrocarbons in the water column shall not exceed 15µg/L (15 ppb). In addition, the State of Alaska water quality criteria (ADEC, 2008) state that total aromatic hydrocarbons in the water column shall not exceed 10 µg/L (10 ppb). These limits originally derive as a hundredfold safety factor, 0.01 of the lowest measured continuous flow 96-hour LC_{50}, for life stages of species identified by the ADEC as the most sensitive, biologically important species in a particular location (ADEC, 1989).

The water quality criteria are intended to represent the water-soluble or water-accommodated fraction of crude or refined oil similar to that used in many laboratory acute and chronic toxicity tests (Neff and Douglas, 1994). The water-soluble fraction includes primarily LMW aromatic hydrocarbons, such as benzene, toluene, ethylbenzene, and total xylenes, with lesser amounts of naphthalene, alkylnaphthalenes, phenanthrene, and light aliphatic hydrocarbons.

The EPA’s water quality criteria for marine waters (EPA, 1986, 2006c) do not include the total hydrocarbon or total aromatic categories found in the State criteria. Instead, the EPA’s criteria include (1) criteria for oil and grease and (2) both acute and chronic criteria for the individual hydrocarbons. Under the current general NPDES Arctic discharge permit (EPA, 2006b), the monthly average discharge limitation for nonvolatile hydrocarbons (oil and grease) in authorized test fluid discharges is 29 mg/L (29 ppm). The maximum daily discharge limitation is 42 mg/L (42 ppm). The EPA's Effluent Guidelines and Standards for offshore oil and gas production facilities can be found at 40 CFR § 435.

Information based on toxicity tests is used to establish criteria that may be considered a measure of water quality. Chronic toxicity tests measure the sublethal effects of substances on such factors as growth, development, reproduction, or behavior. Acute toxicity tests determine the concentration of a substance that causes the mortality (i.e., lethal effects) of some fraction of the test population (for example, half of the population in the LC_{50} test) during a certain period of time (usually 4 days [96 hours]). Most of the information on toxicity is based on the results of acute toxicity tests and, where there are no chronic toxicity tests, an application or safety factor is used to extrapolate to probable sublethal effects. For most toxicants, the chronic toxicity is estimated to 0.01 to 0.001 of the acute toxicity. For this analysis, the acute criterion is assumed to be 100 times greater than the chronic criterion, which results in the chronic criterion being 0.01 of the acute criterion.

Nonvolatile Hydrocarbons (Oil and Grease) and Total Aromatic Hydrocarbons. Nonvolatile hydrocarbons (oil and grease) consist of a variety of organic substances including hydrocarbons, fats, oils, and waxes. The EPA's gravimetric method for determining oil and grease measures certain classes of carbon compounds such as fatty acids, phenols, and related compounds that do not appreciably contribute to the toxicity of produced waters (Brown et al., 1992). The fate of any petroleum hydrocarbons released into the water column along with the produced waters is expected to be similar to the fate of spilled oil in seawater. The discharged substances are affected by chemical and biochemical degradation processes, evaporation, and dissolution and dispersion.

Effects of Mixing. Although produced waters are expected to be reinjected rather than discharged, the effects on water quality, if such discharge were permitted, can be estimated. Produced waters discharged into the mixing zone likely would have concentrations of nonvolatile hydrocarbons averaging 29 ppm or less and total aromatic hydrocarbons with an approximate range of 8-13 ppm. Mixing of the produced waters with the receiving waters reduces the concentrations of the substances in the discharges.

The nonvolatile hydrocarbons (oil and grease) in the produced waters from an oil-production platform would likely be diluted a thousandfold within several hundred meters if discharged. At a 1,000:1 dilution, the concentrations of nonvolatile hydrocarbons would reduce from 29 ppm to 29 ppb within several hundred meters of the platform. The concentrations of total aromatic hydrocarbons might range from 8-13 ppm near the platform to 8-13 ppb farther away. These concentrations at several hundred meters distance are well below the acute criteria of 1,500 ppb for the nonvolatile hydrocarbons and 1,000 ppb for the total aromatic hydrocarbons that were assumed for this analysis but, in general, slightly greater than the chronic criteria of 15 ppb for the nonvolatile hydrocarbons and 10 ppb for the total aromatic hydrocarbons. At some point within this several-hundred-meter distance, acute and chronic criteria would be exceeded. In OCS waters, mixing zones are limited to a 100-m (328-ft) radius. This limitation does not apply to State waters, where mixing zones can be expanded as necessary to ensure that these criteria are not exceeded outside the mixing zone.

Note, however, that mixing is a continuous process, and the dilution rate would depend on the energy of the local receiving environment as derived from the local currents and waves. Evaporation would remove some of the aromatic hydrocarbons from the water column; Jordan and Payne (1980) note that evaporation may remove the majority of the more volatile compounds within 24-28 hours after an oil spill. In addition, biodegradation processes act to continuously change the hydrocarbon compounds in the waters.

Some Other Characteristics of Produced Waters. Other characteristics of produced waters include trace metals, pH, salinity, and biological oxygen demand. The pH of surface seawater generally is about 8.2 (Millero and Sohn, 1991). The general NPDES permit discharge limit ranges from 6-9. The BOD and metal amounts produced from the production platform can be compared with the amounts found in other point sources. Produced waters are a minor potential source of these contaminants. Naturally Occurring Radioactive Materials (NORM) should be expected to occur in low concentrations in produced waters. NORM is best monitored indirectly, taking advantage of natural biological or chemical concentration mechanisms such as shell formation (Farrington et al, 1983; Goldberg et al., 1983).

4.5.2.1.1.2. Effects from Construction Activities. Sediment resuspension and bottom disturbances are likely to occur as a result of siting platforms, creating artificial islands, and trenching and burying subsea pipelines. The amount of disturbance associated with platform siting, anchor setting, and drilling would be minimal and restricted to the area immediately adjacent to the activity. Sediment levels likely would be reduced to background levels within several hundred meters downcurrent. The size, duration, and amount of turbidity depend on the grain-size composition of the discharge, the rate and duration of the discharge, the turbulence in the water column, and the current regime.

Experiences with actual dredging or dumping operations offshore of Alaska and in other U.S. waters show a decrease in the concentration of suspended sediments with time (2-3 hours) and distance (1-3 km [0.54-1.62 nautical miles {nmi}]) downcurrent from the discharge. In dredging operations associated with artificial-island construction and harbor improvements in the mostly sandy sediments of the Canadian Beaufort Sea, the turbidity plumes tended to disappear shortly after operations ceased. Plumes generally extended from a few hundred meters to a few kilometers (Pessah, 1982).

Prior to any discharge of dredge or fill material into U.S. waters, permits and approval from State and Federal regulatory agencies would be required; with associated followup project-specific environmental assessment process and documentation as required. Effects on water quality from dredging (and dumping) are expected to be local and short term. Effects on local water quality are expected to be minor, while regional effects are expected to be negligible.

4.5.2.1.1.3. Effects from Oil Spills.

Fate of Petroleum in Seawater. Petroleum released into seawater is exposed to a variety of physical, chemical, and microbiological processes that operate interdependently and simultaneously with each other to degrade and eventually remove it from the water column (Karrick, 1977). The fate of petroleum in seawater is discussed in Appendix A.1. During the degradation process, some of the various constituents of the spilled oil would spread over the sea surface, evaporate into the atmosphere, disperse and dissolve into the water column, form water-in-oil emulsions, wash onto beaches and sink to the seafloor, and change by chemical and microbiological processes.

Effects of Oil Spills. Only small, accidental oil spills would likely occur in the sale area, if oil production occurs as a result of Sale 212 or 221 (Appendix A.1). Small oil spills are defined as spills <1,000 bbl offshore or spills <500 bbl onshore. For spills <500 bbl, the average spill size of crude oil is 3 bbl (126 gal), and the average spill of refined oil is 0.7 bbl (29 gal). During the 25-year oil production period, an estimated 178 crude oil spills and 440 refined oil spills <500 bbl could occur, for a total spillage of approximately 842 bbl. For small spills >500 barrels, the average crude oil spill size is 680 bbl. During the 25-year oil production period, one small crude oil spill >500 bbl could occur.

The data indicate that for Alternative 2, a spill of ≥1,000 bbl is unlikely to occur. However, for purposes of analysis, we do evaluate what the effects of such a spill could be.

Federal standards are set at 0.01 of the applicable LC_{50}; no absolute Federal concentration standard exists for hydrocarbons (EPA, 1986). "Applicable" in this case refers to life stages of species identified as the most sensitive, biologically important species in a particular location. Applicable ambient-water quality standards for marine waters of the State of Alaska are: (1) total aqueous hydrocarbons in the water column may not exceed 15 µg/L (15 ppb); (2) total aromatic hydrocarbons in the water column may not exceed 10 µg/L (10 ppb); and (3) surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration (ADEC, 2008). The State of Alaska criterion of a maximum of 15 ppb of total aqueous hydrocarbons in marine waters—about 15 times background concentrations—provides the readiest comparison and is used in this discussion of water quality. This analysis considers 15 ppb to be a chronic criterion and 1,500 ppb—a hundredfold higher level—to be an acute criterion.

Very large spills generally result in peak dissolved-hydrocarbon concentrations that are only locally and marginally at toxic levels—parts per million or more. The concentration of oil from the *Argo Merchant* spill (0.18 million barrels [MMbbl], 7.56 million gal) ranged relatively low, from 90-170 ppb at the surface and up to 340 ppb in the water column (NRC, 1985). At several of the sampling stations, the concentrations were uniform to a water depth of 20 m. Concentrations of oil in water from the *Amoco Cadiz* spill (1.64 MMbbl) ranged from 2-200 ppb in the nearshore area to 30-500 ppb in the estuaries (Gundlach et al., 1983). Volatile liquid hydrocarbons in the Ixtoc spill (3.33 MMbbl) decreased from 400 ppb near the blowout to 60 ppb at a 10-km (5.4-nmi) distance and to 4 ppb at a 19-km distance (NRC, 1985). Similar rapid decreases also were found for specific toxic compounds such as benzene and toluene. Concentrations of volatile-liquid hydrocarbons, present mostly as oil-in-water emulsion, within 19 km of the Ekofisk Bravo blowout in the North Sea ranged up to 350 ppb (Grahl-Nielsen, 1978). Lesser amounts of oil (probably <20 ppb) were detectable in some samples at a 56-km distance, but not at an 89-km distance.

In the *Exxon Valdez* oil spill (0.258 MMbbl), concentrations of hydrocarbons in the water were not measured in the first 6 days of the spill. However, Wolfe et al. (1994) used an earlier version of the MMS weathering model (Payne et al., 1984) to estimate water concentrations after passage of the storm on the third day of the spill, arriving at an average value of 800 ppb within the top 10 m (33 ft) of the water, in the "effective" or discontinuous spill area. Wolfe et al. (1994) also summarized the actual measurements made in Prince William Sound. Seven to 11 days after the spill, residual concentrations ranged from 67-335 ppb petroleum hydrocarbons, 1.5 ppb volatile organic analytics (mostly mononuclear aromatics), and 1-5 ppb polynuclear aromatic hydrocarbons (PAHs). Concentrations in Prince William Sound decreased to levels below the chronic criteria levels of concern, to between 1 and 6 ppb petroleum hydrocarbons and 0.1 ppb PAH after 21-41 days. The concentration decreases within these timeframes were attributable to advection and dilution, not decomposition. In restricted waters under very calm seas, however, lack of vertical mixing and dilution can result in higher concentrations, up to 1,000-3,000 ppb within the top 1-3 m (3-10 ft) that persist for a day (Baffin Island Oil Spill Project; Humphrey et al., 1987).

The concentrations of oil deeper in the water column are relatively low because oil is only slightly soluble in water and vertical—and especially horizontal—dispersion and consequent dilution would rapidly decrease hydrocarbon concentrations for all but the largest spills in several hours. For spills of the magnitude of the EVOS, hydrocarbon concentrations could remain elevated above chronic criteria for as long as 10-20 days. Aromatic compounds are the most toxic constituents of crude oil, partly because they are the most soluble constituents. The highest rates of dissolution of aromatics from a slick and, consequently, accumulation in underlying water occur in the first few hours after a spill (Payne, 1987). The bulk of these volatile compounds are lost in <3 days.

At sea, water depth and shoreline do not restrict movement of slick or water, and the slick and underlying water generally move at different angles to the wind. The rate of horizontal dispersion or mixing in the ocean is orders of magnitude greater than the rate of vertical dispersion. By the time dissolved oil worked down 10 m (33 ft) in the water column, it would have spread horizontally and been diluted over a distance of perhaps 10,000 m (5.4 nmi). The slick itself would become patchy, with the total area containing the widely separated patches of oil being orders of magnitude larger than the actual amount of surface area covered by oil.

If the spilled oil were of a composition similar to that of Prudhoe Bay crude, about 40% of the spilled oil could persist on the water surface after the slick disappeared, dispersed into individual tarballs. Slow photo-oxidation and biological degradation would continue to slowly decrease the residual amount of oil. Through 1,000 days, about 15% of the tarballs would sink, with an additional 20% of slick mass persisting in the remaining tarballs (Butler, Morris, and Sleeter, 1976). Because of the drift of the oil over distances of hundreds or thousands of kilometers during the slow process of sinking, individual sunken tarballs would be extremely widely dispersed in the sediments.

The "average" levels of local or regional contamination in sediments would be insignificant. Suspended loads of sediment away from the shoreline (<100 ppm dry weight) are not high enough to appreciably enhance oil removal from the slick or water column (see Payne et al., 1989; Boehm, 1987). Only if oil were mixed into shoreline sediments and then dispersed offshore could elevated concentrations of hydrocarbons occur locally. Regional contamination of offshore sediments would not be detectable.

Under ice, the volatile compounds from a spill would be more likely to freeze into the ice within hours to days rather than dissolve or disperse into the water underneath the ice. After onset of melt, oil spilled under ice generally tends to reach the ice surface in an unweathered state. However, once formed, a hydrocarbon plume in the water column underneath the ice would persist above ambient standards and background over about a fivefold greater distance than under open water conditions (see Cline, 1981).

For purposes of analysis, the larger of the assumed spill sizes was chosen. The weathering characteristics of the assumed 4,600-bbl oil spill (Table A.1-1) in the summer and during meltout are shown in Table A.1-7. Based on these characteristics, the estimated concentration of oil dispersed in the water column for a summer spill after (1) 3 days is estimated to be 1,740 ppb (assuming a 2-m dispersal depth); (2) 10 days is estimated to be 330 ppb (assuming a 5-m dispersal depth); and (3) 30 days is estimated to be 70 ppb (assuming a 10-m dispersal depth). If the spill occurred in the spring during melting, the environmental conditions affecting the characteristics of a spill would be different from those of summer. The estimated concentration of oil dispersed in the water column for a meltout spill after (1) 3 days is estimated to be 5650 ppb (assuming a 2-m dispersal depth); (2) 10 days is estimated to be 880 ppb; and (3) 30 days is estimated to be 130 ppb (assuming a 10-m dispersal depth). The estimated high concentrations of oil associated with dispersal in the water column may represent an upper range of dispersed-oil concentrations reached during the first several days following a large spill. These concentrations are greater than the 15 ppb that was assumed to be the total hydrocarbon chronic criterion and, after 3 days, less than the 1,500 ppb that was assumed to be the acute criterion. Both the summer and meltout concentrations of oil that are estimated to be dispersed in the water column after 30 days, 70 and 130 ppb, respectively, are within the range of concentrations reported for the larger *Argo Merchant* and *Amoco Cadiz* spills. However, these concentrations are much greater than the previously noted concentrations of petroleum hydrocarbons, 1-6 ppb, in Prince William Sound 21-41 days after the EVOS. The estimated concentration of dispersed oil in the water 30 days after both the summer and meltout spills is greater than 15 ppb and indicates a relatively long period of time, perhaps about a month or more, before dilution of the dispersed oil reduces the concentrations below the chronic criterion.

4.5.2.1.2. Mitigation Measures. None of the proposed mitigating measures (see Section 2.5) would decrease the already low estimated effects on water quality. Because oil spills from tankers tend to be larger than those from pipelines, the transportation of hydrocarbons by pipelines is preferred by MMS over tankers. The Alternative 2 scenario already assumes that pipelines would be used to transport produced oil and gas. Types and amounts of discharges that may impact water quality are regulated by the EPA through NPDES permits. This analysis assumes that development and production wastes would not be discharged.

4.5.2.1.3. Cumulative Effects Under Alternative 2.

4.5.2.1.3.1. Cumulative Effects from Exploration and Development. Water quality regulations ensure that the effects of oil and gas exploration and development activities are minor by restricting the types and amounts of discharges from facilities. Any discharges that are permitted would become diluted rather quickly, so the effects would be local and temporary.

4.5.2.1.3.2. Cumulative Effects from Oil Spills. Oil spills would not significantly degrade the quality of Chukchi Sea water. Even from a large spill, concentrations of hydrocarbons in water would be less than the acute criterion within 3 days of spillage, and concentrations above the chronic criterion likely would persist <30 days. Small spills would degrade the water quality locally for a relatively short period of time, though frequent small spills in an area could result in local, chronic contamination.

Overall Conclusion. The activities associated with petroleum exploitation resulting from proposed Sales 212 and 221 would be unlikely to have any substantial effects on water quality. The level of impact on water quality as a result of the proposed lease sales would be minor locally and negligible regionally due to the requirements of EPA and State of Alaska water quality criteria, and the effects would be temporary due to dilution. Proposed mitigation measures would not reduce effects further. The cumulative level of impact on water quality in the Chukchi Sea, including the combined effects of reasonably foreseeable activities and climate change as described in Section 4.5.1.1, would be minor to moderate.

4.5.2.2. Air Quality.

Introduction. Air emissions from OCS activities would be under the jurisdiction of EPA, which regulates air emissions as prescribed in 40 CFR Part 55. For facilities located within 25 mi of a State's seaward boundary, the regulations are the same as would be applicable if the emission source were located in the corresponding onshore area, and would include State and local requirements for emission controls, emission limitations, offsets, permitting, monitoring, testing, and monitoring. For facilities located beyond 25 mi of a State's seaward boundary, the basic Federal air quality regulations apply, which include the EPA emission standards for new sources and the PSD regulations. The EPA has established NAAQS for NO_2, SO_2, PM_{10}, $PM_{2.5}$, CO, lead, and O_3 because of their potential adverse effects on human health and welfare. The health and environmental effects of air pollutants have been summarized by EPA (EPA, 1979, 1998, 1999a). Ambient levels of NO_2, SO_2, PM_{10}, and O_3 can contribute to respiratory illnesses, especially in persons with asthma and the elderly, and can also aggravate heart disease.

Air emissions from OCS oil and gas development arise from production platforms, drilling activities, construction, support vessels, and helicopters. A comprehensive inventory of air emissions from OCS activities was constructed by Wilson et al. (2004), but it was specific only to operations in the Gulf of Mexico. Nevertheless, the emission factors developed in this study are of use in estimating emissions associated with the proposed lease sales in the Chukchi Sea.

The OCS operations in the Arctic Ocean are unique in a number of ways due to the sea ice that is present much of the year. In very shallow waters (5-10 m depth), exploratory wells may be drilled from an ice or gravel island (USDOI, MMS, 2003a). Construction of an ice island would need to take place in winter, and material and personnel would be carried to the site by vehicles operating on an ice road. In water 10-20 m deep, movable platforms resting on the seafloor may be used for exploration. Drilling operations from these platforms could take place all year. Ice islands are not projected for the Chukchi Sea because activities there would not occur close to shore. In deeper waters, drill ships or floating platforms would need to be used, and drilling would be limited to a short time period during the summer months. Material and supplies would be ferried using barges or supply boats. In addition, icebreakers would operate in the vicinity of the drilling rig and vessels to control sea ice. Because of the arctic conditions, the pace of development is slower as activities are limited to certain, rather narrow, timeframes.

4.5.2.2.1. Effects from Routine Air Emissions. In the exploration phase, emissions would be produced by the following:

- Vessels used for seismic and other geological and geophysical surveys;
- Diesel power-generating equipment needed for drilling exploratory and delineation wells;
- Tugboats, supply boats, icebreakers, crew boats, and helicopters used in support of drilling activities; and
- Intermittent operations such as mud degassing and well testing.

Pollutants generated would consist primarily of NO_x, CO, and SO_2. In the analysis, it is assumed that exploration activity would begin in the year following the lease sale, and that up to three seismic surveys could be conducted during the open-water season. Seismic surveys in the Chukchi Sea probably would be coordinated with surveys in the Chukchi Sea to use the same vessels. Typical seismic survey operations would consist of a large seismic vessel towing air guns and cable arrays and a smaller support boat. Survey times likely would average 20-30 days (with down time) to cover a likely survey area of 200 m^2.

Drilling operations would be expected to range between 30 and 90 days at different well sites, depending on the depth to the target formation, difficulties encountered during drilling, and logging/testing operations. Because of the relatively short open-water season in the Chukchi Sea (July-October), a maximum of three exploration wells would be drilled in the open-water season.

In the development phase, including temporary construction operations and drilling, the main sources of emission offshore would be:

- Gas turbines used to provide power for drilling;
- Production equipment, including boilers, heaters, and storage tanks;
- Reciprocating engines used for electrical power, including rig generator (during construction phase only; standby only during commissioning);
- Heavy construction equipment used to install facility and pipelines;
- Construction- and commissioning-support equipment, including cranes, pumps, generators,
- compressors, pile drivers, welders, heaters, and safety flares; and
- Tugboats (needed to move equipment and supply barges), support vessels, and helicopters.

Under EPA and ADEC regulations, best available control technology would be applied for many of the emission sources. The main emissions would be NO_x and CO, with lesser amounts of SO_2, VOC, and PM. Emissions from development under the Proposed Action would be from the installation of one to three platforms, construction of 90 mi of offshore pipeline, drilling of 100 production wells, and constructions of up to 70 mi of onshore pipeline to connect to the TAPS. In the peak years, 8-16 wells per year would be drilled from 1-2 drilling rigs. In the peak year of production, about 44.5-151.7 MMbbl of oil per day would be produced.

In the production phase, the main source of offshore emissions would be from turbines for power generation, gas compression, oil pumping, and water injection. Another source of emissions would be evaporative losses of VOC from oil/water separators, tanks, pumps, compressor seals, and valves. Reduction in VOC emissions would be achieved by equipping produced water and slop-oil tanks with vapor-recovery systems and using valves and seals designed to prevent VOC leakage. The VOC would also be emitted if there were an accidental release of gas (venting). Operators would be required to have a safety flare to safely burn any unexpected releases of natural gas. Flaring gas would be done for safety purposes; but it also would eliminate most of the VOC, although some emissions of NO_x, SO_2, and PM would be released.

Abandonment of facilities after production is no longer viable would require heavy equipment, trucks, and barges, which would emit pollutants at levels comparable to the initial construction phase. Because abandonment operations would last a short time and include no activities that would affect air quality more significantly than previous phases, abandonment operations would cause insignificant effects on air quality.

Other sources of pollutants related to OCS operations are accidents such as blowouts and oil spills. Typical emissions from such accidents consist primarily of VOC; only fires associated with blowouts or oil spills produce other pollutants.

Air emissions resulting from a proposed Chukchi Sea lease sale were estimated by using the exploration and development scenario presented in Table 4.5.2.2-1 and applying air emission factors derived from the permit application for the Shell exploration project (EPA, 2007) and from the Northstar and Liberty development projects (BP Exploration, 1998a, b). Table 4.5.2.2.-1 shows estimated emissions for the various types of activities.

Air quality modeling using the Offshore and Coastal Dispersion (OCD) model has been performed in past studies to assess impacts from planned lease sales in the Beaufort Sea (USDOI, MMS, 1996b) and the Chukchi Sea; additional discussions of air quality impacts may be found in USDOI, MMS (1998b) and MMS (2003a). The highest predicted onshore annual average NO_2 concentrations were in the range of 0.5-1.5 $\mu g/m^3$, which is well within the PSD Class II maximum allowable increase of 25 $\mu g/m^3$. Concentrations of SO_2 and PM_{10} were not modeled; however, when one scales the results according to the respective emission rates, the levels would be well within the PSD Class II increments. Modeling for the Northstar and Liberty projects on gravel islands in the Beaufort Sea (USDOI, MMS, 2002b; U.S. Army Corps of Engineers, 1999) resulted in higher concentrations, because they considered points just outside the facility boundary, but the levels predicted for NO_2, SO_2, and PM_{10} were still within the PSD Class II limits.

An examination of the air quality analysis performed for the Northstar facility and proposed Liberty development project in the Beaufort Sea will give a measure of the expected impacts over water near an OCS production facility on a gravel island in the Beaufort Sea. The highest predicted concentrations for NO_2, SO_2, and PM_{10} for the Northstar and Liberty projects occurred within 200 m of the facility boundary and were close to PSD Class II increments (USDOI, MMS, 2002b; U.S. Army Corps of Engineers, 1999). The highest onshore concentrations were considerably lower because of the effect of atmospheric dispersion over distance. The combined facility concentrations for Liberty plus background were well within NAAQS (between 2% and 30% of the standards). The maximum projected throughput per platform for a Chukchi Sea lease sale is lower than that analyzed for the Liberty project. It is likely that air quality impacts would be somewhat lower than those from the proposed Liberty project.

Finally, one could examine the effect on air quality from the most significant sources of industrial emissions in the Alaska Arctic, the Prudhoe Bay/Kuparuk/Endicott oil-production complex. The area was the subject of monitoring programs during 1986-1987 (ERT Company, 1987; Environmental Science and Engineering, Inc., 1987) and from 1990 through 1996 (ENSR, 1996, as cited in U.S. Army Corps of Engineers, 1999). Five monitoring sites were selected; three were considered subject to maximum air-pollutant concentrations, and two were considered more representative of the air quality of the general Prudhoe Bay area. The more recent observations are summarized in Table 4.5.2.2-1. All the values meet Federal and State ambient air quality standards. The results appear to demonstrate that ambient pollutant concentrations from oil and gas development, even for sites subject to maximum concentrations, meet the ambient air pollution standards.

Summary and Conclusion for Effects from Routine Air Emissions to Air Quality. Air emissions from OCS activities resulting from Chukchi Sea Lease Sale 212 or 217 would be subject to EPA and ADEC emission control standards and would have to meet the PSD Class II and the NAAQS. There would be an increase in the level of criteria pollutants, with the highest level within a few hundred meters of the emission source. Pollutants regulated under PSD would consume a certain portion of the Class II increment, but the area affected would be localized and the maximum allowable increment would not be exceeded. Pollutant concentrations would fall off with distance, and onshore impacts would be significantly lower. Air quality impacts would be comparable or lower than those predicted for Lease Sale 144. One can reasonably conclude that the release of criteria pollutants would remain well within PSD limits and NAAQS. Consequently, the air quality impacts would be low.

4.5.2.2.2. Effects from Oil Spills and Accidents. Small accidental crude oil spills would cause minor, localized increases in concentrations of VOC due to evaporation of the spill. Most of the air emissions would occur within a few hours of the spill and would decrease drastically after that period.

Large spills would result in air emissions over a large area and a longer period of time. Large spills could occur from a well facility or pipeline. Hanna and Drivas (1993) modeled the emissions of various hydrocarbon compounds from a large spill; they examined the rate or evaporation and ambient concentrations of 15 different VOC. A number of these compounds, including benzene, ethylbenzene, toluene, and o-xylenes, are classified by EPA as hazardous air pollutants. The results showed that these compounds vaporize almost completely within a few hours after a spill. Ambient concentrations peak within the first several hours after a spill and are reduced by two orders of magnitude after about 12 hours. The heavier compounds take longer to vaporize and may not peak until about 24 hours after spill occurrence. Total ambient VOC concentrations would be significant in the immediate vicinity of a large oil spill, but concentrations would be much reduced after the first day.

During open-water conditions, spreading of the spilled oil and action by winds, waves, and currents would further disperse VOC concentrations to extremely low levels over a relatively larger area. During broken ice or melting-ice conditions, because of limited dispersion of the oil, the concentrations might reach slightly higher levels for several hours, possibly up to 1 day. The effects from a spill occurring under the ice would be similar to but less than those described for broken-ice or melting-ice conditions; the oil would be trapped and essentially remain unchanged until the ice began to melt and breakup occurred. Some VOC emissions, however, would be released from the oil and dispersed, even from under the ice. In any of these situations, surface winds would further reduce VOC concentrations in the air. Concentrations of criteria pollutants would remain well within NAAQS.

Diesel fuel oil could be spilled either while being transported or from accidents involving vehicles, vessels, or equipment. A diesel spill would evaporate faster than a crude oil spill. Ambient hydrocarbon concentrations would be higher than with a crude oil spill but would persist for a shorter time. Also, because any such spill probably would be smaller than some potential crude oil spills, any air quality effects from a diesel spill likely would be lower than for other spills.

Any accidental release of oil or gas could catch fire or could be intentionally ignited during cleanup. In situ burning is a preferred technique for cleanup and disposal of spilled oil. Burning could affect air quality in two ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons by 99.98% and slightly increase emissions of other pollutants. If an oil spill were ignited, it would emit a plume of black smoke containing nitrogen dioxide, SO2, CO, and PM, but the amount of VOC that otherwise would be emitted through evaporation would be significantly reduced.

In situ burning as part of a cleanup of spilled crude oil or diesel fuel would temporarily affect air quality, but the effects would be low. Fingas et al. (1995) describes the results of a monitoring program of an oil-spill test burn at sea. The program involved extensive ambient measurements recorded during two burns in which approximately 300 bbl of crude oil were ignited. During the burn, nitrogen dioxide, SO2, and CO emissions were measured only at background levels and frequently were below detection limits. Ambient levels of VOC were high within about 100 m of the fire but were significantly lower than those associated with a non-burning spill. Measured concentrations of polyaromatic hydrocarbons (PAHs) were low. It appeared that a major portion of these compounds was consumed in the burn. Effects of in situ burning for spilled diesel fuel would be similar to those associated with a crude oil spill.

If the gas or oil blowout caught fire or if an oil spill was ignited intentionally to clean up and dispose of the spilled oil, burning would reduce emissions of gaseous hydrocarbons by 99.98% and very slightly increase emissions of other criteria pollutants, relative to the quantities emitted in other industrial operations (see USDOI, MMS, 1996a:Table IV.B.12-3). If an oil spill was ignited immediately after spillage, the burn could combust 33-67% of the crude oil or higher amounts of fuel oil that otherwise would evaporate. Incomplete combustion of oil, however, would cause about 10% of the burned oil to be discharged as oily soot into the air. For a major oil blowout, in situ burning may be the only effective technique for spill control. Setting fire to the wellhead could burn 85% of the oil, with 5% remaining as residue or droplets in the smoke plume, in addition to the 10% released as soot (Evans et al., 1987).

The principal contributor of pollution from a fire would be soot. Soot would cling to plants near the fire but would tend to slump and wash off vegetation in subsequent rains, limiting any health effects. Potential contamination of shoreline and onshore vegetation would be limited, however, because exploration and development and production activities under the Proposed Action would be at least 8 nmi offshore, with the exception of any oil- or gas-transport pipelines.

Coating portions of the ecosystem in oily residue is not the only potential air quality risk. Smoke from burning crude oil would contain PAH's. Benzo(a)pyrene, which often is used as an indicator of the presence of carcinogenic varieties of PAH's, is present in crude-oil smoke in very small amounts, but in quantities approximately three times larger than in the unburned oil (Evans, 1988). Investigators have found that, overall, the oily residue in smoke plumes from crude oil is mutagenic, although not highly so (Sheppard and Georghiou, 1981; Evans et al., 1987). McGrattan et al. (1995) reported that smoke-plume models have shown that the surface concentrations of particulate matter do not exceed the health criterion of 150 $\mu g/m^3$ beyond about 5 km downwind of an in situ burn. This is quite conservative, as this health standard is based on a 24-hour average concentration rather than a 1-hour average concentration. The Expert Committee of the World Health Organization considers daily average smoke concentrations of >250 $\mu g/m^3$ to be a health hazard for bronchitis.

Summary and Conclusion for Effects of an Oil Spill and Accidents on Air Quality. Over the life of oil and gas exploration, development, and production in the sale area, the likelihood of one or more large oil spills occurring is 40%. Total ambient VOC concentrations would be significant in the immediate vicinity of a large oil spill, but concentrations would be much reduced after the first day. An oil spill could be set on fire accidentally or deliberately. Burning would significantly reduce the VOC concentrations in the area, but increase slightly the concentrations of other criteria pollutants. The principle contributor of pollution from a fire would be soot. Potential contamination of the shore would be limited, however, because exploration, development, and production activities under the Proposed Action would be at least 8 nmi offshore, with the exception of any oil- or gas-transport pipelines. Smoke from an oil fire could have health risks, although the daily average smoke concentrations would be below the level that constitute health hazard for bronchitis. Other air quality effects from cleanup activities would include emissions from vessels, vehicles, and equipment used in the cleanup effort; air emissions from this equipment would be minimal. We conclude, therefore, that the effect on onshore air quality from accidental releases and corresponding cleanup efforts likely would be low.

4.5.2.2.3. Other Effects to Air Quality. Other effects from air pollution from sale-related activities to the environment not specifically addressed by air-quality standards include the possibility for damage to vegetation from acidification of coastal areas and reduced visibility. These effects may be short term (hours, days, or weeks), long term (seasons or years), regional (Arctic Slope), or local (nearshore only).

Olson (1982) reviewed susceptibility of fruticose lichen, an important component of the coastal tundra ecosystem, to sulfurous pollutants. There is evidence that SO_2 concentration as low as 12.0 $\mu g/m^3$ for short periods can depress photosynthesis in several lichen species, with damage occurring at 60 $\mu g/m^3$. In addition, the sensitivity of lichen to sulfate is increased in the presence of humidity or moisture, conditions that are common in coastal areas.

For their proposed Liberty development project, BPXA found that maximum modeled pollutant concentrations were well below levels that can damage lichens, according to laboratory studies. Research at Prudhoe Bay from 1989 through 1994 showed no effects of pollutants there on vascular plants or lichens (Kohut et al., 1994). Monitoring the vascular and lichen plant communities over the 6 years revealed no changes in species composition that could be related to differences in exposures to pollutants.

Visibility may be defined in terms of visual range and the contrast between plume and background, which determines perceptibility of the plume. For the proposed Liberty Project, BPXA ran the VISCREEN model, which calculates the potential impact of a plume of specified emissions for specific transport and dispersion conditions. It found noticeable effects on a limited number of days, ones that had the most restrictive meteorological conditions, but no effects at all during average meteorological conditions.

A significant increase in O_3 concentrations onshore is not likely to result from exploration, development, or production scenarios associated with the proposed sale. Photochemical pollutants such as ozone are not emitted directly; they form in the air from the interaction of other pollutants in the presence of sunshine and heat. Although sunshine is present in the Chukchi Sea Proposed Action area most of each day during summer, temperatures remain relatively low (Brower et al., 1988). Also, OCS activities would be relatively small and separated from each other at some distance, diminishing the combined effects from these activities and greatly increasing atmospheric dispersion of pollutants before they reach shore.

Community Views on Air Emissions. Elder Bessie Ericklook from Nuiqsut maintained that since the oil fields have been established at Prudhoe Bay, the foxes have been dirty and discolored in the area of Oliktok Point (Ericklook, 1979, as cited in USDOI, BLM, 1979a). Leonard Lampe, former Mayor of Nuiqsut, more recently reported further air-pollution problems and habitat concerns, asserting that Nuiqsut has been experiencing such effects for some time: "A lot of air pollution, asthma, bronchitis—a lot with young children. We see smog pollution that goes from Prudhoe Bay out to the ocean and sometimes to Barrow when the wind is blowing that way…." (Lavrakas, 1996:1, 5).

Summary and Conclusion for Other Effects on Air Quality. Air emissions from a proposed Chukchi Sea lease sale would be subject to EPA and ADEC pollution control requirements. Air quality modeling of typical OCS activities in the Chukchi Sea has demonstrated that with appropriate emission control technologies, pollutant concentrations would be below the PSD incremental limits and the NAAQS. The highest concentration levels would be localized and onshore concentrations would be significantly lower than the modeled results. Because of the distances from the most likely developments to Chukchi coastal communities and the relatively small sizes of anticipated development in the Chukchi compared to the Prudhoe Bay complex, the proposed sale should have little to no significant effect on the air quality of coastal communities. The effects on vegetation and visibility under the Proposed Action would be low.

4.5.2.2.4. Cumulative Effects Under Alternative 2. The cumulative analysis considers the impacts from future OCS oil and gas development in addition to all other reasonably foreseeable emission sources.

The primary emissions in the Arctic Ocean coastal areas arise from oil production facilities and pumping stations on the North Slope, oil production in state waters, on-road and off-road motor vehicles, power generators, heating systems, marine vessels, and aircraft. While some growth of these activities is likely to take place in the future, overall emissions will likely not exceed present levels. Emission standards on motor vehicles are becoming more stringent and the EPA has promulgated new standards on non-road engines and marine vessels. These should result in a downward trend for those emission sources.

There are no significant industrial emission sources in the Chukchi Sea area. The nearest large source of air emissions are from oil production activities in the Alpine and Kuparuk units on the North Slope and the Red Dog Mine about 50 mi from the village of Noatuk and about 55 mi inland from the Chukchi Sea. These emissions have a negligible impact on air quality around the Chukchi Sea. New oil development may result from future state leases and Federal lease sales in the NPR-A. Should any natural gas production occur in the future, there may be air emissions from any related gas processing. Any air quality impacts to Chukchi Sea air quality would be negligible. Any development on potential state leases around the Chukchi Sea area would result in local increases in concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$, and CO. There also would be local sources of gaseous emissions and fugitive dust from construction and maintenance activities associated with both existing and new facilities. Any major emission sources (>250 tons per year) would be subject to the PSD incremental limits for NO_2, SO_2 and PM_{10}. Air quality impacts would be minor.

On the Alaska North Slope, onshore oil production from the Prudhoe Bay, Kuparuk, Milne Point, Colville River, and Badami fields, and oil production from the Duck Island and Northstar fields in State waters are the largest source of emissions. Production from North Slope reservoirs peaked at about 2 MMbbl of oil per day in 1988, and declined to about 0.9 MMbbl per day in 2005 (U.S. Department of Energy, 2007). Production is predicted to remain relatively steady through 2010 and then decline to about 0.5 MMbbl per day by about 2020 (U.S. Department of Energy, 2007).

Actual annual emissions for Prudhoe Bay, Milne, Endicott, and Lisburne for 1994-1995 were reported to be 56,247 tons of NO_x, 6,199 tons of PM_{10}, 2,648 tons of VOC, and 1,471 tons of SO_2 (U.S. Army Corps of Engineers, 1999). While there are many major emission sources (emissions exceeding 250 tons/year) in these production areas, ambient air quality monitoring in the existing North Slope oil production areas has shown that air pollutant levels are well within Federal and State standards (U.S. Army Corps of Engineers, 1999). No ambient air quality data have been collected in the Beaufort or Chukchi Seas. As very few emission sources exist in those areas, air quality should be relatively pristine.

Modeling studies of proposed OCS production facilities in the Beaufort Sea show that concentrations of NO_2, SO_2, and PM_{10} that are within the NAAQS and the PSD incremental limits. The maximum concentrations of NO_2, SO_2, and PM_{10} occur within about 200 m of the facility and are considerably lower at distances >1 km (USDOI, MMS, 2001a). Therefore, there would be little cumulative interaction between facilities that would be located some distance apart. Cumulative impacts therefore would not differ significantly from those associated with the proposed lease sale.

Impacts from OCS activities on ozone and visibility are discussed in Section 4.5.2.2.3. Cumulative impacts from the OCS program would not differ significantly from those associated with the proposed lease sale.

Small accidental oil spills would cause small, localized increases in concentrations of VOC due to evaporation of the spill. Most of the emissions would be expected to occur within a few hours of the spill and decrease drastically after that period. Large spills would result in emissions over a large area and a longer period of time. A discussion of the effects of oil spills on air quality is presented in Section 4.5.2.2.2.

A discussion of the effects of in situ burning is presented in Section 4.5.2.2.2. Studies of in situ burn experiments have shown that air quality impacts are localized and short lived and that pollutant concentrations do not pose a health hazard to persons in the vicinity.

Cumulatively there would be a slightly larger number of oil spills in the Arctic area compared to the predicted number of spills for the proposed Chukchi Sea lease sales. However, the effect of an individual spill would not change; only the probable number of spills would increase. The air quality impacts for the cumulative case would, therefore, be the same as those associated with the proposed Chukchi Sea sales.

Conclusion. The cumulative air quality impacts from existing and future oil production activities on the OCS, State waters, and onshore would result in localized concentrations of be air pollutants. The concentrations would be within the NAAQS and the PSD incremental standards. Air quality impacts would be minor. The proposed Chukchi Sea lease sales would make a minor contribution to the cumulative impacts. Air quality impacts from oil spills would be localized and of short duration.

4.5.2.2.5. Effects from Greenhouse Gas Emissions to Climate. Estimates were made of the total emissions of CO_2 and methane (CH_4) for all projected activities associated with the proposed Chukchi Sea lease sales. Emission factors for the various activities were largely based on a comprehensive inventory of air emissions from OCS activities in the Gulf of Mexico for the year 2000 (Wilson et al., 2004). Emissions are given in terms of teragrams (Tg) of CO_2 equivalent, where one Tg is 10^{12} grams (10^6 metric tons). This measure takes into account a global warming potential (GWP) factor, which accounts for the relative effectiveness of a gas to contribute to global warming with respect to the same amount CO_2. CH_4 has a GWP of 21.

Table 4.4.2.2-2 lists the total calculated emissions of CO_2 and CH_4 from activities associated with a Chukchi Sea lease sale under the proposed multiple-sale program and compares them with the total U.S. greenhouse gas emissions for the year 2005. The emissions presented are those for the peak period of activity for the lease sale. The projected CO_2 emissions are about 0.006-0.008% of all year 2005 CO_2 emissions in the U.S. The CH_4 emissions are about 0.0001-0.0004% of the year 2005 CH_4 emissions in the U.S. If one combines the CO_2 and CH_4 emissions, the lease-sale emissions would be about 0.005-0.007% of the current nationwide figures. The estimated global CO_2 emission rate from combustion of fossil fuels for the year 2005 is approximately 28,193 Tg (EPA, 2008). The U.S. contribution to this total is about 20 percent (EPA, 2008). The estimated 5-Year Program CO_2 emissions are about 0.08-0.016% of the global CO_2 emissions from fossil fuel combustion.

A number of mitigation strategies could be adopted by operators with the goal to reduce greenhouse gas emissions from OCS oil and gas development activities. Use of more energy-efficient engines, turbines, and boilers would reduce CO_2 emissions. Use of gas instead of diesel fuel to provide power on platforms significantly would reduce emissions. However, many operators already primarily rely on produced gas once production starts. More efficient scheduling of transport of material and personnel could lower service-vessel CO_2 emissions by reducing the number of vessel and helicopter trips. Application of optimum power settings on vessels would reduce fuel use and, hence, greenhouse gas emissions.

As noted above, the percentage contribution of CH_4 to the nationwide emissions is significantly greater than that for CO_2. Reductions in CH_4 emissions appear to have the greatest potential in achieving reductions of greenhouse gas emissions from OCS sources. Venting natural gas currently contributes about 59% to the total CH_4 emissions in the Gulf of Mexico. Fugitive emissions sources contribute another 19%. Flaring excess gas rather than venting it would significantly lower overall greenhouse gas emissions from OCS platforms (Herkhof, 2005), although flaring gas would increase CO_2 emissions. More intensive programs to check for fugitive leaks on platforms also would lower CH_4 emissions. Other possible measures to reduce CH_4 emissions would include use of a lighter color of paint on storage tanks to reduce vapor losses and, in cases where crude oil is transported by tanker, use of vapor-balance lines during oil transfer operations.

Conclusion. Activities associated with the proposed Chukchi Sea lease sales would result in a negligible contribution to U.S. and global greenhouse gas emissions.

4.5.2.3. Lower Trophic-Level Organisms.

Summary. Three aspects of the proposed lease sales that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells may likely be local and minor. Any exploratory discharges during summer would likely have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL about pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. Therefore, the cumulative level of effects, including the effect of ongoing climate change, would be major. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.2.3.1. Direct and Indirect Effects Under Alternative 2. Lower trophic-level organisms in the Chukchi Sea are subject to the same potential effects that are summarized under Alternative 1 (Section 4.5.1.2). The potential effects of operations on existing leases were assessed previously in the EA for Chukchi Lease Sale 193 (USDOI, MMS, 2006b), the seismic-survey PEA (USDOI, MMS, 2006a), and the 5-Year Program EIS (USDOI, MMS, 2007c:Section IV.B.3.h). The assessments concluded generally that the overall level of effect with mitigation would be moderate and local; none of the assessments concluded that the level of effects with standard mitigation would be substantial. There have been only a few exploratory drilling operations in the Chukchi Sea; during the early 1990s five holes were drilled, and drilling muds were discharged during the operations. Temporal changes in the Chukchi and northern Bering benthic communities have been observed (Grebmeier et al., 2006), but the authors did not relate the changes to the previous exploratory drilling or discharges. Instead, they related the changes to broad-scale changes in the ice cover and climate, as summarized in Section 3.3.1.2. This section assesses the direct and indirect effects. This section includes a summary of the effects of the Proposed Action, the specific effects from additional seismic surveys (Section 4.5.2.3.1.1), the effects from oil spills (Section 4.5.2.3.1.3), and effects from additional exploration and development (Section 4.5.2.3.1.2). Section 4.5.1.3.2 is a discussion of the measures.

4.5.2.3.1.1. Effects from Seismic Surveys. The effects from seismic exploration on benthic and planktonic organisms probably would be immeasurable, as concluded in the Chukchi Sea EA for Sale 193 (USDOI, MMS, 2007d:Section IV.C.1.c(2) and the seismic-survey PEA (USDOI, MMS, 2006a). The proposed lease-sale area is too deep for ocean-bottom cable (OBC) surveys, which might disturb special benthic communities. The conclusion is consistent with the results of a recent, detailed review by the Canadian government on the effects of seismic sound on invertebrates and other organisms (CDFO, 2004). The CDFO review concluded that there are no documented cases of invertebrate mortality (i.e., of adult life stages, as opposed to eggs or larval life stages) from exposure to seismic sound under field-operating conditions. Similarly, a NMFS Biological Opinion dated June 2006 (NMFS, 2006), concluded that invertebrates probably would not be affected, with the possible exception of squid. Regardless, the effects of specific seismic exploration under standard stipulations (http://www.mms.gov/alaska/re/permits/stips1-5.htm) would be assessed later by MMS.

4.5.2.3.1.2 Effects from Exploration and Development. In this section we include the effects of additional seafloor disturbance, including habitat alteration and the effects of additional discharges.

Additional Seafloor Disturbance or Habitat Alteration. Disturbance during exploration might be caused by the anchoring of drillships and/or drilling vessels, and the construction of "mud-line cellars" for seafloor well-head equipment for the anticipated 14 additional wells. Drillships might include ones like the *Kullu*, which a petroleum company has proposed to use for exploration of Beaufort Sea prospects, and which is anchored on location with about eight large anchors. The seafloor disturbance during previous drilling at the five previously explored Chukchi Sea prospects apparently was very low, possibly like the seafloor disturbance caused by the deep ice keels that ground almost yearly on the relatively shallow Hanna Shoal near the center of the proposed lease area (Map A.1-2c; Eicken et al., 2006). Therefore, the disturbance effect of seafloor sampling and 14 anticipated exploratory wells probably would be negligible, unless they were located near any special biological communities. In that case, MMS could require operators to conduct benthic surveys for such communities. This is similar to the level of effect of disturbance during exploration that was assessed in the Sale 193 EA (USDOI, MMS, 2007d:Section IV.C.1.c(3)(a)1)).

During development and production, disturbance would be caused partly by the installation of production platforms and short docks for onshore support bases. We estimate that there might be one such platform and, like the bottom-founded single steel drilling caisson, it would have a footprint of only a few acres. The low level of effect is confirmed by a recent study of benthos around offshore platforms (Terlizzi et al., 2008). They measured benthic-community changes around platforms in a warm-water environment. They found the greatest changes in the benthos around a deep-water (90 m) platform, and attributed the changes to attached organisms that fell off. Overall, the effect of the disturbance on several acres of benthos in the whole Chukchi Sea probably would be very minor. Regardless, MMS would review in detail any DPPs, including any plans for platform installation; and could require seafloor surveys before the installation of any platforms. The U.S. Army Corps of Engineers also would review the proposals for platform installation, if they involved "fill" or construction of a berm and fall within the agency's jurisdiction.

Short docks also might be constructed for new logistical shore bases (Sections 4.1.2 and 3). An example is the 1.5-km (1-mi) long East Dock that was constructed in eastern Prudhoe Bay on the Beaufort Sea coast. As explained, there have been many studies of nearshore water quality since it was built 3 decades ago, but none have documented adverse effects on water quality or lower-trophic level organisms. Therefore, short docks and short causeways probably would not disturb measurably the hydrologic conditions and lower trophic-level organisms. Subsequent NEPA analysis by MMS and the U.S. Army Corps of Engineers of any development proposals with docks would help to alleviate site-specific effects.

Disturbance also would be caused during the burial of offshore pipelines. We estimate that numerous subsea pipelines would radiate out from each production platform, gathering the production from 20-30 subsea templates with 80-120 wells total (reference scenario). Also, a single pipeline would be buried from a production platform to shore over an estimated distance of 48-220 km (30-150 mi). We estimate that overall, 190-400 km (120-250 mi) of production pipelines might be laid on the Chukchi seafloor. Ice has gouged the seafloor in water up to about 50 m in depth (Section 3.2.4), so almost all of the pipelines would have to be buried deep enough to avoid disturbance from ice keels. The subsea soil in the Chukchi Sea is mostly unconsolidated, as explained in Sections 3.2.1 and 3.3.1. Pipeline trenches 12-ft deep in unconsolidated Beaufort Sea soil would have been up to 40 m (130 ft) wide at the top, as estimated for a development pipeline to the Liberty prospect (USDOI, MMS, 2002b:Section III.C.3.e(2)(b)2)b)). If we assume that Chukchi pipeline trenches would be about half that width (20 m [70 ft]), about 1,000-2,000 acres (202-404 hectares) of Chukchi seafloor might be disturbed during the burial of production pipelines. The seafloor is inhabited by mollusks (clams) and other infauna that are particularly abundant in the northern and northeastern parts of the proposed lease area (Section 3.3.1; Feder et al., 1994:Figure 4b). As explained in the Sale 193 EA (USDOI, MMS, 2007d:Section III.B.1.b), the recolonization time of disturbed benthic areas is slow, and that specifically only about 65% of the benthic organisms recolonized a disturbed area within 9 years (Conlan and Kvitek, 2005). The large clams on which walrus usually feed (Section 4.3.1.3.8) probably are some of the last organisms to recolonize disturbed areas. Therefore, this assessment assumes that the recovery time would require slightly more than a decade. Overall, we assume an extensive system of buried pipelines that would disturb 1,000-2,000 acres (202-404 hectares) of typical benthic organisms that would slowly recolonize the area within a decade, leading to a major level of effect within the Chukchi Sea.

In summary, the disturbance effect of 14 anticipated exploratory wells likely would be local and minor, as concluded in the Sale 193 EA. For development, this assessment assumes that produced hydrocarbons would not be transported to shore by tanker or barge; we estimate that a network of buried pipelines would radiate from a central production platform on the central shelf, and that a single long pipeline would extend to shore. Pipeline burial likely would disturb up to 2,000 acres (810 hectares) of typical benthic organisms. These organisms would likely recolonize the pipeline corridors over a decade, just as they slowly recolonize ice gouges. Site-specific disturbance effects would be assessed later; some assessments might need more accurate information on recolonization and coastal erosion rates. There would be further assessments of any pipeline proposals by the MMS and the Corps of Engineers because they are within those agency jurisdictions.

Additional Discharges. Exploratory discharges would include an estimated 3,000 short tons of drilling mud per year and, over the 7-year period of exploratory drilling, an estimated total of about 26,000 short tons of drilling mud and 33,000 short tons of drill cuttings (USDOI, MMS, 2007d). The effects of exploratory drill mud and cuttings discharges were discussed during a recent meeting with industry, government and academic representatives (Shell Exploration & Production, 2008). Two of the discussion topics were the terms of existing EPA NPDES discharge permits, and the background concentrations of metals in sediments and the biota along the Alaskan Arctic coast. Detailed information on any proposed discharges from Sale 193 leases would be contained in future EPs, including the general toxicity of the discharges; and that information would be reviewed by MMS and EPA. The volumes that might be released from Sale 193 leases are similar to the estimated discharge volumes in the Chukchi Sea Sale 126 EIS. The Sale 126 EIS concluded that the effect on benthic organisms would be low, and the effects on pelagic organisms would be very low (USDOI, MMS, 1990b:Section IV.C.3.c). Muds and cuttings were discharged during the previous exploratory drilling of five wells in about 40 m (140 ft) of water in the Chukchi Sea. The current description of the environment (Section 3.3.1) identified no offshore areas of high production, or biological "hot spots," that might have been affected by discharges. The proposed Sale 193 area includes some nearshore tracts that were not included in Chukchi Sea Sale 126. The water depth of the inner tracts is about 100 ft (30 m), so it is deep enough for discharges in open water and broken ice. Discharges in the adjacent Beaufort Sea are restricted under stable and/or broken ice in water that is <20m (65 ft) deep, because the water circulation is very restricted during the long winter (see Section 4.4.2.1). The water circulation across the Chukchi shelf is not restricted during the exploratory drilling season (i.e., during the summer open-water period), as shown by the estimated monthly exchange of about half the water on the shelf near the old Burger drill site (Woodgate, Aagaard, and Weingartner, 2005). However, in the coastal waters, the circulation might not be as rapid and the productivity is generally higher, as explained in Section 3.3.1. Furthermore, the coastal benthic communities are fed on by many marine mammals and birds that use the coastal areas as a migratory corridor, as discussed in Sections 3.3.5 and 4.4.5. Drilling muds are composed primarily of bentonite (clay), so the toxicity is low. The drilling muds probably would not kill benthic organisms, as concluded also in Section 4.4.2.1, Water Quality. However, any heavy metals in drilling muds might be accumulated by benthic organisms, adding to the body burden in vertebrate consumers. Inorganic mercury accumulated in the sediment near an old platform in the Gulf of Mexico, but the platform did not have the new EPA limits on mercury discharges. In northwest Alaska, the atmosphere is a source of mercury contamination (Garbarino et al., 2002). Total and methyl mercury in zooplankton from the outer Chukchi Sea is relatively low; but apparently it can be accumulated by zooplankton, as shown by those organisms from the eastern Canadian portion of the Beaufort Sea (Stern and Macdonald, 2005). Overall, the exploratory discharges during summer probably would lead to low effects if they were offshore but to slightly greater local effects in relatively shallow water nearer to the coast; regardless, discharge proposals would be reviewed by MMS and EPA.

The effects of production discharges of drilling muds and cuttings are discussed in Section 4.5.2.1.1.1.1, concluding that any water quality effects would be local. The level of effect on plankton and benthos probably would be similar. Any proposed discharge of produced water in the Chukchi Sea would lead to subsequent detailed assessments. The NPDES program requires that water quality-based limitations be applied, as prescribed in the Clean Water Act at 403(e), to ensure that no unreasonable degradation occurs. The evaluation also would examine other effects (e.g., air emissions, potential for spills, etc.) associated with different options. Further, if produced water is discharged, the toxicity of the discharge would be carefully monitored and regulated under the NPDES program.

In summary, any exploratory discharges probably would have only local effects on plankton. Discharges of produced water would have only local effects on water quality (Section 4.5.2.1.1.1.2) and probably would have similar low effects on planktonic and benthic organisms. Any discharge proposal would be reviewed in detail by MMS and EPA.

4.5.2.3.1.3. Effects from Oil Spills. The Chukchi Sea Sale 193 EA concluded that oil and gas liquids are difficult to recover in water with sea ice, and that the effects of a large spill on marine plants and invertebrates would be very low, and the effect on nearshore communities would be low (USDOI, MMS, 2007d:Section IV.C.1.c(4)(b). In the current assessment, we update the effect of a large spill (≥1,000 bbl). The OSRA model estimates the chance of one or more large spills ≥1,000 bbl occurring over the 25-year production life of Alternative 2 (Section 4.3.2.1.1). For this assessment, we assume a 1.500-bbl platform spill or a 4,600-bbl pipeline spill. A 4,600-bbl spill is estimated to cover 42 km^2 (18 mi^2) of water within 3 days during summer (Table A.1-12). The spilled hydrocarbons would float, affecting the neuston (open-water surface zooplankton) and/or the under-ice biota (Gradinger and Bluhm, 2005), but not the benthos. As discussed elsewhere in this assessment, the spill might persist on the water surface for a month (Appendix A.1, Section 2.2.2).

A pelagic habitat that is special (i.e., is a biological “hot spot”) occurs in the southwestern Chukchi Sea near the Bering Strait and along the Russian Chuktoka coast during August (USDOI, MMS, 2006a:Section III.B.1.a). The OSRA model estimates the chance that a large spill from any launch area within the proposed lease-sale area would drift into Russian water within 3 days during summer (Table A.3-31). The specific “hot spot” area is offshore of Russian LSs 33-36 (Table A.3-39); and the OSRA model estimates only a ≤3% chance of a large spill from any launch area within the proposed lease-sale area contacting these land segments within 30 days during summer.

The persistence of any effect on the planktonic populations probably would last a month, judging by the water-exchange rate on the Chukchi shelf, as discussed by Woodgate, Aagaard, and Weingartner (2005). Given the chance of contacting organisms in Russian waters and the persistence of the effects, MMS could rely on existing agreements with Russia about emergency responses during the regular MMS review of OSRPs for any western Chukchi development plan (Section 4.1.3). However, the general effects of, and responses to, oil spills in the Arctic are a challenging threat (AMAP, 2007). The AMAP authors, who included U.S. Federal representatives, concluded that spills are the largest threat in the arctic marine environment, and that responding to spills there is a challenge.

The OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of Alternative 2 (Section 4.3.2.1.4). If a spill occurred in broken ice, cleanup would present substantial challenges (Section 4.3.3.1.7). If a large spill drifted to the coast, the effects would persist for a long time. A 1,500-bbl spill of crude oil probably would affect 25 km (16 mi) of coastline and persist for many years in some shoreline sediment, despite cleanup responses (Appendix A.1, Sec. 2.2.2 and Table A.1-11). Most of the U.S. Chukchi coast is exposed to storm waves, so the coast is gradually eroding. The coast is composed primarily of tundra cliffs and gravel beaches, but it also includes a few marshes and tidal flats (Research Planning, Inc., 2003; Appendix A.1, Table A.1-5). Even in the marshes, there would not be well-developed communities because of the winter ice. The persistence of hydrocarbons in arctic marshes and tidal flats is discussed in the Chukchi Sea Sale 193 EA; it concludes that hydrocarbons would persist on such shorelines for more than a decade (USDOI, MMS, 2007d:Section IV.C.1.c(4)(b). Crude oil has persisted in the tidal and subtidal sediments of the Canadian Arctic islands for more than a decade (Prince, Owens, and Sergy, 2002). The effects of spills on vegetation and wetlands above saltwater are discussed in Section 4.4.2.10.

If a large spill occurs in the proposed lease area during summer, the model estimates a 1% chance that it would contact the U.S. Chukchi coastline within 3 days and up to 22% within 30 days (Tables A.3-43 and 45). The difference indicates a reduction in impact to lower trophic-level organisms of the requirement for rapid response capabilities (Section 4.3.3.1.5.5). If a large oil spill did contact this coastline, the oil probably would persist in a few of the tidal and subtidal sediments for more than a decade, leading to a local but serious effect on the intertidal lower trophic-level organisms.

The OSRA model estimates the chance of one or more large spills occurring and contacting the U.S. Chukchi shoreline is 1% and 6% within 3 and 30 days, respectively, over the 25-year life of production; the chance increases with the longer trajectory time periods. This coastline is adjacent to the spring lead system (Tables A.3-82).

The OSRA model estimates a <29% chance of a large spill from any hypothetical platform or pipeline launch area drifting across the border and contacting Russian water (ERA 7) (and plankton in the water) within 3 days (Table A.3-31). The OSRA model estimates the chance of one or more large spills occurring and contacting ERA 7 is 2% and 11% within 3 and 30 days, respectively.

The MMS regulations would help to prevent spills and to moderate the effects of any that occur. The MMS regulations require operators to prepare an OSRP as part of their EP (30 CFR 250.42); the OSRP is reviewed by MMS at the same time that the EP is reviewed. Some previous OSRPs that were approved for operations in the Chukchi Sea included the voluntary storage of response equipment on site (i.e., on a barge) to speed responses. The Federal Oil Pollution Act of 1990 would help to reduce spill effects. The Act would require operators to conduct drills to demonstrate readiness. The regulations are important to lower trophic-level organisms, because the main effects on the organisms would be spill related. As explained above, if a spill contacted the coastline, oil would persist in the intertidal and subtidal areas. This assessment explains that there is a very low chance that a spill would contact the U.S. Chukchi coast within 3 days; but that the chance rises 20% for a 10-day trajectory and another 400% for a 30-day trajectory. The difference demonstrates one advantage of local response equipment at drill sites in the Chukchi Sea.

In summary, the OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of Alternative 2 (Section 4.3.2.1.4). If the assumed spills occur in broken ice, cleanup responses would be difficult. If a large spill occurs during summer near the center of the proposed lease-sale area (LA11), the model estimates a <20% chance that they would drift within 30 days to the U.S. Chukchi coast (Table A.3-45). The model estimates a <22% chance a large spill would drift into Russian water (ERA 7) within 10 days (Table A.3-33 32), where U.S. responses might be difficult. The same chances decrease to <7% and <3% within 10 days (Tables A.3-32 33 and 44 45), indicating a reduction in impacts for lower trophic-level organisms of the requirements for rapid-response capabilities (Section 4.3.3.1.5.5). If a large spill did contact the Alaskan coastline, the hydrocarbons would likely affect an estimated 25 km (16 mi) of coastline (Table A.1-11), persisting in the few noneroding areas for more than a decade. Some lower trophic-level organisms would experience a larger effect than others. There is no existing pipeline infrastructure to which an offshore pipeline could be connected, and this lease sale would include no clear MMS policy about a preference for offshore pipelines in this seasonally ice-covered area, creating a possible higher level of effect.

Overall, even though development is unlikely, we are concerned about the effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the unmitigated direct and indirect consequences of foreseeable industry operations.

4.5.2.3.2 Mitigation Measures. Our scenario considers development unlikely, but the disturbance effects of pipeline burial have been assessed anyway. The effect of pipeline burial would be extensive, but an alternate to buried production pipelines—the effects of transporting production by vessel—would be more serious. This is partly because barges or vessels carrying relatively large amounts of liquid hydrocarbons might be routed to a facility on the adjacent coast or through the Bering Strait. The consequences of a tanker or barge spill on the Chukchi coastline might be similar to the effects of a low-probability, very large spill (USDOI, MMS, 2003a:Section IV.I) and much worse than the disturbance due to pipeline burial. The relative low risk of transporting liquid hydrocarbons through pipelines is part of the reason for the ITL on Transportation of Hydrocarbons (Section 2.2.3.3). That ITL describes the agency preference for the use of pipelines, if they are economically feasible, to transport OCS production to shore. The *West Falmouth* oil spill in ice-covered water gives an indication of cleanup effectiveness and effects (Teal and Howarth, 1984). Barges and/or tankers are used in some situations. For example, a prospect near Sakhalin Island, Russia, was developed recently using tankers to transport oil from an offshore terminal that is covered seasonally by sea ice. Tanker shipments of Chukchi Sea OCS production to shore might mean the transport of liquid hydrocarbons to areas near Cape Lisburne, Point Hope, and/or the Bering Strait, all of which are extremely important for lower trophic-level organisms and their predators, such as marine mammals and seabirds. Therefore, even though development is unlikely and MMS has proposed an ITL on pipelines, we are concerned about the effect of development on benthic and coastal organisms. We conclude that benthic and coastal organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations.

4.5.2.3.3. Cumulative Effects Under Alternative 2.

Summary. Lower trophic-level organisms would not be affected by onshore activities and do not migrate from one lease area to another, so there would be no cumulative effect due to additional sales in Federal offshore waters, adjacent State waters, adjacent Canadian waters, or adjacent onshore areas. The level of effects would be similar to the level for operations on the proposed and existing Chukchi Sea leases. Overall, some effects on lower trophic-level organisms (without additional mitigation on proposed leases) would be unavoidable or moderate, but the level would be less than for existing climate change effects. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.2.3.3.1. Cumulative Effects from Seismic Surveys. Lower trophic-level organisms would be disturbed only by OBC seismic surveys, as explained in Section 4.4.2.3.1.1. All proposed and existing leases in the Chukchi Sea are in such deep water that OBC surveys would not be conducted on them. Regardless, the effects of specific seismic proposals under standard regulations (http://www.mms.gov/alaska/re/permits/stips1-5.htm) would be assessed later by MMS.

4.5.2.3.3.2. Cumulative Effects from Exploration and Development. We assume there would be a single system of offshore pipeline to support development. Therefore, the cumulative effect of buried pipelines would be to disturb 1,000-2,000 acres (404-810 hectares) of typical benthic organisms (unless the pipelines were near unknown special biological communities such as pockmark or kelp communities). Typical organisms would slowly recolonize the disturbed areas within few years. The disturbance effects would be assessed and probably monitored by the pipeline company, MMS, and/or the Corps of Engineers. Any discharge of produced water on the Beaufort shelf during the life of the field probably would lead to a measurable effect within 10 km of the discharge location. Any such discharge proposals would be reviewed in detail by MMS and EPA. The OSRA model estimates a 26% chance of one or more large spills ≥ 1,000 bbl occurring over the production life of the Proposed Action, but only a 1% chance of one or more large spills occurring and contacting the Alaskan coastline within 3 days over the production life of the Proposed Action. If a spill in broken ice did contact the Alaska coastline, the oil probably would persist in a few of the tidal and subtidal sediments for a couple of decades, leading to a high level of effect on the few intertidal lower trophic-level organisms. The chance of one or more large spills contacting the coastline increases to 6% within 10 days over the production life of the Proposed Action, demonstrating the advantages for lower trophic-level organisms of existing requirements for rapid-response capability (Section 4.3.3.1.5.5).

The cumulative level of effects would be related to the mitigation (rather than an ITL) on existing leases and on proposed leases. A stipulation on existing leases in the Chukchi Sea is Stipulation 3, Transportation of Hydrocarbons. Section 4.4.2.3.1.2 assesses the effects of development pipelines, concluding in a moderate level of effect on the benthos due to trenching. In spite of the relatively high level of effects, the use of pipelines has been preferred under certain conditions, per former Stipulation 3. Part of the reason is that the effects of an alternative to production pipelines, i.e., the transportation of produced liquids in vessels/barges, would pose a greater spill risk to the environment and particularly the coastline. In old Stipulation 3 and a new ITL, the agency states its preference for transportation of offshore oil and gas fluids in pipelines. As explained in the previous Chukchi Sea Sale 193 EA (USDOI, MMS 2007d:Section II.B.3.c(1):

> This stipulation reflects the agency preference for transporting offshore oil and gas in pipelines, especially in the arctic environment where much of the area is covered by sea ice for much of the year. This stipulation helps reduce or moderate the potential effects to…lower trophic-level organisms…. This stipulation does not change the level of impacts that may occur from a large oil spill.

In summary, three aspects of the proposed lease sale that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells likely may be local and minor, as concluded in the Sale 193 EA. For development, it is estimated that a network of buried pipelines would radiate from a central production platform on the central shelf, and that a single long pipeline would extend to shore. This assessment assumes that produced hydrocarbons would not be transport to shore by tanker or barge. Pipeline burial likely would disturb up to 2,000 acres (810 hectares) of typical benthic organisms. These organisms likely would recolonize the pipeline corridors over a decade, just as they slowly recolonize ice gouges. Site-specific disturbance effects would be assessed later; some assessments might need more accurate information on recolonization and coastal erosion rates.

Any exploratory discharges during summer likely may have immeasurable or negligible effects to the planktonic and benthic communities. Produced water from all Beaufort Sea developments to date have been reinjected voluntarily rather than discharged; this assessment assumes that produced water would be reinjected also at Chukchi Sea developments. Any discharge proposal would be reviewed in detail by MMS and EPA.

The OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of the Proposed Action (see Section 4.3.2.1.4). If the assumed spills occur in broken ice, cleanup would present substantial challenges (Section 4.3.3.1.7). If a large spill occurred during summer near the center of the proposed lease area, the model estimates a <20% chance that the spill would drift within 30 days to the U.S. Chukchi coast. The model estimates a <22% chance a large spill would drift into Russian water within 10 days, where U.S. responses might be difficult. The same chances decrease to <7 and <3% within 10 days, indicating a reduction in impacts for lower trophic-level organisms of the requirements for rapid-response capabilities (Section 4.3.3.1.5.5). If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Some lower trophic-level organisms would experience a larger effect than others.

Conclusion. Three aspects of the proposed lease sales that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells likely may be local and minor. Any exploratory discharges during summer likely would have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL on pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. So, the cumulative level of effects, including the effect of ongoing climate change, would be major. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.2.4. Fish Resources.

Summary. Lease Sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS. We determined that exploration activities resulting from additional leases being offered under the Proposed Action are anticipated to have no more than a minor level of direct and indirect adverse effect to fish resources. Because oil and gas production under the Proposed Action is considered speculative, adverse effects to fish resources from petroleum spills, which could result in a major level of effect to certain fish resources, are not reasonably foreseeable. Similarly, construction impacts are not anticipated. Changes in the physical environment may promote increased vessel traffic in the Alaskan Arctic, especially in the form of tourism or cargo shipping, thereby increasing the risk of vessel accidents, groundings, and spills. Transfer of bulk fuel to coastal communities of the North Slope poses the greatest risk of a large noncrude oil spill in the marine environment. These events could have similar effects as a large spill described above, but as they are illegal or accidental, the level of effect is difficult to predict with any certainty. Effects due to climate change may benefit some fish species and harm others. We conclude that the Proposed Action would not have a direct effect on climate change nor any more than a negligible effect on greenhouse gas emissions. Alternative 2 is anticipated to result in a minor level of cumulative effect to fish resources in the Proposed Action area, with the exception of changes in the physical environment that are anticipated to have a major level of effect on fish resources. These effects are the same as those identified under Alternative 1.

In the following assessment we identify the potential effects of the Proposed Action to fish resources, identify the mitigation measures that could avoid or help reduce the level of these effects, and then determine the anticipated level of effect on fish resources. These direct and indirect effects are combined with the cumulative effects under Alternative 1 (no-action alternative) to determine the new cumulative effects under this alternative.

4.5.2.4.1. Potential Effects to Fish Resources. The potential effects to fish resources in the Beaufort and Chukchi seas were described in Section 4.4.1.4.1, and are not repeated here.

4.5.2.4.2. Mitigation Measures. The potential effects can be moderated by application of the relevant mitigation measures and lease stipulations (Appendix F) listed below in addition to state and local measures described in Section 4.4.1.4.2.

There are three primary mitigation measures that would avoid or minimize adverse effects to fish resources. The first one is Stipulation 2 (Appendix F), which allows seismic survey activity in the Ledyard Bay Critical Habitat Area until July 1 of each year. Any adverse effects to fish resources from seismic surveys and associated vessel noise would not occur in the Ledyard Bay Critical Habitat Area after July 1. This also applies to other vessels transiting the Chukchi Sea to accomplish MMS-authorized activities.

The second mitigation measure is the ramping-up of seismic airguns. Ramping up conceptually allows fish to move away from a lower level of underwater noise before the noise level is increased to the full performance range. Also, seismic operations are required to remain at least 15 mi away from other concurrent seismic operations to limit the interference with data collection. Separation of concurrent survey operations indirectly benefits fish resources by conceivably allowing fish to move freely between these zones of potential displacement.

4.5.2.4.3. Anticipated Effects Under Alternative 2. The following analysis describes the anticipated effects to fish resources that most likely would occur if MMS opens the entire lease-sale area in the Chukchi Sea without deferring any areas from consideration. The potential effects of certain activities were presented in Section 4.4.1.4.1. This analysis considers mitigation measures and lease stipulations described in Section 4.4.2.4.2. The anticipated effects are separated into direct and indirect effects (Section 4.5.2.4.3.1) and cumulative effects (Section 4.5.2.4.3.2).

4.5.2.4.3.1. Direct and Indirect Effects Under Alternative 2.

4.5.2.4.3.1.1. Anticipated Level of Effect from Underwater Noise. Underwater noise can be generated from vessels, seismic surveys, and activities from exploration or production (including drill rig and construction noise).

4.5.2.4.3.1.1.1. Vessel Noise. The potential effects to fish resources from vessel noise were described in Section 4.4.1.4.1.1.1. Vessel traffic occurs chiefly during ice-free conditions. Vessel traffic associated with additional leases in the Chukchi Sea could disturb some fish resources and their habitat during oil and gas exploration. Vessels and their associated noise, however, are transient, as they move through an area, and fish in the immediate vicinity of such vessels are believed likely to avoid such noise, perhaps by as much as several hundred meters away. The amount of vessel traffic associated with new leases is not anticipated to change the level of effect on fish resources, but could extend them into the future. The underwater noise produced from vessels associated with new leases is anticipated to have no more than a minor effect on fish resources.

4.5.2.4.3.1.1.2. Seismic-Survey Noise. Potential effects to fish resources from seismic survey noise are presented in Section 4.4.1.4.1.1.2. Avoidance behavior that results in displacement from preferred habitat would be temporary. Mortalities would be limited to those fish in close proximity to operating airguns. Ramp-up procedures would mitigate some effects by allowing fish to avoid being in close proximity to airguns. Because survey activities are limited by availability of seismic-survey vessels and similar survey resources and a limited open-water season, and are further constrained by mitigation measures that regulate concurrent surveys, seismic surveys conducted in association with the proposed Chukchi Sea lease sales 212 and 221 would have negligible to minor adverse impacts on fish resources.

Under this alternative, anticipated seismic-survey activity in the Chukchi Sea likely would continue as part of ongoing efforts to delineate oil and gas potential on existing leases and surrounding waters in the Chukchi Sea. The MMS concludes that the potential for impacts to fish resources from seismic activity, with mitigation measures imposed, is minor.

We also considered the issue of basing this assessment on limited or lacking information on specific fish resources in the Alaska Arctic. A review of the available science and management literature shows that, at present, there are no empirical data to document potential impacts reaching a population-level effect, nor have the experiments conducted to date contained adequate controls in place to allow us to predict the nature of a change, or that any change would occur. The information that does exist has not demonstrated that seismic surveys would result in major impacts to marine fish or related issues (e.g., impacts to migration/spawning, rare species, subsistence fishing). Therefore, based on a review of available scientific and fishery-management literature, MMS believes that ongoing seismic surveys, in some cases, could result in minor impacts to fish resources; but, in most instances, impacts to fish resources would be negligible.

4.5.2.4.3.1.1.3. Oil and Gas Exploration or Production Noise. Underwater noise generated during subsea drilling would occur only on the Federal OCS. Production of oil and gas resources in the Chukchi Sea is not considered reasonably foreseeable. If fishes were disturbed by underwater noise emitted from the drill rigs, similar to reactions described in Section 4.4.1.4.1.1.3, fish could move away from the source of the noise, effectively being displaced from a zone around the drill rig. No more than two exploration rigs are anticipated to be operating in the Chukchi Sea at any one time, and these zones of displacement would not result in more than a minor effect on fish resources.

Noise-related disturbance effects to fish and direct loss or degradation of fish habitats likely would occur during construction in the marine environment (e.g., platform placement, pipeline trenching or burial) and at freshwater sites (pipeline and maintenance road construction). As additional construction associated with production is not considered reasonably foreseeable, adverse effects from construction noise are not anticipated.

4.5.2.4.3.1.2. Anticipated Level of Effect from Habitat Loss. The activities that are anticipated to result in habitat loss include drilling and construction effects in marine and freshwater habitats.

Community Development. Community development is not considered to be a direct effect of the Proposed Action.

Industrial Development. Oil and gas activities considered under the Proposed Action include exploration of oil and gas resources resulting from additional Federal leases in the Chukchi Sea. Effects would be localized as leases are explored. Exploration wells could result in potential perturbations to fish resources, such as from drilling discharges at the placement sites (assessed in Section 4.4.2.3.1.2**)**, but these sites are relatively small compared to the amount of similar habitats available to fish in the marine environment. Direct or indirect effects from facility construction in marine or freshwater habitats are not anticipated, because production is not reasonably foreseeable. No more than a minor level of effect to fish resources is anticipated.

4.5.2.4.3.1.3. Anticipated Level of Effect from Petroleum Spills. Adverse effects on fish resources from petroleum spills can occur in both freshwater and the marine environments. Depending on the timing, location, and size, a spill in the marine environment that reaches the nearshore environment has the greatest potential to affect relatively large numbers and multiple species of fish. Similarly, a large spill occurring in freshwater, at a pipeline river crossing for example, also has the potential to affect large numbers of fish. Vulnerability to a spill's effects will vary depending on the level of exposure and the fish species' life stages and habitat preferences or requirements. These variables are addressed in Section 4.4.1.4.1.3 (Potential Effects from Petroleum Spills).

In most instances, exploration activities would not present significant threats from spill events. A large spill, not considered reasonably foreseeable during the leasing and exploration stages, could affect relatively large numbers of fish and multiple fish species; however, because of their numbers and relatively broad geographic distribution, effects to arctic fish species and fish populations in the Beaufort and Chukchi seas most likely would range from negligible to moderate. The greatest chance for a petroleum spill to have a major effect on a fish population would be if genetically distinct or uniquely isolated and vulnerable fish populations were impacted by a spill. Pacific salmon in the Arctic occupy the extreme northern edge of the species' range. When conditions allow, pink and chum salmon appear to be capable of slowly expanding their range in the Arctic. Regardless of whether or not this expansion is considered an ecologically positive event, a petroleum spill could delay this range expansion by contaminating limited freshwater, intertidal, or estuarine spawning habitats.

4.5.2.4.3.1.3.1. Oil-Spill Analysis. This section references the OSRA model to discuss the percent chance that a large oil spill from the Chukchi Sea Lease Sale area could contact specific environmental resource areas or land segments that are important to fish resources.

No large oil spills are assumed to occur during exploration activities, including seismic-survey activity.

A large spill from a well blowout is described as a very unlikely event in Section 1.1.4. In the following, we assess the effects on fish resources if a large spill were to occur. Combined probabilities combine the percent chance of a spill occurring and then combining that with the percent chance that spilled oil could contact areas important to fish.

Conditional Probabilities. The OSRA model estimates the conditional probabilities (expressed as a percent chance) of a spill contacting a specific environmental resource area or land segment (shoreline area representing nearshore fish habitats). Conditional probabilities are based on the assumption that a spill has occurred (Appendix A). Combined probabilities, in the next part, factor in the chance of one or more large spills occurring and then contacting. The assessments for fishes were based on conditional probabilities. The resultant summaries recognize that models are simulations representing typical or average interactions of highly variable factors, and are used here in a broad sense in drawing conclusions about anticipated effects on fish resources.

Appendix A.1 describes the many facets of oil-spill assessment pertaining to the proposed leasing actions. Maps A.1-3a and A.1-3d show the location of the land segments dividing the Beaufort and Chukchi seas coastlines for analytical purposes. Land segments and the geographic place names within the land segments are shown in Table A.1-18. Conditional probabilities of a large spill contacting any of the various land segments are reported in Appendix A.1. There are numerous instances and probabilities whereby oil may contaminate intertidal/estuarine substrates and waters that may be used as spawning and/or rearing habitat by anadromous fish. The PAHs in weathered oil contaminating such spawning sites can be biologically available for long periods and very toxic to sensitive lifestages.

For the development and production phases, the fate and behavior of a 1,500-bbl spill from a platform or a 4,600-bbl spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A.1). The 1,500-bbl spill would cover a smaller discontinuous area (577 km^2) (Table A.1-11) than a 4,600-bbl spill (1,008 km^2) (Table A.1-12) after 30 days. The OSRA uses the center of the spill mass as the contact point, so the probabilities of either spill contacting specific environmental resource areas would be the same. Because of this similarity, only the 4,600-bbl spill is analyzed for potential effects on fish and fishery resources.

Approximately 44% of a 4,600-bbl spill during the open-water period would remain after 30 days, covering a discontinuous area of 1,008 km^2. An estimated 42 km of coastline could be oiled. A spill during broken ice in fall or under ice in winter would melt out the following summer. Approximately 55% of a 4,600-bbl spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2. An estimated 51 km of coastline could be oiled.

Summer Spill. The OSRA model estimates <9% chance that a large oil spill starting at LAs 1-15 or PLs 1-11 contacts land segments containing streams noted for the presence of salmon within 30 days. On the high end of the range, the OSRA model indicates that LS72, which includes Point Lay and the Kokolik River (noted for the presence of pink and chum salmon), has a 9% chance of contact from PL6, a 2% chance of contact from LAs 10 and 11, and a 1% chance of contact from PL1. Spills emanating from all other locations were estimated to have a <0.5% chance of contacting LS72 (Table A.3-39).

The model estimates that LS64, which includes Point Hope and the Kukpuk River (noted for the presence of pink salmon), has an 8% chance of contact from PL1 and a ≤2% chance of contact from PL3 and PL6. The chance of contact from LA9 and LA10 is ≤3%. All other modeled spill locations were estimated to have a <0.5% chance of contacting LS64.

Kuchiak Creek (LS70) is noted for supporting spawning coho and chum salmon. The OSRA model estimates a 1% chance that a large spill from LA10 or LA11, or PL3 or PL6 contacting LS70. A large spill from any other location is estimated to have <0.5% chance of contacting LS70. Kukpowruk River (LS71) is noted for the presence of pink and chum salmon. The OSRA model estimates a 3% chance of contact from PL6 and a 2% chance of contact by LA10, LA11, and PL3. Spills emanating from any other locations were estimated to have <0.5% chance of contacting LS71.

Kasegaluk Lagoon and the Utukok River (LS74), are noted for the presence of pink and chum salmon, have a 5% chance of being contact from PL6 and a ≤3% chance of contact from LA10 and LA11. Spills emanating from any other locations were estimated to have ≤1% chance of contacting LS74. The Kugra River (LS80) is noted for spawning pink and chum salmon and has a 6% chance of being contact from PL9 and a ≤4% chance of contact by a spill from PL11 and LA12. Spills emanating from all other locations were estimated to have a <2% chance of contacting LS80. All other land segments along the U.S. Chukchi Sea coastline with streams supporting salmon were estimated to have a ≤1% chance of contact from a large oil spill starting at particular location.

Salmon streams and lagoons along the Russian coastline are also noted for supporting salmon populations. Chinook, sockeye, coho, pink, and chum salmon have been documented as being present in waters bordered by LS38 (Inchoun Lagoon) and LS39 (Uelen Lagoon). The OSRA model estimates a 1% chance that a large oil spill, starting at LA9, would contact these land segments. Spills emanating from any other location were estimated to have a <0.5% chance of contacting these two LSs. The Chegitun River (LS37) is noted for supporting spawning populations of chinook, sockeye, pink, and chum salmon. The OSRA model estimates that a large spill, staring at either LA8 or PL1, has a 2% chance of contacting LS37; spills from LA10 and PL3 have a 1% chance; and spills originating from any of the other modeled locations have a <0.5% chance of contacting LS37.

The OSRA model estimates that, after 360 days, the percent chance of a large spill from launch areas or pipelines contacting those land segments identified as being important to salmon increased 2% or less (Table A.3-42). Salmon streams in particular are highlighted for their significance as essential fish habitat; however, diadromous fish species also inhabit many of the streams along the Chukchi Sea coast (Table A.1-18). The OSRA model estimates most of these streams have a very low chance (<2%) of contact from a large oil spill emanating from launch areas or pipelines.

While anadromous fish streams are relatively easy to identify, there are many other nearshore resource areas that are important to fish. For example, lagoons, river deltas, and estuaries are important to rearing fish, including outmigrating juvenile salmon. On a larger scale, capelin and sand lance use beaches along the coast for spawning. Shoreline habitats are predominantly fine-to medium-grained sand beaches or mixed sand and gravel beaches. A large spill could impact an estimated 42 km of shoreline during a summer release and 51 km of shoreline as a meltout spill (winter release into/under ice) (Table A.1-12). The OSRA trajectory model predicts movement of a surface slick, but does not assess subsurface transport of oil in water or tarballs onto beaches or the persistence of oil once it has been transported to spawning beaches, rearing areas, or spawning streams.

While the percent chance of a large oil spill contacting land segments with anadromous streams is comparatively low, the chance of contact within 30 days to environmental resource areas identified as important subsistence areas adjacent to Point Hope (ERA38), Point Lay (ERA39), and Wainwright (ERA40) can be quite high, ranging between 20% and 51% (Table A.3-33). Direct impacts to fish resources from a large oil spill contacting these environmental resource areas are anticipated to be negligible; however the presence of oil in these resource areas likely would disrupt subsistence uses of fish resources in these areas and adjacent nearshore areas.

The chance of contact, within 360 days, from a large oil spill starting at LAs 8, 13, and 14 to Harrison Bay (ERA86), the Colville River Delta (ERA87), and the Mackenzie River Delta (ERA89) ranges from 1-

2%. The OSRA model also estimates that ERA86 has a 1% chance of contact within 360 days from a large spill starting from PL10 (Table A.3-36). Spills starting from other locations were estimated to have a <0.5% chance of contacting ERAs 86, 87, and 89 within 360 days.

Finally, as the Chukchi Sea Lease Sale 212 and 221 area is adjacent to the Beaufort Sea, the OSRA model estimates the chance of a large spill originating in the Chukchi Sea during the summer and contacting anadromous streams along the Beaufort Sea coast (LSs 87, 89, 91, 93-110, 112-114, 116-117, 119, 122-126) ranges from <1% after 30 days (Table A.3-39) and <2% after 360 days (Table A.3-42). As expected, salmon streams and rearing areas are most vulnerable to contact from pipeline segments and launch areas that are adjacent to the coast.

Winter Spill. The OSRA model estimates a <6% chance that a large oil spill starting at LAs 1-15 or PLs 1-11 contacts land segments containing streams important to salmon and other anadromous fish, within 30 days (Table A.3-63). Because of landfast ice along the coastline, a large spill could be prevented from contacting the shoreline at almost all locations during winter months. After 360 days, the OSRA model estimates the percent chance of contact to land segments important to chum or pink salmon increases to <9% (Table A.3-66). The land segments with anadromous streams that have the highest percent chance of contact after 360 days are LS80 (Kugrua River), which has a 9% chance of contact from PL9; and LSs 72-74, which have a 7% chance of contact from PL6. In general, the primary concern is that a large oil spill may contaminate intertidal/estuarine substrates and nearshore waters that may be used as spawning and/or rearing habitat by diadromous fish. Diadromous fish species inhabiting many of the streams along the Chukchi Sea coast, therefore, could be exposed to oil after meltout. Overall, the OSRA model estimates the highest chance of contact to land segments from launch areas or pipelines during winter is 6% at 30-days after a spill and 9% at 360 days after a spill. A large spill from LA9 or PLs 1 and 6 attain this 6% chance of contacting land segments within 30 days (Table A.3-63). Only a large spill from PL9 attains this 9% chance of contacting a land segment within 360 days (Table A.3-66). This situation occurs at LS80, which contains streams noted for spawning pink and chum salmon.

The OSRA model estimates a large spill during the winter from LAs 1-15 or PLs 1-11 have <0.5% chance of contacting ERA84 (Canning River Delta), ERA85 (Sagavanirktok River Delta), ERA86 (Harrison Bay), and ERA87 (Colville River Delta) within 30 days (Table A.3-57). Within 360 days, these percentages increase slightly, to 1% for ERA86 for a large spill from LAs 8 and 14 and to 1% for ERA87 for a large spill from LAs 7, 8, and 14 and PL10 (Table A.3-60). Large spills from all other modeled locations are estimated to have a <0.5% chance of contacting these four environmental resource areas.

There are numerous instances and probabilities whereby oil may contaminate intertidal/estuarine substrates in waters that may be used as spawning and/or rearing habitat by pink salmon or capelin. The PAHs in weathered oil contaminating such spawning and rearing sites can potentially remain both biologically available for long periods and toxic to sensitive life stages. Lethal effects, or sublethal effects reducing growth, reproductive fitness, or overall survival may therefore also persist.

Combined Probabilities. The OSRA model estimates the chance of one or more large spills occurring and contacting land segments with streams noted for the presence of chum salmon or essential fish habitat is ≤1% within 30 days (Table A.3-80). The chance of one or more spills occurring and contacting ERAs 84-87 ranges from <0.5% within 30 days over the 25-year production life of the project (Table A.3-79).

4.5.2.4.3.1.3.2. Chronic Small-Volume Spills. Small volumes of oil may be released from leaking tanks and valves, accidents during loading and offloading, and flushing of tanks and bilges. Small or low-volume spills are defined as <1,000 bbl. The average small crude-oil spill size is 126 gal (3 bbl). An estimated 178 small crude oil spills would occur during the 25-year oil and gas production period (Table A.1-32), an average of more than 7 per year. The average refined-oil spill size is 29 gal (0.7 bbl) and an estimated 440 refined-oil spills would occur during the 25-year oil and gas production period (Table A.1-36), an average of 17 per year. Overall, an estimated 25 small-volume crude and refined oil spills would occur each year of production. It is unknown how many small-volume spills or what total volume would reach areas used by fish in the nearshore coastal areas. These spills would be subject to the same environmental factors that influence the trajectory analysis (currents, wind patterns, etc.). If these small-volume spills occurred during beach spawning events or incrementally harmed resident fish in the same location on a recurrent basis, reproductive success for certain species could be reduced. If these spills remained unchecked and were to repeatedly reach fish during sensitive life stages, depression of recruitment, over time, could result in reduction, displacement, or elimination of fish from the affected area.

While small-spills are required to be reported, the number of unreported spills is unknown. Not all spills would be expected to receive a spill response. Overall, it is unclear whether, over the long term and in the absence of a monitoring program to assess effects, any negative impacts to fish resources from chronic small spills would be detected.

4.5.2.5.3.1.3.3. Effects from Oil-Spill Response. Conditional probabilities do not 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 production.

Oil-spill response could originate from Deadhorse, about 150 mi east of Barrow. Specific resource-protection 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 State officials on fishery management issues in the event of a spill, including the need, for example, to boom the entrances to salmon spawning streams and streams with important subsistence species. Effectiveness could, however, be expected to improve if spill response equipment were staged closer to the site of a potential spill.

4.5.2.4.3.1.4. Anticipated Level of Effect from Changes in the Physical Environment. Climate change trends are expected to continue whether or not alternative 2 is selected. Climate change is expected to continue to affect marine, estuarine, and freshwater fish resources including effects to fish distribution, abundance, foraging and migrational patterns and increased oxygen consumption rates. Increases in ocean acidification are anticipated to continue. Over time, continuing Arctic warming could result in a major level of adverse effect to fish resources. The proposed action however, would have no more than a negligible effect on greenhouse gas emissions.

Climate change could benefit some fish species by making habitat in the Arctic more hospitable for feeding, overwintering, and reproduction. In contrast, cryopelagic species, including their prey, and species that are uniquely adapted to life in the Arctic may find climate changes to be extremely detrimental due to loss of habitat and prey, from increased competition, and predation from species extending their range into the Chukchi Sea. Climate change already may be causing changes in the diversity and abundance of arctic fish species but, because of limited information on the status of many marine and freshwater species, these changes may not become evident for many years. Successful oil and gas development and production resulting from Lease Sales 212 and 221 is speculative; however, the worldwide trends in demand, production and consumption of hydrocarbons are expected to continue.

4.5.2.4.3.2. Cumulative Effects Under Alternative 2. Lease Sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS. Because of the limited timing and resources available for seismic exploration and open-water exploratory drilling at lease locations, these activities are anticipated to continue at present levels for the foreseeable future, even if more leases are issued. Exploration activities on additional leases issued throughout the entire lease-sale area (no deferrals) are anticipated to result in no more than a minor level of adverse effect to fish resources.

Large petroleum spills are anticipated to occur only following production. Oil and gas development and production in the Chukchi Sea is not considered reasonably foreseeable. The MMS modeled spill risks and determined that, in most instances, a moderate level of adverse effects to fish resources from large spill would occur. A major level of adverse effect could result if large numbers of a discreet population, such as an entire year-class of juvenile fish from a population, were impacted simultaneously.

Changes in the physical environment may promote increased vessel traffic in the Alaskan Arctic, especially in the form of tourism or cargo shipping, thereby increasing the risk of vessel accidents, groundings, and spills. Transfer of bulk fuel to coastal communities of the North Slope poses the greatest risk of a large noncrude oil spill in the marine environment. These events could have similar effects as a large spill described above, but as they are illegal or accidental, the level of effect is difficult to predict with any certainty.

Climate change could benefit or harm some fish species by making habitat in the Arctic more or less hospitable for feeding, overwintering, and reproduction. Cryopelagic species, and their prey, are uniquely adapted to life in the Arctic and may find climate changes to be extremely detrimental due to loss of habitat and from increased competition and predation from species extending their range into the Chukchi Sea. Changes in the physical environment could have major adverse effects to some fish resources in the Arctic. Climate change already may be causing changes in the diversity and abundance of arctic fish species but, because of limited information on the status of many marine and freshwater species, these changes may not become evident for many years.

Because of worldwide trends in demand, the worldwide production and consumption of hydrocarbons are also expected to continue, regardless of whether development occurs in the Arctic or elsewhere in the world. The direct contribution to greenhouse gas emissions as a consequence of the Proposed Action proceeding through to future production would be negligible. Alternative 2 would result in a minor level of cumulative effect on fish resources in the Proposed Action area, with the exception of changes in the physical environment that are anticipated to have a major level of effect on fish resources. These effects are the same as those identified under Alternative 1.

4.5.2.5. Essential Fish Habitat.

Summary. Lease Sales 212 and 221could result in a small increase in the number of leases in the Chukchi Sea OCS. The direct and indirect effects to EFH from seismic surveys include temporary displacement from the activity and small disturbance of sea floor habitats. Some salmon might be displaced from preferred EFH by noise or turbidity associated with exploration drilling, a new activity in the Chukchi Sea. These activities would result in no more than a minor level of effect. Under this alternative, existing leases in the project area would continue to be explored with seismic surveys and other ancillary activities. These activities are anticipated to continue at present levels for the foreseeable future, even if more leases are sold. Continued development of coastal community facilities (e.g., roads, airports, public facilities) along the Chukchi Sea has the potential to destroy wetlands that support fish habitats.

The direct and indirect effects under the Proposed Action were combined with the cumulative effects under Alternative 1 to determine the new cumulative effect for this alternative. The changing climate could affect the current distribution or abundance of Pacific salmon and their prey. The Proposed Action

is not anticipated to have a direct effect on greenhouse gas emissions. Continuing climate change would lead to the loss or alteration of EFH and to changes in biological communities. Adult salmon may become more common in arctic waters, and straying salmon may colonize new spawning locations. Climate change is anticipated to result in a major level of effect on EFH. Climate change, for example, also may serve to promote increased vessel traffic in the Arctic, especially in the form of tourism or cargo shipping, thereby increasing the risk of vessel accidents, groundings, and spills. A large oil spill was determined to be a high-effect, low likelihood event that would follow development and production only which, for the Chukchi Sea, is considered speculative in the reasonably foreseeable future. Transfer of bulk fuel to coastal communities of the North Slope poses the greatest risk of a large noncrude oil spill in the marine environment. The cumulative effects under the Proposed Action would not be appreciably greater than those under Alternative 1.

In the following assessment we identify the potential effects under the Proposed Action to EFH, identify the mitigation measures that could avoid or help reduce the level of these effects, and then determine the anticipated level of effect on EFH. These direct and indirect effects are combined with the cumulative effects under Alternative 1 (no-action alternative) to determine the new cumulative effects under this alternative.

4.5.2.5.1. Potential Effects to Essential Fish Habitat. The potential effects to EFH are described in Section 4.4.1.5.1.

4.5.2.5.2. Mitigation Measures. The potential effects are moderated by the mitigation measures identified in Section 4.5.2.4.2.

4.5.2.5.3. Anticipated Effects Under Alternative 2. The following analysis describes the anticipated effects to EFH that would most likely occur if the MMS opens the entire lease-sale area in the Chukchi Sea without any deferral areas. This section describes the anticipated effects on EFH under the Proposed Action with consideration of the mitigation measures and lease stipulations described in Section 4.5.2.5.2.

4.5.2.5.3.1. Direct and Indirect Effects Under Alternative 2.

4.5.2.5.3.1.1. Anticipated Level of Effect from Seismic Surveys. The anticipated effects from MMS-authorized seismic-survey activities to EFH were presented in Section 4.4.1.5.3. Those effects to fish are incorporated here by reference. Any mortality would be limited to those fish in close proximity to operating airguns. Ramp-up procedures would mitigate some effects by allowing fish to avoid being in close proximity to airguns. Avoidance behavior that results in displacement from EFH or direct habitat effects from anchoring and cable deployment/retrieval would be temporary. Seismic surveys conducted in association with the proposed Chukchi Sea Lease Sales 212 and 221 would have no more than a minor level of effect on EFH.

4.5.2.5.3.1.2. Anticipated Level of Effect from Exploration and Development. The potential effects to EFH from exploration and development activities were described in Section 4.4.1.5.1. Future development and production of oil or gas resources on the Chukchi Sea OCS is considered speculative (Section 4.2). Exploration activities resulting from additional leases may include generation of underwater noise and discharges of produced water and wastes at drill sites. The present trend towards using disposal wells instead of discharges into the marine environment would help to reduce any adverse effects of these discharges on EFH. These sites, however, are relatively small compared to the amount of similar habitat available. Adverse effects would be localized and affected habitats would begin to be repopulated once the disturbance ceased. These activities are anticipated to have no more than a minor level of effect on EFH.

4.5.2.5.3.1.3. Anticipated Level of Effect from Petroleum Spills. The potential effects to EFH from petroleum spills are described in Section 4.4.1.5.1.3. The potential for a large spill is associated with postdevelopment activities. Exploration activities typically would not present a significant threat from spill events. A large spill, not considered reasonably foreseeable during the leasing and exploration stages, could affect relatively large numbers of fish and multiple fish species; however, because of their numbers and relatively broad geographic distribution, effects to arctic fish species and fish populations in the Beaufort and Chukchi seas most likely would range from a negligible to moderate level of effect. The greatest chance for a petroleum spill to have a major level of effect on a fish population would be if genetically distinct or uniquely isolated and vulnerable fish populations were impacted by a spill. Pacific salmon in the Arctic occupy the extreme northern edge of the species' range. When conditions allow, pink and chum salmon appear to be capable of slowly expanding their range in the Arctic. Regardless of whether or not this expansion is considered an ecologically positive event, a petroleum spill could delay this range expansion by contaminating limited freshwater, intertidal, or estuarine spawning habitats.

There are various aspects of important fish habitats that make them vulnerable to potential effects of a large oil spill. Young salmon use estuaries and shallow coastal waters as rearing and feeding grounds and migration areas (Costello, Elliott, and Thiel, 2002; Elliott, 2002, citing McHugh, 1967 and Haedrich, 1983). Juvenile salmon EFH within the intertidal, estuarine, and nearshore zone in the Chukchi Sea would be among the areas considered more vulnerable to effects from oil-related activities. The different ways that hydrocarbons can affect juvenile salmon are detailed under Section 4.4.1.4.1.3.1.

Adverse effects on fish resources from petroleum spills can occur in both freshwater and the marine environments. Depending on the timing, location, and size, a spill in the marine environment that reaches the nearshore environment has the greatest potential to affect relatively large numbers and multiple species of fish. Similarly, a large spill occurring in freshwater, at a pipeline river-crossing for example, also has the potential to affect large numbers of fish. Vulnerability to a spill's effects will vary depending on the level of exposure and the fish species' life stages and habitat preferences or requirements. Section 4.4.1.4.1.3 (Potential Effects of Petroleum Spills) addresses these variables.

4.5.2.5.3.3.1. Oil Spill Effects Analysis. This section references the OSRA model to discuss the percent chance that a large oil spill from the Chukchi Sea lease-sale area could contact specific environmental resource areas or land segments that are important to fish resources. A large spill from a well blowout is described as a very unlikely event in Section 1.1.4.

Conditional Probabilities. The following sections present conditional probabilities (expressed as a percent chance) estimated by the OSRA model of a spill contacting specific environmental resource or shoreline areas (representing nearshore fish habitats). Conditional probabilities are based on the assumption that a spill has occurred (Appendix A). The assessments for fish were based on conditional probabilities. The resultant summaries recognize that models are simulations representing typical or average interactions of highly variable factors, and are used here in a broad sense in drawing conclusions about anticipated effects on fish resources.

Appendix A.1 describes the many facets of oil-spill assessment pertaining to the proposed leasing actions. Maps A.1-3a and A.1-3d show the location of the land segments dividing the Beaufort and Chukchi seas coastlines for analytical purposes. Land segments and the geographic place names within the land segments are shown in Table A.1-18. Conditional probabilities of a large spill contacting any of the various land segments are reported in a suite of tables contained in Appendix A.1. There are numerous instances and probabilities whereby oil may contaminate intertidal/estuarine substrates and waters that may be used as spawning and/or rearing habitat by anadromous fish. The PAHs in weathered oil contaminating such spawning sites can be biologically available for long periods and very toxic to sensitive life stages.

No large oil spills are assumed to occur during exploration activities. For the development and production phases, the fate and behavior of a 1,500-bbl spill from a platform or a 4,600-bbl spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A.1). The 1,500-bbl spill would cover a smaller discontinuous area (577 km^2) (Table A.1-11) than a 4,600-bbl spill (1,008 km^2) (Table A.1-12) after 30 days. The OSRA uses the center of the spill mass as the contact point, so the probabilities of either spill contacting specific environmental resource areas would be the same. Because of this similarity, only the 4,600-bbl spill is analyzed for potential effects on fish and fishery resources.

Approximately 44% of a 4,600-bbl spill during the open water period would remain after 30 days, covering a discontinuous area of 1,008 km^2. An estimated 42 km of coastline could be oiled. A spill during broken ice in fall or under ice in winter would melt out the following summer. Approximately 55% of a 4,600-bbl spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2. An estimated 51 km of coastline could be oiled.

Summer Spill. Salmon streams are most vulnerable to nearshore pipelines and launch areas adjacent to the coast. The OSRA model estimates a ≤9% chance that a large oil spill starting at LAs 1-15 or PLs 1-11 contacts land segments containing streams noted for the presence of salmon within 30 days. On the high end of the range, the OSRA model indicates that LS72, which includes Point Lay and the Kokolik River (noted for the presence of pink and chum salmon), has a 9% chance of contact from PL6, a 2% chance of contact from LAs 10 and 11, and a 1% chance of contact from PL1. Spills emanating from all other locations were estimated to have a <0.5% chance of contacting LS 72 (Table A.3-39).

The model estimates that LS64, which includes Point Hope and the Kukpuk River (noted for the presence of pink salmon), has a 8% chance of contact from PL1, a 2% chance of contact from PL3, and a 1% chance of contact from PL6. The chance of contact from LAs 9 and 10 is 3% and 1%, respectively. All other modeled spill locations were estimated to have a <0.5% chance of contacting LS64.

Kuchiak Creek (LS70) is noted for supporting spawning coho and chum salmon. The OSRA model estimates a 1% chance that a large spill from LAs 10 or 11, or PLs 3 or 6 would contact LS70. A large spill from any other location is estimated to have a <0.5% chance of contacting LS70. Land Segment 71, which includes Kukpowruk River (noted for the presence of pink and chum salmon), has a 3% chance of contact from PL6 and a 2% chance of contact by LAs 10 and 11 and PL3. Spills emanating from any other locations were estimated to have a <0.5% chance of contacting LS71.

Land Segment 74, which includes Kasegaluk Lagoon and the Utukok River (also noted for the presence of pink and chum salmon), has a 5% chance of being contacted from PL6, a 2% chance of contact from LA10, and a 3% chance of contact from LA11. Spills emanating from any other locations were estimated to have a <1% chance of contacting LS74. Land Segment 80, which includes Kugrua River (noted for spawning pink and chum salmon), has a 6% chance of being contact from PL9, a 4% chance of contact by a spill from LA12, and a 3% chance of contact by a spill from PL11. Spills emanating from all other locations were estimated to have a ≤2% chance of contacting LS80. All other land segments along the U.S. Chukchi Sea coastline with streams supporting salmon were estimated to have a ≤1% chance of contact from a large oil spill starting at a particular location.

Salmon streams and lagoons along the Russian coastline are also noted for supporting salmon populations. Chinook, sockeye, coho, pink, and chum salmon have been documented as being present in waters bordered by LS38 (Inchoun Lagoon) and LS39 (Uelen Lagoon). The OSRA model estimates a 1% chance that a large oil spill, starting at LA9, would contact these land segments. Spills emanating from any other location were estimated to have a <0.5% chance of contacting these two land segments. The Chegitun River (LS37) is noted for supporting spawning populations of chinook, sockeye, pink, and chum salmon. The OSRA model estimates that a large spill, staring at either LA8 or PL1, has a 2% chance of contacting LS37, spills from LA10 and PL3 have a 1% chance, and spills originating from any of the other modeled locations have a <0.5% chance of contacting LS37.

The OSRA model estimates that, after 360 days, the percent chance of a large spill from launch areas or pipelines contacting those land segments identified as being important to salmon increased 2% or less (Table A.3-42). Salmon streams in particular are highlighted for their significance as Essential Fish Habitat; however, diadromous fish species also inhabit many of the streams along the Chukchi Sea coast (Table A.1-18). The OSRA model estimates most of these streams have a ≤2% chance of contact from a large oil spill emanating from launch areas or pipelines.

While anadromous fish streams are relatively easy to identify, there are many other nearshore resource areas that are important to fish. For example, lagoons, river deltas, and estuaries are important to rearing fish, including outmigrating juvenile salmon. On a larger scale, capelin and sand lance use beaches along the coast for spawning. Shoreline habitats are predominantly fine-to medium-grained sand beaches or mixed sand and gravel beaches. A large spill could impact an estimated 42 km of shoreline during a summer release and 51 km of shoreline as a meltout spill (winter release into/under ice) (Table A.1-12). The OSRA trajectory model predicts movement of a surface slick, but does not assess subsurface transport of oil in water or tarballs onto beaches or the persistence of oil once it has been transported to spawning beaches, rearing areas, or spawning streams.

While the percent chance of a large oil spill contacting land segments with anadromous streams is comparatively low, the chance of contact within 30 days to environmental resource areas identified as important subsistence areas adjacent to Point Hope (ERA 38), Point Lay (ERA 39), and Wainwright (ERA 40) range from 20% to 41% (Table A.3-33). Direct impacts to fish resources from a large oil spill contacting these environmental resource areas are anticipated to result in a negligible level of effect; however, the presence of oil in these resource areas likely would disrupt subsistence uses of fish resources there and adjacent nearshore areas.

The chance of contact, within 360 days, from a large oil spill starting at LAs 8, 13, and 14 to Harrison Bay (ERA 86), Colville River Delta (ERA87), and the Mackenzie River Delta (ERA89) is ≤2%. The OSRA model also estimates that ERA86 has a 1% chance of contact within 360 days from a large spill starting from PL10 (Table A.3-36). Spills starting from other locations were estimated to have a <0.5% chance of contacting these ERAs 86, 87, and 89 within 360 days.

Finally, as the Chukchi Sea Lease Sale 212 and 221 area is adjacent to the Beaufort Sea, the OSRA model estimates the chance of a large spill originating in the Chukchi Sea during the summer and contacting anadromous streams along the Beaufort Sea coast (LSs 87, 89, 91, 93-110, 112-114, 116-117, 119, 122-126) is ≤1% after 30 days (Table A.3-39) and ≤2% after 360 days Table A.3-42).

Winter Spill. The OSRA model estimates a ≤6% chance that a large oil spill starting at LAs 1-15 or PLs 1-11 contacts land segments containing streams important to salmon and other anadromous fish, within 30 days (Tables A.3-63). Because of landfast ice along the coastline, a large spill could be prevented from contacting the shoreline at almost all locations during winter months. After 360 days, the OSRA model estimates the percent chance of contact to land segments important to chum or pink salmon increases; the chance of contact after 360 days is ≤9% (Tables A.3-66). The land segments with anadromous streams that have the highest percent chance of contact after 360 days are LS80 (Kugrua

River), which has a 9% chance of contact PL9, and LSs 72-74, which have a 7% chance of contact from PL6. In general, the primary concern is that a large oil spill may contaminate intertidal/estuarine substrates and nearshore waters that may be used as spawning and/or rearing habitat by diadromous fish. Diadromous fish species inhabiting many of the streams along the Chukchi Sea coast, therefore, could be exposed to oil after meltout. Overall, the OSRA model estimates the highest percent chance of contact to land segments from land areas or pipelines during winter is 6% at 30-days after a spill and 9% at 360 days after a spill. A large spill from LA9 or PLs 1 and 6 attain this 6% chance of contacting land segments within 30 days (Table A.3-63). Only a large spill from PL9 attains this 9% chance of contacting a land segment within 360 days (Table A.3-66). This situation occurs at LS80, which contains streams noted for spawning pink and chum salmon.

The OSRA model estimates a large spill during the winter from LAs 1-15 or PLs 1-11 have a <0.5% chance of contacting ERA84 (Canning River Delta), ERA85 (Sagavanirktok River Delta), ERA86 (Harrison Bay), and ERA87 (Colville River Delta) within 30 days (Table A.3-57). Within 360 days, these percentages increase to 1% for ERA86 for a large spill from LAs 8 and 14, and to 1% for ERA87 for a large spill from LAs 7, 8, and 14 and PL10 (Table A.3-60). Large spills from all other modeled locations are estimated to have a <0.5% chance of contacting these four environmental resource areas.

There are numerous instances and probabilities whereby oil may contaminate intertidal/estuarine substrates in waters that may be used as spawning and/or rearing habitat by pink salmon or capelin. The PAHs in weathered oil contaminating such spawning and rearing sites can potentially remain both biologically available for long periods and toxic to sensitive life stages. Lethal effects (or sublethal effects reducing growth, reproductive fitness, or overall survival), therefore, also may persist.

Combined Probabilities. Combined probabilities, in contrast to conditional probabilities, factor in the chance of one or more large spills occurring and then contacting a resource area of interest. The OSRA model estimates the chance of one or more large spills occurring and contacting LSs 71-80 with streams noted for the presence of salmon is ≤1% within 30 days and is 1% within 360 days (Table A.3-80). The chance of one or more spills occurring and contacting ERAs 84-89 is <0.5 % within 30 days over the 25-year production life of the project (Table A.3-79).

4.5.2.5.3.3.2. Chronic Small-Volume Spills. Small volumes of oil may be released from leaking tanks and valves, accidents during loading and offloading, and flushing of tanks and bilges. Small or low-volume spills are defined as <1,000 bbl. The average small crude-oil spill size is 126 gal (3 bbl). An estimated 178 small crude oil spills would occur during the 25-year oil and gas production period (Table A.1-32), an average of more than 7 per year. The average refined-oil spill size is 29 gal (0.7 bbl) and an estimated 440 refined-oil spills would occur during the 25-year oil and gas production period (Table A.1-36), an average of 17 per year. Overall, an estimated 25 small-volume crude and refined oil spills would occur each year of production. It is unknown how many small-volume spills or what total volume would reach areas used by fish in the nearshore coastal areas. These spills would be subject to the same environmental factors that influence the trajectory analysis (currents, wind patterns, etc.). If these small-volume spills occurred during beach spawning events or incrementally harmed resident fish in the same location on a recurrent basis, reproductive success for certain species could be reduced. If these spills remained unchecked and were to repeatedly reach fish during sensitive life stages, depression of recruitment, over time, could result in reduction, displacement, or elimination of fish from the affected area.

While small-spills are required to be reported, the number of unreported spills is unknown. Not all spills would be expected to receive a spill-response. Overall, it is unclear whether, over the long-term and in the absence of a monitoring program to assess effects, any negative effects to EFH from chronic small spills would be detected.

4.5.2.5.3.3.3. Effects from Spill Response. Conditional probabilities do not 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 production.

Oil-spill response could originate from Deadhorse, about 150 mi east of Barrow. Specific resource-protection 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 State officials on fishery management issues in the event of a spill, including the need, for example, to boom the entrances to salmon-spawning streams and streams with important subsistence species. Effectiveness, however, could be expected to improve if spill-response equipment were staged closer to the site of a potential spill.

4.5.2.5.3.1.4. Anticipated Level of Effect from Changes in the Physical Environment.. Additional leasing in the Chukchi Sea is not anticipated to have a direct effect on greenhouse gas emissions. Successful oil and gas development and production resulting from Lease Sales 212 and 221 is speculative; however, the worldwide trends in demand, production and consumption of hydrocarbons are expected to continue. Anthropogenic influences on climate change caused by oil and gas development are expected to continue, regardless of whether development occurs in the Arctic or elsewhere in the world. Under both the no-action and the Proposed Action alternatives, these trends are expected to continue and, over time, a major level of adverse effect to EFH is anticipated. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.2.5.3.2. Cumulative Effects Under Alternative 2. Lease sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS; however, based on history, some of the existing and newly leased tracts will not be explored and some that are explored will not be subjected to further evaluation or development. Oil- and gas-infrastructure development in State waters and lands bordering the Chukchi Sea, unrelated to OCS, are not planned. These activities are anticipated to continue at present levels for the foreseeable future even if more leases are sold because of the limited timing and resources available for seismic exploration, a limited open-water exploratory drilling season at active lease locations, and constraints imposed by mitigation measures that regulate concurrent surveys. Consequently, cumulative effects under the Proposed Action would not be appreciably greater than those under Alternative 1.

Continued development of coastal community facilities (e.g., roads, airports, public facilities) along the Chukchi Sea has the potential to destroy wetlands that support fish habitats or adversely affect ponds and lakes that support fish and fish habitats. The extent of these developments on the North Slope and some recently proposed projects are described in Sections 3.1.2.1 (Infrastructure), 4.2.1.1 (Transportation and Infrastructure), and 4.4.1.6.2.1.7 or 4.4.1.7.1.2.1.7 (Habitat Loss). While perhaps fewer along the Chukchi coast compared to the Beaufort coast, these development activities likely have greater effects on EFH than on-going or future exploration activities. Together these activities are anticipated to have no more than a minor level of effect on EFH.

Climate change could benefit some salmon species by making habitat in the Arctic more hospitable for feeding, overwintering, and reproduction. Climate change already may be causing changes to EFH and to the diversity and abundance of arctic fish species; however, because of limited information on the status of many marine and freshwater species, these changes may not become evident for many years.

4.5.2.6. Threatened and Endangered Species.

4.5.2.6.1. Threatened and Endangered Whales.

Summary. Endangered-Species Act-listed whales that can occur within the Chukchi Sea Planning Area or that potentially could be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. Fin whales could be affected by activities occurring in the Chukchi Sea OCS. Alternative 2 would result in a minor level of direct, indirect, and cumulative effects on bowhead and humpback whales and a negligible level of effects on fin whales in the Proposed Action area. If Lease Sales 212 and 221 were held, level of effects would vary from negligible to minor, temporary, and nonlethal from presence and noise of seismic surveys (2D, 3D, high resolution); vessels; aircraft; drilling and production facility placement and operation, and abandonment; petroleum spills; discharges; subsistence hunting; vessel collision and injury; and physical changes or alteration of habitat. The greatest potential for a major effect is habitat change resulting from arctic warming; effects may be beneficial or adverse but remain speculative at this time. The lease sales would not change the effects of arctic warming. The occurrence of a large fresh petroleum spill in the Chukchi Sea spring open-lead system when large numbers of bowhead whales and newborn calves are present and contacted by such a spill is a case where major effects, including population-level effects and mortality of some individuals, could occur. The likelihood of circumstances leading to such an event is considered very unlikely and not expected to occur, but we acknowledge the potential. Direct and indirect effects of this alternative, combined with the cumulative effects under Alternative 1 (no-action alternative), result in a cumulative level effects that would be the same as those under Alternative 1. Mitigation applied by MMS on and adjacent to existing and new leases to exploration, development, and production activities avoid or minimize adverse effects to endangered whales in the Chukchi and Beaufort seas. The MMS actions presumably would result in incremental increases in intensity, duration, distribution, and magnitude of activities; the total additive effect is not substantially greater than the effects under Alternative 1.

After reviewing the current status of bowhead, fin, and humpback whales, the environmental baseline for the action area, the Proposed Action, and the cumulative effects, it is NMFS's biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that the Proposed Action is not likely to jeopardize the continued existence of Western Arctic Bowhead whales, North Pacific fin whales, or humpback whales. No critical habitat has been designated for these species: therefore, none will be affected. The NMFS concludes at this time, there is reasonable likelihood that oil and gas development and production in the Alaska Beaufort and Chukchi seas, as described, would not violate Section 7(a)(2) of the ESA (NMFS, 2008c).

The following analysis describes potential adverse effects to endangered whales from OCS activities associated with oil and gas exploration and development activities as described in Section 2.4.5. Scenario for the "Typical" Chukchi Sea Lease Sale (Sales 212 and 221) in Section 4.5.2.6.1.1, mitigation measures to avoid or minimize potential adverse effects to endangered whales are in Section 4.5.2.6.1.2, and the anticipated effects resulting from application of mitigation to potential adverse effects is in Section 4.5.2.6.1.3. Anticipated effects discussed herein consider mitigation measures applied to determine the effects under Alternative 2, the Proposed Action, to bowhead, fin and humpback whales.

4.5.2.6.1.1. Potential Effects to Threatened and Endangered Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified under Alternative 2, the Proposed Action, that could occur if the entire Chukchi Sea Planning Area were open to proposed Lease Sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain similar for all Alternatives including the Proposed Action and will not be repeated here.

4.5.2.6.1.2. Mitigation Measures. The measures listed in Section 4.4.1.6.1.2 are in effect for existing OCS activities to protect ESA-listed whales and other marine mammals during seismic and exploratory drilling in the Beaufort Sea and Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities associated with Lease Sales 212 and 221, as appropriate. The mitigation measures represent current Federal regulation, the collective results of recent MMS Section 7 consultations for lease sales (Lease Sales 193, 186,195, and 202) and seismic activities in the Beaufort and Chukchi seas. Mitigation of specific EPs, DPPs, and G&G permits would be based on complete application packages that meet information needs identified in the NTLs for MMS and NMFS to base case-by-case assessments and determinations of appropriate adaptive mitigation. In addition to the mitigation measures listed in Section 4.4.1.6.1.2, measures are provided here to address the dynamic management of the synergistic effects interrelationships of multiple seismic surveys and other OCS activities for each open-water period.

- Adapt a command system model for in-season, onsite day-to-day open-waterseason administration and management. Such a command system provides a structured team for day-to-day onsite centralized planning; decision making; conflict avoidance and resolution; coordination; mitigation implementation; dispatch; operational tracking; personnel and equipment resources coordination; real-time intelligence (coordinated data input for location, type, monitoring data for all activities, vessels); communications; record keeping; and consistent data management. This may be a command system that integrates regulatory, industry, local government, stakeholder and other entities on a short-term basis (open-water period) and are delegated decision-making command authority. If activities become more or less complex over time, the command team can change to an appropriate level and composition of skills. An analogy might be the function of a flight control tower at an airport. This is a flexible system or organizational approach to complex and controversial incidents and operations as experienced in the Arctic OCS.
- Unitized or preseason comprehensive or collective planning for all seismic surveys and other OCS activities for each open-water period.

The following is a summary of generalized practices available to mitigate effects to endangered whales relative to the specific location, type, duration, magnitude, complexity, and timing of an activity being applied for (may or may not be currently active in Alaska OCS):

- Minimum elevations for aircraft overflights of marine mammals; 1,500-ft minimum AGL while conducting monitoring flights and personnel transport to offshore facilities - all aircraft.
- Seasonal operation windows; examples: No seismic survey activity until after July 1 in the spring lead system, to protect concentrated migrating and calving bowhead whales.
- Spatial and temporal closures to ensure migrating bowhead whales to access and occupy traditional subsistence hunt areas to provide historical opportunity for harvest.
- Sound-verification tests to determine individual sound-proliferation profiles for specific sound sources.
- Situational shutdown protocols when marine mammals occur within established sound-exposure level safety zones of injury and behavior.
- Established sound-level criteria for injury, and onset of significant behavioral responses.
- Laws-regulation; example: 100-yd approach distance and slow, safe speed regulation for humpback-vessel interactions; ESA and MMPA compliance and respective Letters of Authorization and IHA procedures.
- Application of NOAA established vessel-large whale approach and interaction guidelines or establishment of appropriate guidelines for OCS activities.
- Spill-response preparedness, protocols, and standard practices for prevention cleanup response.
- Conflict Avoidance Agreements.

- Establish minimum distances between and arrangements of other OCS sound sources (active drill ships) that allow for corridors with adequate noise levels to allow free passage of migrating marine mammals.
- Protect opportunity for timely marine mammal access and occupancy duration to traditional subsistence-hunting areas.
- Communication-network systems.
- Monitoring and research programs designed to implement and evaluate effectiveness of mitigation and to provide information to craft more effective mitigation and make better decisions to protect endangered species while meeting the goals of the OCS Program. Passive-acoustic monitoring and active-acoustic monitoring are examples, as well as aerial- and vessel-marine mammal monitoring of exclusion and safety zones around sound-source vessels. To document and confirm new occurrences of and identify trends in distribution, abundance, and habitat selection of endangered whales and their responses, short and long term, to activities.
- Monitoring to have real-time data from which to make timely proactive in-season decisions to eliminate and minimize potential conflicts and adverse effects.
- Research to resolve specific issues and adverse effects to endangered whales where data is lacking, or specific information needs to better implement operations and mitigation actions. Satellite-transmitter equipped whale tracking during migrations and habitat selection determination studies; photo-identification to strengthen stock of origin for humpback whales.

4.5.2.6.1.3. Anticipated Effects Under Alternative 2. The following analysis describes the anticipated effects to ESA-listed whales that likely would occur if MMS opens the Chukchi Planning Area (no deferral areas) to Lease Sales 212 and 221 noted in the Proposed Action. Anticipated effects discussed herein consider mitigation measures and specific biological and activity characteristics discussed in Section 4.4.2.6.1.3 and 4.5.2.6.1.3.

4.5.2.6.1.3.1. Anticipated Effects from 2D/3D Seismic-Survey Noise and Disturbance. It is expected that prospective leaseholders and others would conduct 2D/3D seismic surveys to evaluate potential lease blocks for oil and gas resources in the Chukchi Sea Planning Area. These surveys would occur during the open-water period, and noise introduced to the marine environment by such surveys is anticipated to injure, disturb, or modify behavior of bowhead, humpback, and fin whales during important seasonal migrations, feeding concentration periods, and locations. Seismic-survey activities would be subject to mitigation measures, terms, and conditions of IHAs issued by NMFS, and to MMS mitigation measures determined through ESA Section 7 consultation and subsequent Biological Opinions to avoid or minimize effects such that anticipated adverse effects to endangered whales are negligible.

4.5.2.3.6.1.3.2. Anticipated Effects of Noise from High-Resolution Seismic Surveys. It is expected that leaseholders and others would conduct high-resolution seismic surveys to evaluate and support oil and gas exploration drilling, delineation, and production on leases obtained from Lease Sales 212 and 221. If potential commercial deposits are indicated, localized high-resolution seismic surveys would be expected to increase as leaseholders evaluate and plan specific exploration, delineation, and production actions. High-resolution surveys would be expected to decline in localized areas as production and transport facilities are completed. High-resolution seismic activities would be subject to mitigation measures, terms, and conditions of IHAs issued by NMFS, and to MMS mitigation measures determined through ESA Section 7 consultations and subsequent Biological Opinions to avoid or minimize effects such that anticipated adverse effects to endangered whales are negligible.

4.5.2.6.1.3.3. Anticipated Effects of Noise from Vessel and Aircraft Traffic.

Icebreakers. Icebreakers introduce noise levels to the marine environment at greater levels than vessels not engaged with the high intensity power needed for ice management. Bowhead whales would be most sensitive to icebreaker activity, as fin and humpback whales are not likely to be in ice-covered waters. Bowhead whale response to icebreaker noise usually is avoidance. Increased use of icebreakers over an expanding region could expose more whales to more frequent short-term exposure to noise earlier and later in the ice-associated period of the year. Drillships often are attended by an icebreaker in the late fall and early winter as ice forms and assists in prolonging the drilling period. This trend is anticipated to continue into the foreseeable future to support drillship operations for exploration and delineation wells. If resource discoveries on Chukchi Sea leases are developed (speculative at this time), icebreaker support for platform construction and production would occur in deeper water where drillships also would be used. These vessels would be relatively free to transit and operate in areas where disturbance to bowhead whales in early winter as ice forms and the fall bowhead migration is occurring. Icebreaker activities would be subject to mitigation measures, terms, and conditions of IHAs issued by NMFS and to MMS mitigation measures determined through ESA Section 7 consultation and subsequent Biological Opinions to avoid or minimize effects such that anticipated adverse effects to endangered whales are negligible. Some individual whales would potentially experience minor, temporary, nonlethal effects. Endangered bowhead whales may display avoidance of vessels or alteration of migratory path, and may have multiple exposures to icebreaker noise during a single migration season.

Other Vessel Traffic and Noise. Vessel-related postlease activities likely would increase in the Chukchi Sea. Activity could take place in lease blocks that have not experienced exploration drilling activities in the past. Support vessels and barges would make multiple trips between shore-based supply hubs, such as Barrow or West Dock, and offshore activities. Bowhead, humpback, and fin whales would experience temporary, nonlethal avoidance behavior responses to vessel traffic and noise. The MMS-imposed mitigation measures on vessels associated with oil and gas exploration and development activities would avoid or minimize effects to endangered whales. As a result, MMS-authorized vessel activity would have proportionately fewer impacts to endangered whales than unrestricted vessel operations. Anticipated vessel noise and movement-related effects would be minor.

Effects could result in the injury or mortality of individual bowhead, humpback, and fin whales in the Chukchi Sea as a result of vessel-whale contact, including collision and propeller injury. Regulation and guidelines relating to vessel-whale interaction would serve to mitigate such effects when visibility is good and active observer monitoring is conducted; however, during darkness, poor visibility due to weather and ocean state, the opportunity exists for vessel-related injury or mortality. The MMS-imposed mitigation measures would serve to minimize such injury or mortality and no injury or mortality of large whales from vessel contact has been documented in the Alaska OCS Arctic Region. Injury and mortality from vessel-whale contacts are not anticipated.

Aircraft Traffic and Noise. OCS oil- and gas-related aircraft (helicopter) support for post-lease operations is expected to increase as exploration, development, and production phases occur on the Chukchi Sea leases resulting from Leases Sales 212 and 221. Crew change and light supply helicopter overflights are anticipated to support exploration activities. The distances to potential lease-operation sites in the Chukchi Sea would result in moderate-duration overflights to and from operations over waters inhabited by whales and other marine mammals that have not experienced helicopter and other aircraft overflights in recent years. In the Chukchi, fixed-wing aircraft flights, if used as a monitoring platform, are anticipated to increase, as no fixed-wing aircraft monitoring currently occurs in Chukchi Sea offshore areas. The MMS-required mitigation avoids or minimizes the effects of aircraft traffic and noise on endangered whales and other marine mammals; however, flight-altitude restrictions may be violated to ensure the safety of personnel and flight operations when adverse flight conditions occur. The MMS acknowledges there may be increases in numbers, frequency, and duration of flights for production-related support, crew transport, and monitoring flights if development (speculative at this time) should occur. However, mitigation measures avoid or minimize adverse effects from aircraft activity. Fixed-wing monitoring activities would not occur under unsafe adverse weather, visibility, or sea conditions and would be subject to mitigation altitude standards to avoid effects to endangered whales. A negligible level of effect is anticipated from aircraft traffic and noise.

4.5.2.6.1.3.4. Anticipated Effects of Noise from Drilling Operations (placement, construction, drilling). Drilling is anticipated as leaseholders explore for productive oil and gas finds. Exploration drilling likely would involve drillships on leases resulting from Lease Sales 212 and 221; however, bottom-founded platforms, and other drilling technologies could be feasible if development and production is pursued. If exploration drilling indicates development and production is feasible, drilling would be expected to continue at a rate determined by the number of drill rigs available.

Exploration drilling is anticipated to be up to two drillships operating in the Chukchi Sea. These may drill at more than a single location in a given year or season. There are no OCS drillships active in the Chukchi OCS at this time. However, drilling has occurred in the past. Bowhead whale response to stationary sound sources indicates avoidance and behavioral modifications that include altering travel path or deflecting slightly around drilling operations. Little is known about humpback whale response to stationary sound-source drilling activities. Activities occurring in winter when ice cover predominates the Chukchi Sea do not affect humpback, bowhead, and fin whales, because they are not present. Most bowhead whales would not be exposed to drilling-related activities conducted during the spring migration through the spring lead system, which occurs mostly nearshore and out of the proposed Chukchi Sea lease-sale area. A few individuals may migrate through the spring lead system northward in the Chukchi Sea to the vicinity of the proposed lease-sale area. The lease-sale area is offshore at distances where noise levels and disturbance from drilling activities would not cause avoidance responses by most of the migrating bowhead whales. Fall migrating and summer/fall feeding whales could be exposed to the noise introduced to the marine environment, and avoidance response would be anticipated. Displacement of some whales from localized areas around active drill operations is anticipated. Drillship operations, drill location, and platform construction and placement operations and support activities are subject to mitigation measures that avoid or minimize adverse effects to bowhead whales. Effects of drillship operations can cause slight deflection of some migrating whales from established migration corridors; however, the deflection is transitory and migration corridor fidelity is reestablished after passage of a drillship or platform. The fall migration pattern and summer/fall habitat use of the Chukchi Sea is uncertain at this time. The fall migration appears to be dispersed widely over the Chukchi Sea, as noted by limited satellite tracking studies; however, data remain insufficient to confirm this is the case. The MMS would impose mitigation and monitoring measures, as appropriate, to avoid deflecting migrating whales away from and provide for historical levels of whale access to and presence within subsistence-hunt areas during hunt periods to avoid impacts to subsistence-harvest opportunity. Similar mitigation would be applied should delineation and production wells be developed. Synergistic adverse effects may occur as a result of platform placement and construction, drilling and multiple concurrent activities. Adverse effects can be avoided or minimized by application of mitigation measures that manage or minimize the footprint of multiple activities relative to one another and to bowhead whales and other endangered whale biological activities, habitat use, movement, and subsistence-hunt periods. Subsistence bowhead harvest opportunity in the Chukchi Sea is not anticipated to be enhanced or hindered by noise from drilling activities, because subsistence hunting for bowheads in spring and fall occurs nearshore and well outside the proposed lease-sale area. Localized prey concentrations, in part, may be locally avoided by some whales when in close proximity to active drilling operations; however, bowhead whales appear to be more likely to tolerate sound when motivated to feed in such areas. Similar tolerance responses of humpback and fin whales under similar circumstances are uncertain. It is unknown whether tolerating prolonged higher level sound exposure in high-concentration feeding areas results in temporary (TTS, no tissue damage, but temporary reduction in hearing sensitivity) or permanent (PTS, resulting in tissue damage and permanent loss of hearing sensitivity) threshold shifts. Some individuals could experience TTS or PTS, but it is uncertain at this time. No population-level effects and minor level effects are anticipated with the exception of authorized subsistence harvest of bowhead whales, which is anticipated to remain at current levels.

4.5.2.6.1.3.5. Anticipated Effects of Noise From Production Activities. It is speculative as to whether development and production would occur on leases resulting from Lease Sales 212 and 217, but it is anticipated that development and production of economically recoverable resource discoveries likely would occur. Effects from noise to endangered whales in the Chukchi Sea Planning Area that would result from seismic surveys, vessels and aircraft, and drilling activities associated with development and production were discussed in Sections 4.5.2.6.1.3.1 through 4. Development and Production Plans (DPPs) would be subject to additional incremental ESA Section 7 consultation, as appropriate. Mitigation measures resulting from ESA consultation that ensure negligible effects to endangered whale species would be imposed by MMS. Specific MMPA mitigation measures, terms, and conditions would be applied by NMFS through IHAs. Development and production would entail a suite of activities, including seismic operations; product-transportation-infrastructure construction, operation, and maintenance; platform construction, operation, and maintenance; and support vessel and aircraft that would continue over the duration of production. Minor level of effects to some individual whales is anticipated. Detectable population-level effects to bowhead, humpback, and fin whales are not anticipated.

4.5.2.6.1.3.6. Anticipated Effects of Noise from Facility Abandonment. Abandonment activities would be anticipated for production facilities in the Chukchi Sea when no longer capable of commercial production. Abandonment activities and associated noise are anticipated to be localized and short term; however, it is speculative to anticipate the degree to which facilities may be abandoned and/or used for other industrial, civilian, or military purposes. Localized exposure of some individual whales to noise introduced to the marine environment from abandonment activities could occur. Activities could include vessel and barge traffic and noise; aircraft-support traffic and noise, use of explosives for demolition, and possibly the noise and activities associated with refurbishing facilities for other industrial, civilian or military uses not associated with OCS oil and gas leases. Eventually, OCS production facilities and infrastructure facilities would be abandoned or put into other uses that may or may not affect whales and would not fall under MMS authority. The MMS would require mitigation measures, as appropriate, to avoid or minimize effects to endangered whales and the subsistence hunt for bowhead whales on OCS leases. Negligible level effects to some individual endangered whales are anticipated.

4.5.2.6.1.3.7. Anticipated Effect of Noise from Oil-Spill Response and Cleanup. In the event of a large oil spill in the Chukchi Sea, it is reasonable to expect emergency response and cleanup activities that would involve aircraft and vessel deployment. Refer to section 4.4.1.6.1.1.1.4 for discussion of potential effects to endangered whales from vessel and aircraft traffic and noise. The general avoidance response to active vessels and low-flying aircraft by endangered whales would serve to reduce whale contact with a spill. This is especially important if a spill occurs in the spring lead system and if fresh oil with high concentrations of volatile aromatic hydrocarbons were present. Some individual whales could experience impaired lung and other physiological function or mortality, if prolonged exposure to polluted air occurs. These circumstances potentially could be injurious or fatal to contacted bowhead whales and especially very young calves. It is anticipated that, depending on the location, timing, and circumstances of a spill, delayed spring bowhead migration and route alteration could occur for some whales as a result of noise from cleanup activity. Much of the spring lead system in the Chukchi Sea is nearshore of existing leases and launch areas of fresh spilled petroleum; however, pipelines would provide potential sources of large spills. Endangered whale avoidance of noise from spill-cleanup vessels, aircraft, and human activity in the open-water season would serve to decrease contact opportunity and shorten the duration of exposure to oil and poor air quality resulting from volatile toxic aromatic hydrocarbons (benzene, xylene, toluene and polycyclic hydrocarbons) associated with spilled petroleum. Noise and activity could alter use or displace whales from preferred habitats or prey concentrations. Minor level effects are anticipated from noise related to petroleum spill response and cleanup activities.

4.5.2.6.1.3.8. Anticipated Effects from Discharges. Discharges related to exploratory drilling would occur and effects remain localized in relation to endangered whale habitat and prey populations if released into the marine environment. The effects of such discharges are anticipated to remain localized as result of rapid deposition and dilution, and potentially contaminate (if toxic contaminants are present in discharges) an extremely small proportion of the habitat or the prey base available to endangered whales and, for practical purposes, are negligible in terms of population-level effects. Contaminants and discharges are regulated by other agencies, and levels that would contaminate marine mammals are prohibited. Bowhead whales are long lived, and a few individuals potentially could accumulate contaminants; however, bowhead whale tissues sampled to date indicate contaminant accumulation is not an issue in the current bowhead whale population but indicates long monitoring to be conducted to detect any change over time. Bottom-founded drilling units may obliterate small areas of benthic habitat and seafloor that support epibenthic invertebrates on which bowheads and other whales use as food. Such effects would be negligible in relation to the available habitat in the Chukchi Sea. Turbidity or sediment suspension in marine waters would remain localized to the immediate area of gravel island construction, placement of fill, installation of gravel bags or sheetpile are not anticipated to effect bowhead, fin or humpback whales. The proportion of habitat and prey affected is negligible compared to the habitat that would be available. Some construction activities likely would occur when bowheads are not present, in winter and in the open-water periods before the fall migration would occur. The MMS mitigation measures likely would require discharges not be discharged into marine waters but treated and disposed into the subsurface in disposal wells or barged to and disposed of in designated and approved disposal wells. Anticipated effects to fin and humpback whales are uncertain and assumed to be similar to the anticipated effects to bowhead whales. Negligible effects from discharges are anticipated.

4.5.2.6.1.3.9. Anticipated Effects of Large and Small Oil Spills. Potential effects of petroleum spills to endangered whales are discussed in Section 4.4.1.6.1.1.1.11. Fresh oil spills with high content of volatile aromatic hydrocarbons associated with the spring lead system and large numbers of bowhead whales migrating through the lead system present the greatest potential to affect large numbers of bowhead whales and vulnerable newborn calves. Exposure to a large spill of fresh oil in summer or fall in areas with concentrations of feeding whales also presents the potential to affect large numbers of whales.

No large petroleum spills are anticipated from exploration activities (Section 1.1.4). A large spill from a well blowout is considered as a very unlikely event. Development/production projects and associated infrastructure for product transport may occur in the Chukchi Sea OCS. The combined probabilities expressed as percent chance of one or more large spills (≥1,000 bbl) from any source in the Chukchi Sea lease sale area contacting environmental resource areas important to endangered whales (Table A.1-15) varies from <0.5-7.0% over the 25-year production life of the lease-sale area within 180 days (Table A.3-79). It is anticipated that in the unlikely event of a large oil spill, some individual bowhead whales may experience injury or mortality as a result of prolonged exposure to freshly spilled oil; however, the number affected likely would be small. Some individual endangered whales could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, localized reduction in prey sources, consumption of petroleum contaminated food items, perhaps temporary displacement from feeding/resting areas and temporary interruption of migration timing and route. Anticipated effects of exposure of endangered whales to spilled oil may result in lethal effects to some individuals, and most individuals exposed to spilled oil likely would experience temporary, nonlethal effects that may cause temporary or permanent impairment of physiological functions and potential productivity. If a spill resulting in fresh oil with high aromatic hydrocarbon release and retention in the atmosphere near the surface in the spring lead system when large numbers of bowhead whales are present and confined to the lead system, they potentially could experience prolonged exposure to inhalation of aromatic hydrocarbons. Moderate to major effects, including mortality of large numbers of newborn calves of the year and other individuals, could occur. Physiological function impairment resulting from inhalation of volatile aromatic compounds appears to be reversible in humans when removed from a polluted air environment; however, whether or not this is the case for bowhead, humpback, or fin whales is unknown. Prolonged exposure of large numbers of feeding bowhead whales or small numbers of humpback or fin whales concentrated in high prey density habitats could be exposed to prolonged oil contact and experience moderate effects including mortality of some individuals and impaired physiological function and reproductive capacity. Both latter cases are considered very unlikely; however, if they should occur, they could result in long-term adverse population-level effects.

Vulnerability of Whales to Oil Spills. Humpback whales have been observed only during the ice-free period of the year in the Alaska Chukchi Sea, and they potentially would be vulnerable to contact from summer spill events. Fin whales have been observed during the open-water period on rare occasion (2 observations between 1979 and 2007 and 2 in 2008) in the southern Chukchi Sea. One account of an acoustic detection of a fin whale vocalization from within the lease-sale area has been documented. Bowhead whales migrate north and east from the Bering Sea and give birth to calves in late winter and early spring in the Chukchi spring lead system. Bowheads also migrate west across the Chukchi Sea during fall in what appears to be a widely dispersed pattern; however, bowhead migration and summer/fall use of the Chukchi lease-sale area is largely unknown. Ongoing tagging studies are anticipated to add substantially to knowledge of bowhead use of the Chukchi Sea. Effects to bowhead whales associated with an oil spill are likely to reflect seasonal habitat use, age structure, and proportion of population contacted and situational variables surrounding the spill itself.

Oil-Spill Analysis. The potential for large spills to contact ESA-protected whale species in the Beaufort Sea was described in the Sale 193 final EA (USDOI, MMS 2007d) and the Biological Evaluation on endangered whales (USDOI, MMS, 2006c). Adjustments in the environmental resource area polygons (size/shape), lease areas, and other model refinements have updated the assessment for the proposed Chukchi Sea lease sale discussion below. The results of this analysis are similar to those for the previous multiple lease sales in the Beaufort Sea. The chance of a large oil spill contacting an environmental resource area or habitat important to endangered whales is not the same as chance of oil contacting whales. Effects of oil contacting whales must consider/verify that actual whales are present, whale-oil contact occurs, duration of contact, age of spilled oil, atmospheric mixing other variable circumstances of a specific spill event, location, movement, avoidance capability/opportunity, numbers, age classes, activity of whales, atmospheric mixing and other variable circumstances of a specific spill event in an oil-contacted environmental resource area.

The spill rate of large platform and pipeline spills during production is 0.58 (95% confidence interval = 0.26-0.78) per billion barrels, with a 26% chance of one or more large spills occurring over the 25-year production life of the project (Table A.1-26). For the development and production phases, the fate and behavior of a 1,500-bbl spill from a platform and a 4,600-bbl spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A). The 1,500-bbl spill would cover a smaller discontinuous area (577 km^2) (Table A.1-11) than a 4,600-bbl spill (1008 km^2) (Table A.1-12) after 30 days in summer. The OSRA uses the center of the spill mass as the contact point, so the chances of either spill contacting specific environmental resource areas would be the same. Because of this similarity, only the 4,600-bbl spill is analyzed. If natural gas becomes the primary product produced in the Chukchi Sea, the probabilities of contact with environmental resource areas would remain the same; however, a spill would not be expected to persist more than 3 days for a summer spill and 10 days for a winter spill, as the natural gas liquids and volatile components would age, evaporate, and disperse into the atmosphere much more rapidly than crude oil. Prolonged exposure of whales to volatile aromatic hydrocarbons could occur but is unlikely with the degree of atmospheric mixing that occurs in the Chukchi Sea area. Such a spill would age and dissipate to a much greater degree than oil and not remain on the water surface for a long period. Prolonged periods of calm that would allow the heavier and toxic components of gas to remain concentrated at or near the ocean surface are unlikely.

A 4,600-bbl spill could contact environmental resource areas where bowhead and humpback whales may be present (Appendix A). Approximately 40% of a 4,600-bbl spill during the summer open-water period would remain after 30 days, covering a discontinuous area of 332 km^2. A spill during broken ice in fall or under ice in winter would melt out in the following summer. Approximately 69% of a 4,600-bbl spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 188 km^2.

The following discussion presents conditional and combined probabilities (expressed as a percent chance) estimated by the OSRA model of a large spill contacting or one or more large spills occurring and contacting environmental resource areas important to bowhead, humpback, and/or fin whales. Conditional probabilities are based on the assumption that a large spill has occurred (see Appendix A). Combined probabilities factor in the chance of one or more large spills occurring. The probabilities in the following discussions, unless otherwise noted, are conditional probabilities estimated by the OSRA model of a large spill contacting the environmental resource areas discussed. The resource area locations are in Appendix A, Maps A.1-2a through 2e, and the launch areas and pipeline segments are found in Appendix A, Map A.1-5 (Chukchi Sea).

Large Spills: Summer. The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting bowhead, fin, and humpback whale seasonal habitats (environmental resource areas, Table A.1-15). The following discussion summarizes LAs 1-15 and PLs 1-11during summer, unless otherwise specified. The OSRA model estimates that the chance of a large spill from any offshore environmental resource area important to bowhead, fin, or humpback whales (Table A.1-15) ranges from <0.5-44% for launch areas and <0.5-51% from pipelines within 10 days (Table A.3-32); for 30 days the range is from <0.5-51% from launch areas and <0.5-60% from pipelines (Table A.3-33); for 180 days, that chance ranges from <0.5-59% from launch areas and <0.5-67% from pipelines (Table A.3-35), depending on the distance between launch areas/pipeline segments and environmental resource areas (Maps A.1-5 and A.1-2a through e).

The highest chance of contact from launch areas occurs to ERAs 35 and 56 along the fall migration for bowhead whales, which have a respective 61% and 59% chance of contact within 180 days from LA12 (Table A.3-35). The chance of contact to these areas is highest, because the OSRA model's launch area and the resource area are in close proximity to or overlap each other (maps, Appendix A). Other adjacent launch areas (LAs 11 and 13) have a respective 21-48% and 18-29% chance of contacting ERAs 35 and 56 (Table A.3-5). The greatest percent chance of contact from pipelines occurs at ERA 35, which has a 67% chance within 180 days of contact from a large spill occurring at P11 (Table A.3-35). As with the launch areas, the chance of contact to this resource area is highest, because the pipeline segment and the resource area are in close proximity to or overlap each other (Appendix A).

Bowhead whales in the process of calving and accompanied by newborn calves are somewhat confined to the Chukchi spring lead system, ERA19, during the spring migration period (April-June). The chance of oil contacting ERA19 is <0.5-9% from any launch area within 180 days (Table A.3-35). Similarly, the OSRA model estimates a spill originating from any pipeline has a <0.5-14% chance of contacting bowhead whales using ERA19 within 180 days (Table A.3-35). Bowheads continue the spring migration into the Beaufort spring lead system (ERAs 24, 25, 26, 27, 28, 37 and 80). The OSRA model estimates the chance of contact from to these environmental resource areas from launch areas varies from <0.5-6% and from <0.5-4% from pipelines (Table A.3-35) within 180 days.

The OSRA model estimates that fall migration and potential feeding concentration ERAs 19, 35, 56, 65 have a <0.5-61% chance of contact from launch areas and a <0.5-67% from pipelines within 180 days (Table A.3-35). The potential for prolonged exposure of migrating bowhead whales to fresh (<10-day old oil) is not likely, as migrating whales would transit rapidly through a spill areas; however, if migrating whales delay or concentrate to feed in a spill area, prolonged exposure could occur. Some whales could experience physiological function impairment and possible mortality from inhalation of aromatic hydrocarbons; however, numbers affected are likely to be small, and cleanup activity would promote whales avoiding the areas of vessel and aircraft activity.

Large Spill: Winter. The OSRA model estimates there is a ≤0.5-9% chance that a large oil spill originating at launch areas will contact environmental resource areas important to bowhead, humpback, and fin whales within 10 days, and a <0.5-17%, assuming a spill starts at a pipeline segment (Table A.3-56). The highest chance of contact from a pipeline occurs to ERA25, Beaufort Spring Lead 7, which has a 9% chance of contact from PL6 (Table A.3-56). The highest chance of contact from launch areas occurs from LAs 10 and 11 contacting ERA 19, Chukchi Spring Lead System (Table A.3-56). The OSRA model estimates the chance that a spill originating from adjacent launch areas (LAs 12 and 13) contacts this ERA19 ranges from 1-3%. The chance of contact tends to be highest where the launch areas or pipelines and the environmental resource area are in close proximity to or overlap each other (Maps A.1-5 and A.1-2a through e).

The OSRA model estimates there is a <0.5-16% chance that a large spill originating at launch areas will contact environmental resource areas important to bowhead, fin, and humpback whales within 30 days, and a <0.5-23% from a pipeline (Appendix A, Table A.3-57). The highest chance of contact from a pipeline segment occurs to ERA19, Chukchi Spring System, which has a 23% chance of contact from PLs 6 and 9 (Table A.3-57). The highest chance of contact occurs from LA10 to ERA19, Chukchi Sea Spring Lead 10, which has a 16% chance of contact (Table A.3-57). The chance that a spill originating from adjacent LAs 8-11 would contact this same ERA ranges from 2-14%. The chance of contact tends to be highest where the launch areas or pipeline segments and the environmental resource areas are in close proximity to or overlap each other (Table A.3-57, Map A.1-5 and A.1-2a).

The OSRA model estimates there is a <0.5-26% chance of a large spill contacting environmental resource areas important to bowhead, fin, or humpback whales from launch areas within 180 days, and a <0.5-35% chance from pipelines (Appendix A, Table A.3-59). The highest chance of contact from pipelines occurs to ERA19, Chukchi Sea Spring Lead System, which has a 35% chance of contact from PL9. The highest percent chance of a spill contacting from a launch area occurs from LA10 contacting ERA19, Chukchi Spring Lead System (Appendix A, Table A.3-59). The chance that a large spill, originating from adjacent LAs 8-13 contacts this same resource area ranges from 4-23%. The chance of contact tends to be highest where the launch areas or pipeline segments and the environmental resource areas are in close proximity to or overlap each other (Table A.3-59; Maps A.1-5 and A.1-2a through e).

Inhalation of volatile aromatic hydrocarbon components of fresh oil presents the potential for nonlethal, temporary, short-term and long-term impairment of physiological function and mortality of newborn calves and bowhead whales concentrated in the Beaufort or Chukchi spring lead systems. Winter spills can be trapped under and within ice and be transported to environmental resource areas within and under ice to be released as ice movement mixes and exposes trapped oil, melts, or breaks up in spring. The freshness or aging of fresh oil trapped or incorporated into ice in regard to volatile aromatic hydrocarbons can vary, depending on pathways for exposure and opportunity to dissipate into the atmosphere. A spill originating within 180 days contacting spring lead system environmental resource areas during winter from any launch area or pipeline segment in the Beaufort Sea or Chukchi Sea Planning Areas melting out in spring still could retain characteristics of fresh oil, including varying amounts of toxic aromatics, and retain a <0.5-31% chance of contact (Table A.3-59).

If a large spill occurs during winter, it is assumed that at least part of the spill would not be cleaned up prior to ice breakup and, thus, could contact one or more important habitat areas after ice breakup.

Combined Probabilities-Large Spills. 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 that one or more large spills occur is multiplied by the areawide chance that spilled oil would reach a particular environmental resource area to estimate a combined probability that both would occur simultaneously. Combined probabilities are defined in Appendix A (Section 4.3). The combined probabilities expressed as percent chance of one or more large spills occurring (≥1,000 bbl) from any source in the Chukchi Sea lease-sale area and contacting resource areas important to bowhead, fin, or humpback whales varies from <0.5-7.0% over the 25-year production life of the lease area (Table A.3-79).

Chronic Small Spills. Small or low-volume spills are defined as being <1,000 bbl. The average crude oil spill size is 126 gal (3 bbl) for spills <500 bbl. An estimated 178 small crude oil spills would occur during the 25-year oil-production period (Table A.1-32), an average of more than 7 per year. The average refined-oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined oil spills would occur during the 25-year oil production period (Table A.1-36), an average of 17.6 per year.

It is unknown how many small-volume spills or what total volume would reach areas used by bowhead, fin, or humpback whales. Vessel and aircraft traffic, noise, and human activity associated with oil-spill response and cleanup is anticipated to result in avoidance response from endangered whales and reduce the opportunity for these whales to contact these spills. Negligible level effects are anticipated from low-volume spills.

Spill-Response Activities. The conditional or combined probabilities do not consider the effectiveness of oil-spill response activities to large spills, which vary from highly effective under ideal conditions to largely ineffective during unfavorable or broken-ice conditions. An OSRP would be required prior to oil production.

Activities purposely stimulating an avoidance response to deflect whales away from or around spilled oil or cleanup operations and areas of other human activities (large numbers of cleanup workers, boats, and additional aircraft) could impact endangered bowhead whales if large numbers of migrants, especially females with newborn calves are confined to the spring lead system. Such activities may have limited success depending on whale opportunity, ability, and inclination to avoid the activity, delay migration, or detour around a spill. If oil is expected to enter an ice lead that whales use, cleanup or contact-prevention activities may be counterproductive. There may be few effective alternative routes in the lead system available to whales, especially calves that cannot break through ice up to 18 inches thick to breathe and require shorter distances between more frequent breaths than adults. Failure of calves to follow mothers through large areas of ice cover could result in enhanced calf mortality that could exceed, for the year of the spill event, the Potential Biological Removal established for the bowhead population recovery. Calf losses of this magnitude would affect recruitment of reproductive females into the population when this cohort would enter the productive segment of the population and thereby contribute to potential decline in productivity at a population level over what would have been their effective productive lifespan.

Anticipated effects from cleanup activities in leads during April-June are anticipated to be temporary and nonlethal; however, some bowhead whales, especially newborn calves, under some circumstances could experience a moderate or major level of effect. Cleanup activity during the open-water period is anticipated to result in a negligible level of effect to endangered bowhead, humpback, or fin whales, because the tendency and opportunity to avoid activity would not be hindered by ice conditions. Some displacement from high-value feeding habitats could occur for an entire season, depending on the circumstances of a specific spill event, if a spill occurs, and that an area important to whales is affected when they are present.

Oil-spill response could originate from as far away as Barrow. 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 NMFS regarding whale-management activities in the event of a spill. In an actual spill, NMFS likely would be active within the Incident Command organization to review and approve proposed activities and monitor their effects. As a member of the team, NMFS personnel would be largely responsible for providing critical information affecting response activities to protect endangered whales in the event of a spill.

Prey Reduction or Contamination. Reduction or contamination of food sources would be localized relative to the available prey in the Chukchi Sea to bowhead, humpback, and fin whales. Exposure to contaminated prey multiple times over the long lifetime of these whales could increase contamination of whale tissues through accumulation. This generally likely would not affect large numbers of whales, because they would be exposed to contaminated prey in localized areas. Because the percent chance of large spills occurring is unlikely, infrequent consumption of contaminated prey is unlikely to accumulate to toxic levels that would cause population-level effects.

Summary of Spill Effects. To put the risk of a large spill having population-level impacts in perspective, one has to consider several variables. First of all, to ever have an oil spill, production would have to occur. The most likely scenario states the probability of a successful commercial find is <10%, indicating that production is unlikely (USDOI, MMS, 2007c). Secondly, the location of the oil or gas find and subsequent development platform could influence the probability that a spill would occur as well as the probability that it would reach resource areas important to endangered whale species when the species are present. Third, the numbers, sex/age, duration and type of exposure of whales affected would have variable degrees of effects, from negligible, temporary, and nonlethal effects to major mortality events having long-term population-level effects. Given the stated low chance of successful oil-field development, the low likelihood that a large spill would occur, and the low percent chance that a large spill would reach resource areas important to endangered whales, including environmental resource areas with migrating and calving bowhead whales concentrated in the spring lead system, a spill causing adverse effects of a magnitude to have long-term population level effects appears to be a low likelihood event. The MMS would require OSRPs to further reduce opportunity for spilled oil to reach resource areas important to whales and remove oil from the marine environment.

Chronic low-level spills are not modeled by the trajectory analysis; however, a negligible level effects is anticipated from low-volume spills. Oil-spill modeling indicates that the percent chance of a spill of a magnitude that could jeopardize the continued existence of bowhead, humpback, or fin whales is extremely low.

Considering the low probability of a large spill, coupled with a variety of other factors that would need to be satisfied to result in population-level effects, MMS anticipates that it is highly improbable that listed whales would be jeopardized as a result of oil spills under the Proposed Action and, a minor level of effects is anticipated.

4.5.2.6.1.3.10. Anticipated Effects from Subsistence Hunting. Activities under the Proposed Action in the Chukchi Sea are not anticipated to contribute to adverse effects to subsistence activities and harvest of bowhead whales. Anticipated effects of the closely regulated subsistence harvest of bowhead whales are discussed in section 4.4.1.6.1.1.1.12. The harvest of bowhead whales for subsistence purposes would remain the major known human-caused mortality and are expected to continue at the current levels until 2012, at which time subsistence-harvest quotas may be revisited by the IWC. Humpback and fin whales are not subject to harvest and not expected to be so in the future.

If additional recoverable oil and gas resources are discovered and produced from leases in the Chukchi Sea, subsistence hunting of endangered bowhead whales would continue. Chukchi Sea OCS leases are located offshore and do not overlap nearshore subsistence bowhead hunting areas. Depending on where discovery and production activities may occur, MMS-required mitigation measures would ensure whale movement into harvest areas and that subsistence-hunting activities and opportunity to harvest bowhead whales are not impaired or enhanced by OCS actions. The OCS activities are not anticipated to alter the subsistence harvest or the vulnerability of bowhead whales to harvest.

4.5.2.6.1.3.11. Anticipated Effects from Changes in the Physical Environment. Trends in arctic warming are anticipated to continue, and potential or predicted effects were discussed in Section 4.4.1.6.1.1.1.13. Direct and indirect effects of climate change remain speculative as to timing, magnitude, and intensity. These trends are outside the scope and influence of the Proposed Action. Continuing monitoring, evaluation, and appropriate ESA Section 7 consultation procedures will allow MMS and others to adjust activities as appropriate to protect endangered whales.

The contribution of oil produced and the energy consumed to explore and produce oil under the Proposed Action to arctic warming would be incremental, not detectable, and inconsequential to direct effects to endangered whales. If oil were not discovered or produced, U.S. and world demand for and consumption of oil would continue to be met by other worldwide sources, and the contribution to the global greenhouse gases and resulting climate change trends and effects would not change. It is anticipated the Proposed Action would have a negligible level of effects to changes to the physical environment (including greenhouse gas emissions) resulting from climate change and subsequent effects to endangered whales.

4.5.2.6.1.4. Direct and Indirect Effects Under Alternative 2.

Summary. Temporary and nonlethal effects to bowhead, humpback, and fin whales are anticipated from displacement and disturbance from routine exploration seismic and drilling activities. Potential whale injury or mortality of very few individuals is anticipated to occur from whale-vessel interaction and collision associated with routine exploration activities. Negligible effects to productivity, recruitment, fitness, and survival of individuals or the populations of bowhead, humpback, and fin whales are anticipated.

The proposed lease sales could result in development and production activities; however, such activities remain speculative. Activities associated with development and production were analyzed to determine effects on endangered whales, if such a discovery occurred and is proposed to be developed in the future. Temporary, nonlethal effects to bowhead and humpback whales are anticipated as result of support-vessel traffic and noise; support, construction, operation, and maintenance activities associated with development and production facilities; and abandonment. Collective effects of frequent disturbance, displacement from important habitats, ineffective use of important habitats, and increased opportunity for vessel-whale interaction injury and mortality are anticipated to result in minor temporary, nonlethal effects, and some individuals would experience lower fitness, reproductive capability, survivorship, injury, or mortality not detectable at a population level. The extent, intensity, and magnitude of development and production activities and the exposure endangered whales could encounter remains speculative at this time. The unlikely occurrence of one or more large oil spills in the spring lead system could expose large numbers of bowhead whales and newborn calves to fresh oil and associated toxic aromatic hydrocarbon fumes. This could represent moderate to major population-level effects, depending on the numbers and age of whales contacted and the duration of contact. Moderate effects are anticipated if a large, fresh oil spill results in prolonged contact of large numbers of feeding whales concentrated in high-density prey concentration areas in the open-water periods.

4.5.2.6.1.5. Cumulative Effects Under Alternative 2.

Summary. The effects of OCS oil and gas operations on endangered whales have been assessed in a number of documents (see USDOI, MMS, 2003a, 2006b,c, 2007c,d, 2008; USDOC, NOAA, 2006a,b).

If the proposed lease sales are held, past and existing environmental changes and conditions that may be sources of adverse effects to bowhead, humpback, and fin whales would be those discussed in Section 4.3. These are expected to persist, and the effects under the Proposed Action would be additive to them. Many of these activities and effects are beyond the authority of MMS to control, and some endangered whales and populations could be adversely affected over the next 30 years. Past and existing OCS activities and previous assessments not associated with Lease Sales 209 and 217 include mitigation measures to avoid or minimize effects to bowhead whales and other marine mammals. Activities beyond MMS authority may or may not be subject to mitigation measures for the protection of endangered whales. Commercial and private aircraft or climate change may be subject to limited or no direct regulatory or mitigation measures regarding endangered whales.

The cumulative interaction of ongoing or existing activities and climate change processes may or may not adversely affect endangered whales, depending on the complex temporal, spatial, magnitude, rate of change, and many more variables that are unpredictable at this time. Climate change may create positive and/or negative effects to endangered whales. How such potential changes would occur singly or in combination would be highly speculative at this time, and continued intensive monitoring effort would be necessary to document changes and effects and to develop responsive management, as appropriate. Increased human activities could deflect and possibly alter nearshore and offshore spring and fall bowhead whale migration corridors that, in turn, may or may not adversely affect whales, their habitat, and human use of the whale resource. Such traffic could prevent effective duration of use of or prevent bowhead and other endangered whale access to high-quality prey concentrations. Frequent encounters and exposure to noise disturbance could reach levels of chronic and cumulative stress to some animals so as to impact health, social bonds, and productivity of individuals and, potentially, populations.

There could be small or large oil- and gas-related petroleum spills under the Proposed Action. Spills associated with existing leases, prelease activities, and activities related to Lease Sales 209 and 217 also could occur, as spills from those past, present, and foreseeable activities (e.g., shipping, military operations, cruise-ship activity, refueling, vessel collision and grounding, State and Canadian oil and gas activity, aircraft crashes, etc.) not authorized by MMS. Spill probability and response have been analyzed in previous documents (USDOI, MMS, 2003a; USDOC, NOAA, 2006a,b) for past and existing OCS activities in the Beaufort and Chukchi seas. Most whales exposed to spilled oil are expected to experience temporary, nonlethal effects from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil-contaminated prey items, baleen fouling, reduced food resources, or temporary displacement from feeding areas. A few individuals may be killed, temporarily or permanently experience sensory or physical impairment or tissue contamination as result of exposure to freshly spilled oil; however, the chance of a spill occurring and also contacting whale habitat during the periods when whales are present is considered low. Whales tend to avoid vessel traffic, noise, and human activity, and the percentage of the Western Arctic stock of bowheads affected is expected to be very low. The percent chance of an oil spill increases with more and broader regional distribution of oil- and gas-related activity, nonshipping vessel activity, refueling events, increased vessel transport of fuel and goods, and other activities or events. Potential climate change-induced increases in numbers, changes, and/or expansion in seasonal distribution and range by Northwest Pacific humpback and Western Arctic bowhead whales also could increase potential exposure of whales to oil spills depending on the circumstances of a spill event.

Mitigation measures associated with foreseeable exploration, development, and production and with existing offshore lease areas are expected to avoid or minimize adverse effects to whale migration corridor use at key periods, minimize interference with availability of bowhead whales for subsistence hunts, and endangered whale use of important seasonal habitats and feeding areas. Monitoring of endangered whales would continue to document and provide data regarding climate change-induced alterations of whale populations, ecology, human uses from which to formulate and implement informed and adaptive decisions, as appropriate, to ensure the protection and recovery of endangered whales in the Chukchi Sea Planning Area relative to OCS activities, but not other activities beyond OCS authority that also would occur simultaneously. These other activities may or may not be subject to protective mitigation or process by which adaptive management protocols can actively avoid or minimize short or long term adverse effects to bowhead, humpback, and fin whales.

4.5.2.6.2. Threatened and Endangered Birds.

Summary. There likely would be few direct or indirect effects to threatened and endangered birds if the lease sales were held. There would be a negligible level of effect from vessel presence and noise, aircraft presence and noise, seismic airgun noise, petroleum spills, increased bird predator populations, and subsistence hunting, and a minor level of effect from collisions with structures and habitat losses from exploration drilling activities in sensitive habitats. While the greatest potential for a major cumulative level of effect is associated with continuing physical changes in the arctic environment, the lease sales would not result in a direct effect on climate change. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1 to determine the net cumulative effects under this alternative. The resultant levels of effect are comparable to those under Alternative 1, except for the potential of increased adverse effects from exploration drilling in sensitive bird habitats. Mitigation measures imposed by MMS on future exploration activities on existing or new leases and surrounding waters avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. While MMS-authorized actions could result in a small incremental increase in or longer duration of some activities, the total effect would be proportionately lower when compared to similar, but unrestricted activities in the area.

This analysis identifies the anticipated level of effect for this alternative on threatened and endangered birds. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.2.6.2.3.1) and cumulative effects (Section 4.5.2.6.2.3.2). As threatened and endangered birds represent a resource group, we address differential effects to each species in Section 4.5.2.6.2.4.

4.5.2.6.2.1. Potential Effects to Threatened and Endangered Birds. Threatened and endangered birds in the Chukchi Sea are subject to the same potential effects described for threatened and endangered birds in Section 4.4.1.6.2.1 and 4.5.1.6.2.1. These potential effects are not repeated here.

4.5.2.6.2.2. Mitigation Measures. The potential effects are moderated by the mitigation measures listed in Section 4.4.1.6.2.2 for prelease seismic surveys, State- and locally authorized activities, and relevant portions of Stipulation 2 (see Appendix F), and except that there are no mitigation measures for

State lease sales in the Chukchi Sea, because the State is not considering any lease sale activities there (ADNR, 2008).

Stipulation No. 2 – Measures required to minimize effects on species listed under the Endangered Species Act.

> Operations conducted in support of exploration and development activities on this OCS lease are required to adhere to the conditions of the most recent Biological Opinions issued by the Fish and Wildlife Service and the National Marine Fisheries Service.

Summary of the Effectiveness. The Biological Opinion issued by the FWS specifies reasonable and prudent measures necessary and appropriate to minimize potential adverse impacts to protected species. To be exempt from the prohibitions of Section 9 of the Endangered Species Act, the MMS must comply with the terms and conditions identified in the Biological Opinion. This stipulation could reduce the potential for spectacled and Steller's eiders to strike structures, which would lessen the potential effects of OCS exploration and development on these species.

ITL Information on the Spectacled Eider and Steller's Eider. Lessees are advised that the spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*) are listed as threatened by the FWS and are protected by the ESA (16 U.S.C. 1531 et seq.).

Spectacled eiders and Steller's eiders are present in the Chukchi Sea during spring migration in May and June. Males return to the open sea in late June, while nesting females remain on the arctic coastal tundra until late August or early September, when they move to coastal areas of the Beaufort and Chukchi seas for brood-rearing. Molting eiders occur in certain offshore areas until freeze-up (typically in November). Onshore activities related to OCS exploration, development, and production during the summer months (May-September) may affect nesting spectacled eiders and Steller's eiders.

Lessees are advised that exploration and development and production plans submitted to MMS will be reviewed by the FWS to ensure that spectacled eider, Steller's eider, and their habitats are protected. For the proposed lease sales, MMS is specifically requesting an incremental Section 7 consultation with the FWS. The MMS will consult with FWS on the potential effects of leasing and seismic/exploration activities.

As few details are known regarding the specific location/design of a future development, therefore that stage of activity will require further consultation with the FWS. To allow this stepwise approach, FWS must find that the leasing and seismic/exploration stage of the lease sales would not result in a jeopardy determination to either the Steller's eider or spectacled eider nor would adverse modification of spectacled eider critical habitat occur.

The FWS must also evaluate our evaluation of potential development and production that could occur as a result of leasing and exploration locating a commercially viable discovery and conclude that there is a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the Endangered Species Act. Section 7(a)(2) of the Act requires that Federal agencies ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species or adversely modify designated critical habitat. Lessees are advised that future development projects arising from lease sales in the Chukchi (212 and 221) and Beaufort (209 and 217) seas will be subject to future Section 7 consultation with the FWS and a future project would not be authorized by MMS if it is likely to result in jeopardy or adverse modification of designated critical habitat as determined by FWS.

Stipulation 2 states that leases are required to adhere to the conditions of the most recent Biological Opinion issued by the FWS pertaining to post-lease activities. At the time the DEIS was prepared, the following conditions apply to the Chukchi Sea.

Chukchi Sea: Measures to minimize effects to spectacled and Steller's eiders during exploration activities in the Chukchi Sea. The following measures minimize the likelihood that Steller's and spectacled eiders would strike drilling structures or vessels. They also provide additional protection to eiders within other important areas, including the Ledyard Bay Critical Habitat Area, during times when eiders are present. The mitigation measures would protect birds listed under the Endangered Species Act ("ESA-listed") and other marine and coastal birds during seismic activities and exploration drilling operations in the Chukchi Sea. These measures are consistent with the recent Section 7 consultations for Lease Sale 193 and programmatic seismic activities in the Chukchi Sea. Case-by-case exceptions require re-consultation under the ESA with the FWS.

A) General condition. The following conditions apply to all lease exploration and support activities.

(1) Vessels will minimize the use of high-intensity work lights, especially when traversing the spring lead system. 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.

(2) An Exploration Plan, ancillary activities, and other proposed lease activities 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, 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 U.S. Fish and Wildlife Service (FWS) does not recommend recovery or transport of dead or injured birds due to avian influenza concerns.

B) Seismic Activities. The following conditions apply to any seismic survey and the supporting vessels and aircraft supporting those activities.

(1) No vessels associated with seismic survey activity, including re-supply and other related vessels, will be permitted within the Ledyard Bay Critical Habitat Area following July 1 of each year, unless human health or safety dictates otherwise.

(2) Seismic survey support aircraft must avoid overflights across the Ledyard Bay Critical Habitat Area below an altitude of 1,500 ft (450 m) above sea level (ASL) after July 1 of each year, unless human health or safety dictates otherwise. Seismic-survey support aircraft shall maintain at least a 1,500 ft (450 m) altitude over beaches, lagoons, and nearshore waters as much as possible. Designated aircraft flight routes will be established for situations when aircraft associated with seismic activity cannot maintain at least 1,500 ft ASL over the Ledyard Bay Critical Habitat Area.

(3) Whenever vessels are in the marine environment, there is a possibility of a fuel or toxic substance spill. If vessels transit through the spring lead system before June 10 they may encounter concentrations of ESA-listed eiders. These vessels are required to have wildlife hazing equipment (including Breco buoys or similar equipment) pre-staged, and readily accessible by

personnel trained in their use, either on the vessel, at Point Lay or Wainwright, or on an on-site Oil Spill Response Vessel, in order to ensure rapid deployment in the event of a spill.

(4) The spring lead system is defined as the Ledyard Bay Critical Habitat Area as well as the Federal OCS areas landward from an imaginary line extending from the outer corner of the Critical Habitat Area (70°20'00" N. x 164°00'00" W.) extending northeast to the southeastern-most corner of the Lease Sale 193 Area (71°39'35" N. x 156°00'00" W.) and the area landward of an imaginary line drawn between Point Hope and the other outer corner of the Ledyard Bay Critical Habitat Area (69°12'00" N. x 166°13'00" W.).

C) Drilling Activities: The following conditions apply to operations conducted in support of exploratory and delineation drilling.

(1) Surface vessels (e.g., boats, barges) associated with exploration and delineation drilling operations should avoid operating within the Spring Lead System 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 3 *Breco* buoys or similar devices) and personnel trained in its use; hazing equipment may be located on-board 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.

(2) 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.

(3) Aircraft supporting drilling operations will avoid operating below 1,500 ft ASL over the spring lead system between April 15 and June 10 and 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 Exploration Plan. Route or altitude deviations for emergencies or human safety shall be reported within 24 hours to MMS.

D) Lighting Protocols. The following requirements apply to all activities conducted between April 15 and November 15 in the Chukchi Sea.

Drilling 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 would 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:

(1) Shading and/or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;

(2) Types of lights;

(3) Adjustment of the number and intensity of lights as needed during specific activities;
(4) Dark paint colors for selected surfaces;
(5) Low-reflecting finishes or coverings for selected surfaces; and
(6) Facility or equipment configuration.

Lessees are encouraged to consider other technical, operational and management approaches that could be applied to their specific facility and operation 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 submit this information with an Exploration Plan when it is submitted for regulatory review and approval pursuant to 30 CFR 250.203.

Nothing in this ITL 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.

The following condition "E" is only required if lease sales 212 or 221 include part of LBCHA (Alternatives 2, 5, and 6).

E) Exploratory Drilling Operations in the Ledyard Bay Critical Habitat Area. The following condition applies to any exploratory and delineation drilling operations proposed to occur in the Ledyard Bay Critical Habitat Area (July 1–November 15).

The drill rig and support vessels must enter the Ledyard Bay Critical Habitat Area from the northwest and proceed directly to the drill site. Support vessels will remain in close proximity to the drill rig while providing support and exit the drill rig vicinity to the northwest until out of the Critical Habitat Area. Deviations from this routing shall be reported within 24 hours to MMS.

4.5.2.6.2.3. Anticipated Effects Under Alternative 2. In this section, we determine the anticipated level of effect on threatened and endangered birds if MMS opens the entire lease-sale area (no deferrals) in the Chukchi Sea. These anticipated effects consider mitigation measures (identified above) and other important factors (timing, residence time and productivity, spatial extent, etc.) described in Section 4.4.1.6.2.3. We also defined the terms used to describe the anticipated level of effect in Section 4.4.1.6.2.3. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.2.6.2.3.1) and cumulative effects (Section 4.5.2.6.2.3.2).

4.5.2.6.2.3.1. Direct and Indirect Effects Under Alternative 2.

Summary. The loss of a small number of spectacled and Steller's eiders as a result of collisions with offshore structures from routine exploration activities are anticipated to result in a minor level of effect on Steller's and spectacled eiders. Disturbance in or displacement from important habitats from exploration activities are anticipated to have a negligible level of effect on the fitness or survival of individual eiders or production of young under this alternative.

4.5.2.6.2.3.1.1. Anticipated Level of Effect from Vessel Presence and Noise. While additional Federal leases likely would result in a continuation or limited expansion of existing levels of seismic-vessel activity in the Chukchi Sea (compared to 2006 and 2007), the incremental increase in the total number of vessels operating in the Chukchi Sea would have proportionately fewer impacts compared to other unrestricted vessels operating in this area. Mitigation measures imposed by MMS on future exploration and development activities avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea and a negligible level of effect is anticipated.

4.5.2.6.2.3.1.2. Anticipated Level of Effect from Aircraft Presence and Noise. The number of nesting Steller's or spectacled eiders that would be exposed to low-level flights associated with OCS oil and gas development is low, because the potential direct flight from an airbase to offshore drilling sites within the OCS primarily would be over coastal waters. Mitigation measures imposed on future exploration activities avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. While additional Federal leases likely would result in a continuation or limited expansion of existing levels of exploration activity in the Chukchi Sea (compared to 2006 and 2007), the incremental increase in the total number of aircraft flights associated with this activity would have proportionately fewer impacts compared to other unrestricted aircraft operating in this area.

4.5.2.6.2.3.1.3. Anticipated Level of Effect from Collisions. Oil and gas exploration activities likely would increase the total number of structures in the project area. Mitigation measures imposed on exploration activities are believed to minimize collision mortality to ESA-listed birds in the Chukchi Sea. Vessels and drillships must operate their lights to minimize collisions. While the Lease Sale 193 boundary excluded nearshore areas used by migrating birds, the Proposed Action does not exclude this area (the calculation, however, would not change the estimated mortality).

The MMS, however, cannot assume that recommendations for the design and implementation of lighting of structures would result in no strikes by threatened eiders. The MMS and FWS both acknowledge that estimating incidental take of listed eiders is extremely difficult due to a lack of available information. An estimated incidental take of listed species was calculated in the Biological Opinion for the Chukchi Sea Lease Sale 193 (USDOI, FWS, 2007). Collisions with exploration structures on existing leases in the Chukchi Sea OCS were calculated to result in an incidental take of three spectacled eiders and one Steller's eider. There were a variety of assumptions made to support these calculations.

The MMS considers this level of incidental take to be an unavoidable, but minor level of effect to listed eiders. A negligible level of effect on Kittlitz's murrelets is anticipated. No population-level effects to ESA-listed birds are anticipated.

Although production from existing Chukchi Sea leases is speculative, the MMS calculated that mortality of as many as 17 spectacled eiders and one Steller's eider could occur from collisions with structures associated with hypothetical production drilling on existing leases in the Chukchi Sea OCS (USDOI, MMS 2006c). There were a variety of assumptions made to support these calculations. As the scenario remains unchanged, this number also would represent the hypothetical developmental collision impacts from the Proposed Action.

4.5.2.6.2.3.1.4. Anticipated Level of Effect from Petroleum Spills. 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 ESA-protected birds because of their ability to spread and persist in coastal environments. Exposure of spectacled and Steller's eiders and Kittlitz's murrelets is expected to result in the general effects reviewed in Section 4.4.1.6.2.1.4. This analysis assumes that all birds contacted by oil would not survive, and that secondary effects may cause impaired physiological function and production of fewer young. The same mitigation measures described for existing leases in the Beaufort Sea (Section 4.4.1.6.2.2) would be implemented for the proposed lease sales. A large spill from a well blowout is described as a very unlikely event, and no large oil spills are assumed to occur during exploration activities (Section 1.1.4).

It is important to remember that a large spill event associated with OCS oil and gas activities likely would occur only during the production phase, when volumes of oil or gas product is being moved to production facilities in the existing facilities at Kuparuk or Prudhoe Bay. Section 4.4.1.6.2.3.2 (Anticipated Effects to Threatened and Endangered Birds: Oil Spills) describes the basis for concluding that oil or gas production resulting from the proposed lease sales is considered speculative and production effects are not considered reasonably foreseeable. Such a commercial discovery warranting production has not been identified or proposed for development and is considered speculative at this time. In other words, while MMS and FWS acknowledge that a large spill could have major impacts on ESA-protected species, a large spill from production activities is not considered a reasonably foreseeable future event.

The MMS models large spills to estimate the percent chance that a spill of certain size could contact important resources and then analyzes the potential effects from oil spills to determine which areas might be at highest risk. In the following sections we evaluate the vulnerability of spectacled and Steller's eiders and Kittlitz's murrelets to oil spills (oil-spill analysis), then we describe the effect of disturbance from oil-cleanup activities, the effects of prey reduction or contamination, and the anticipated effects of that mortality on ESA-listed bird populations.

4.5.2.6.2.3.1.4.1. Oil Spill Effects Analysis. The potential for spills to contact ESA-protected species in the Chukchi Sea was previously described in the Chukchi Sea Lease Sale 193 final EA (USDOI, MMS 2007d). Due to small adjustments in the ERA polygons (size/shape), changes in lease areas and other model refinements, we have updated the assessment for the proposed Chukchi Sea lease sales below. The results of this analysis are much the same as those for the previous lease sale in the Chukchi Sea.

The spill rate of large platform and pipeline spills during production is 0.51 (95% confidence interval = 0.32-0.77) per billion barrels, with a 40% chance of a spill occurring over the life of the project (Appendix A, Table A.1-28). For the development and production phases, the fate and behavior of a 1,500-bbl spill from a platform and a 4,600-bbl spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A). The 1,500-bbl spill would cover a smaller area (577 km^2) (Appendix A, Table A.1-11) than a 4,600-bbl spill (1,008 km^2) (Appendix A, Table A.1-12) after 30 days. The OSRA model uses the center of the spill mass as the contact point, so the probabilities of either spill contacting specific environmental resource areas would be the same. Because of this similarity, only the 4,600-bbl spill is analyzed.

A 4,600-bbl spill could contact environmental resource areas where Steller's and spectacled eiders and Kittlitz's murrelets may be present (Appendix A). Approximately 44% of a 4,600-bbl spill during the summer open-water period would remain after 30 days, covering a discontinuous area of 1,008 km^2. A spill during broken ice in fall or under ice in winter would melt out the following summer. Approximately 55% of a 4,600-bbl spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2.

Conditional Probabilities. This section discusses the chance that a large oil spill from the Chukchi Sea lease sale area could contact specific environmental resource areas that are important to Steller's and spectacled eiders and Kittlitz's murrelets, assuming a hypothetical large spill occurs.

The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting Steller's and spectacled eider and Kittlitz's murrelet habitats assuming a spill occurs. The ERAs 1, 2, 8, 9, 10, 19, 65, 68, 69, 71, 72, 73, 77 and 81 are used in this analysis. Table A.1-14 show environmental resource areas and Maps A.1-2a-e show their spatial locations. Conditional probabilities are based on the assumption that a large spill occurred (see definition and applications, Appendix A).

Summer Spill. The following discussion summarizes the results for LAs 1-15 and PLs 1-11 during summer unless otherwise specified. The OSRA model estimates a <0.5-42% chance that a large spill starting at launch areas will contact environmental resource areas important to ESA-listed birds within 180 days, and a <0.5-56% chance from a pipeline (Table A.3-35). The highest chance of contact from a launch area is 42% to ERA10 (Ledyard Bay Spectacled Eider Critical Habitat) from LA10. The chance of contact in this resource area is highest, because the launch area and the environmental resource area are in close proximity to or overlap each other (maps, Appendix A). For pipelines, the highest chance of contact to ERA10 is from PL6, which has a 56% chance of contact. As with the launch areas, the chance of contact in this resource area is highest, because the OSRA model's pipeline segments and the environmental resource area are in close 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 9% from any launch area within 180 days (Table A.3-35). Similarly, a spill originating from PLs 6, 9, or 11 has a 12-14% chance of contacting ERA19 within 180 days (Table A.3-35).

Most postbreeding spectacled eiders move offshore and then migrate west to the Ledyard Bay Critical Habitat Area (ERA10). A large spill from LAs 9, 10, and 11 has an 11%, 42%, and 29% chance of contacting the critical habitat area, which spectacled eiders use during the May-October open-water period (Table A.3-35).

Winter Spill. The following discussion summarizes the results for LAs 1-15 and PLs 1-11 during winter, unless otherwise specified. The OSRA model estimates a <0.5-26% chance that a large spill starting at a launch area contacts environmental resource areas important to ESA-listed eiders within 180 days, and a <0.5-35% from a pipeline (Table A.3-59 and maps). The highest percent chance of contact from a launch area occurs at ERA19, the spring lead system (April-June), which has a 26% chance of contact from LA10 and 35% from P9. The chance of contact in this resource area is highest, because the OSRA model's launch areas or pipeline segments and the environmental resource area are in close proximity to or overlap each other (Table A.3-59 and maps).

Most postbreeding spectacled eiders move offshore and then migrate west to the Ledyard Bay Critical Habitat Area (ERA10). The OSRA model estimates a spill from LA10 or PL6 has a 10% or 13% chance of contacting ERA10 during winter, melting out in the spring. On an annual basis, a large spill from LA10 or PL6 has a 23% and 31% chance, respectively, of contacting ERA10 within 180 days (Table A.3-5).

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, could contact one or more important habitat areas after ice breakup.

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 areawide probability that spilled oil would reach a particular environmental resource area to estimate a combined probability that both would occur simultaneously. Combined probabilities are defined in Appendix A (Section 4.3). The combined probabilities of one or more large spills occurring and reaching environmental resource areas of most concern to threatened bird species are in Table 4.5.2.6.2-1. These probabilities are broken into different periods to indicate volatility, weathering, and movement of the spill over time.

Chronic Small Spills. Small or low-volume spills are defined as being <1,000 bbl. The average crude oil spill size is 126 gal (3 bbl) for spills <500 bbl. An estimated 178 small crude oil spills would occur during the 25-year oil production period (Table A.1-32), an average of more than seven per year. The average refined-oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined oil spills would occur during the 25-year oil production period (Table A.1-32), an average of 17.6 per year. Overall, an estimated 25 small-volume oil spills would occur each of the 25 years of production.

It is unknown how many small-volume spills or what total volume would reach areas used by Steller's or spectacled eiders or Kittlitz's murrelets. If these small-volume spills were in close proximity to or within the Ledyard Bay Critical Habitat Area, a large number of molting spectacled eiders could be contacted and injured or killed. Kittlitz's murrelets or Steller's eiders close to the source of these spills also could be affected, but these birds are at lower densities and substantial adverse effects would not be expected to occur.

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 production.

Activities such as hazing and other human activities (vessel and aircraft traffic) could impact threatened eiders and Kittlitz's murrelets. 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 July through September are likely to adversely affect listed eiders.

The presence of large numbers of cleanup workers, boats, and additional aircraft is likely to displace spectacled and Steller's eiders 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 6 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 Deadhorse, about 150 mi east of Barrow. 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 FWS 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, FWS personnel would be largely responsible for providing critical information affecting response activities to protect listed birds in the event of a spill.

Oil-spill-response plans do not typically 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.

For the purposes of evaluating the potential impact of a large spill on threatened or candidate bird species, 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 hours).

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 Steller's or spectacled eider populations, because they exhibit a dispersed breeding distribution. However, it could be more serious if these populations are experiencing a population decline. 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 (for details, see USDOI, MMS, 2002:Section III.C.2.c).

Anticipated Mortality from an Oil Spill. Spectacled and Steller's eiders are essentially absent from the Beaufort Sea from late October to May. Eiders 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 et al. (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 (USDOI, MMS 2003a:Figure 9b). 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).

An oil spill contacting the Ledyard Bay Critical Habitat Area (ERA10) during the open-water period could contact tens of thousands of molting 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 Arctic Coastal Plain would result in large-scale, adverse population-level effects. Oil-spill modeling, however, indicates that the risk of a spill of a magnitude to jeopardize the continued existence of spectacled eiders to be a low-likelihood event.

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 result in a large-scale, adverse population-level effect on this species. Oil-spill modeling, however, indicates that the risk of a spill of this magnitude is a low-likelihood event.

Summary of Spill Effects. An oil spill contacting the Ledyard Bay Critical Habitat Area (ERA10) during the open water period could contact as many as 33,000 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 adverse population-level effects.

To put the risk of a large spill having population-level impacts in perspective, one has to consider several variables. First of all, to ever have an oil spill, production would have to occur. The most likely scenario states the probability of a successful commercial find is <10%, indicating that production is unlikely (USDOI, MMS, 2007c). Secondly, the location of the oil or gas find and subsequent development platform could influence the probability that a spill would occur as well as the probability that it would reach resource areas important to threatened or candidate bird species when the species are present or, in the case of a winter spill, when those birds return. Finally, the number and sex/age of threatened or candidate birds affected would have differing degrees of population-level effects, from a few birds in an area to all birds in an area during particular time periods. Given the stated low probability for successful oil-field development, the probability that a large spill would occur, and the probability that a large spill would reach a resource area important to threatened eiders and murrelets, an adverse effect of this magnitude appears to be a low-likelihood event.

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 result in a large-scale, adverse population-level effect on this species. Oil-spill modeling, however, indicates that the risk of a spill of this magnitude is a relatively low-likelihood event.

If a commercially viable resource discovery is made and is considered for development, MMS must complete Section 7 consultation with FWS on a production plan. As with the Lease Sale 193 final EIS (see Information to Lessees, Appendix F of this EIS), "…a future project would not be authorized by MMS if it results in jeopardy or adverse modification of designated critical habitat as determined by FWS." The MMS believes that this condition will help industry incorporate stringent spill prevention measures into their plans that avoid the risk of population-level effects on ESA-protected species in the Chukchi Sea.

Chronic low-level spills are not modeled by the trajectory analysis, but could adversely affect a moderate number of Steller's eiders and Kittlitz's murrelets. Although difficult to state with any certainty, a small-volume spill in close proximity to a large, dense flock of molting spectacled eiders could result in adverse impacts to perhaps several hundred eiders, maybe more. Depending on the chronic nature of small spills, this situation could occur repeatedly. There appears to be a relatively higher percent chance of this occurring from a large spill originating in the Chukchi Sea reaching the spring lead system or Ledyard Bay, where large flocks of eiders may be present. Similarly, smaller spills, despite having less mobility and persistence, would have a greater likelihood of reaching these nearby areas. Oil-spill modeling indicates that the percent chance of a spill of a magnitude that could jeopardize the continued existence of spectacled eiders on the North Slope is highest where launch areas or pipeline segments are in close proximity to important eider habitats.

Considering the low probability of a large spill coupled with a variety of other factors that would need to be satisfied to result in mortality, MMS anticipates that it is improbable that listed eider mortality would result from oil spills associated with the proposed action, and a negligible level of effect is anticipated.

4.5.2.6.2.3.1.5. Anticipated Level of Effect from Increased Bird Predator Populations.

Should development ever be proposed, mitigation measures would avoid or minimize adverse effects to ESA-listed birds. While there likely would be an incremental increase in the total number of structures or facilities that could be used by bird predators, such as ravens or foxes, these facilities would not be constructed or operated in a manner that would support bird predators. For example, a lease stipulation (requiring that new infrastructure would avoid the artificial enhancement of predator populations) recently has been implemented for the Liberty project and is anticipated to be implemented for future developments associated with Federal leases. Implementation and enforcement of a leasing stipulation could be expected to minimize any effects of increased predator populations resulting from Federal actions in the OCS to a negligible level of effect.

4.5.2.6.2.3.1.6. Anticipated Level of Effect from Subsistence-Hunting Activity. There would not be any change in subsistence-hunting activity due to exploration activities. Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). If development and production were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. The pipeline would need a road for periodic maintenance, and this road could increase access of local hunters to previously inaccessible areas. Waterfowl hunters may be able to access pipeline roads during the period immediately following spring breakup to hunt geese and nonlisted eiders.

It is unknown whether increased access would result in an increased accidental or illegal harvest of spectacled or Steller's eiders following the creation of a road along a pipeline. The long-term consequences of this speculative development would be evaluated in future NEPA documents and via formal consultation under the ESA, but at the present time is not anticipated to affect listed eiders.

4.5.2.6.2.3.1.7. Anticipated Level of Effect from Habitat Loss. There would not be any permanent loss or alteration of bird habitat during exploration and delineation activities. Small amounts of temporary habitat loss of Steller's and spectacled eider migration habitats could occur from drilling exploration or delineation wells into the seafloor. Increased exploration drilling could result from multiple companies exploring more leases. Exploration and production wells/platform could be proposed on any leases issued for blocks within the Ledyard Bay Critical Habitat Area. Exploration wells would result in a temporary loss (via displacement) of spectacled eider habitat and a negligible level of effect is anticipated.

Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2, Petroleum Spills). Permanent habitat loss could occur if production facilities (offshore platform, an undersea pipeline, a pipeline landfall to an onshore base, and a pipeline linking to existing infrastructure) are located in areas used by Steller's and spectacled eiders. An offshore production platform, if located within the Ledyard Bay Critical habitat Area, would have multidecadal displacement effects on eiders using this area.

It is assumed that onshore developments would originate at a pipeline landfall, location presently unknown. The pipeline and associated developments conceivably would then be the shortest, most cost-effective route to connect with pre-existing support infrastructure. Additional airstrip construction or use of overland ice roads/pads is not anticipated. Indirect habitat losses could result from eiders and murrelets not using habitats near sites of industrial activity.

The MMS can only speculate about the size and location of permanent onshore developments associated with a future phase of oil production. The size of these facilities would remain the same as those from the Lease Sale 193 final EIS, detailed in Section and Table 4.5.1.6.2-1 of this EIS. These calculations were used to estimate the number of nesting eiders displaced from development sites and surrounding areas. These projects would require Section 7 consultation with the FWS. As with the Lease Sale 193 final EIS (see Information to Lessees, Section 4.5.1.6.2.3.2.4 of this EIS), MMS would not authorize a future project if it were likely to jeopardize the continued existence of an ESA-protected bird or result in adverse modification of designated critical habitat as determined by FWS.

The MMS believes that this condition will help industry incorporate stringent spill-prevention measures into their plans that avoid the risk of population-level effects on ESA-protected species in the Chukchi Sea.

4.5.2.6.2.3.1.8. Anticipated Level of Effect from Seismic Airgun Noise. Offshore surveys on Federal lands are conducted by vessels during the open-water period. Additional leases in the Chukchi Sea OCS would be investigated for the potential for oil or gas production. Exploratory or delineation drilling, seismic work, and related support activities generally would occur primarily during the ice-free, open-water period. Benthic habitats in used by birds could be temporarily disturbed and/or altered by drilling exploratory or delineation wells in the seafloor. These well-site areas would be small and would be expected to return to predrill condition in <3 years.

More leasing likely would result in a continuation or limited expansion of existing levels of seismic activity and increased exploration drilling in the Chukchi Sea compared to 2006 and 2007. The MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. Molting eiders could be displaced from important feeding/molting areas in the Ledyard Bay Critical Habitat Area during the open-water period. This disturbance and displacement would result in a minor level of effect to ESA-listed birds, especially spectacled eiders.

4.5.2.6.2.3.1.9. Anticipated Level of Effect from Changes in the Physical Environment. Changes in the physical environment are believed to result from climate changes superimposed on the vagaries of regional weather patterns. These long-term trends are outside the influence of the Proposed Action. The argument that potential sources of energy that could be generated from Arctic OCS oil or gas development contributes to further changes in the physical environment fails to recognize that America has large energy needs, and energy not produced from the Alaska OCS would continue to be replaced by foreign imports. Overall, as America uses these fuels, it affects worldwide CO_2 levels/climate change to the same extent, regardless of their source.

4.5.2.6.2.3.2. Cumulative Effects Under Alternative 2. The anticipated direct and indirect effects under the Proposed Action are combined with the anticipated cumulative effects under the no-action alternative to determine the cumulative effects under this alternative. Lease Sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS. Some of the existing leases may not be explored and some that are explored and may not be evaluated further by the time the lease lapses. While there may be an initial increase in the number of active leases following the proposed sales, there would be a decline in active leases over time.

Seismic surveys and exploration drilling could continue at existing levels due to a limited number of suitable or specialized vessels for conducting these activities. No more than two drill rigs could operate in the Chukchi Sea at any one time. Similarly, no more than six seismic-surveying activities could be completed during a season—an unrealistic number, because there are not six seismic-surveying vessels available. It is more reasonable to assume that no more than three seismic surveys could be completed simultaneously in the Chukchi Sea. This level of activity would represent a continuation of the same level of effect as described for anticipated Federal oil and gas activities under the Reasonably Foreseeable and Speculative Future Events (Section 4.2), except that these activities likely would extend further into the future as new leases are granted. While MMS actions likely could result in a small incremental increase in some sources of potential impacts (e.g., vessel and aircraft traffic), required mitigation measures would limit these sources to proportionately fewer impacts compared to other similar, but unrestricted sources of impact in this area.

Impacts to threatened and endangered birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to eiders in nearshore areas from unrestricted vessel and low-flying aircraft traffic, all unrelated to OCS leasing activities, would continue to have a combined negative, moderate level of effect. The greatest source of large noncrude oil spills would continue to arise from bulk-fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in major adverse effects on ESA-listed bird populations in the Chukchi Sea. Continued climate change is likely to result in major effects to ESA-protected birds.

4.5.2.6.2.4. Species-Specific Level of Effect.

Cumulative Effects on the Steller's Eider. Wetland fills from community and industry infrastructure development would immediately eliminate Steller's eider habitat compared to the more gradual habitat changes expected to result from climate change. Collisions with existing or future developments at these and other sites would continue to occur, and small numbers of Steller's eiders would be expected to be killed. Unrestricted vessel and low-level aircraft traffic would continue to be chronic sources of disturbance, especially to Steller's eiders in the spring lead system.

The MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to Steller's eiders in the Chukchi Sea. Exploration activities present a risk that Steller's eiders would collide with a vessel or drilling structure. Despite mitigation measures to reduce the risk of this occurring, an incidental take of one (0.2 rounded up) Steller's eider was calculated to be killed by collision with drilling structures during exploration and delineation activities associated with existing leases in the Chukchi Sea (USDOI, MMS, 2007d). While additional leases could be issued from the proposed lease sales, the anticipated activity level remains unchanged, and the amount of estimated incidental take remains the same.

The MMS considers the level of incidental take during exploration activities to be an unavoidable, but minor effect to Steller's eiders. No population-level effect to Steller's eiders is anticipated.

The overall effects of potential production (considered speculative) include periodic interruption of postbreeding Steller's eiders migrating in nearshore coastal areas. Activity associated with the construction and operation or maintenance of onshore facilities (pipelines, roads, etc.) likely would not result in a loss of Steller's eider nesting habitat. Despite mitigation measures to minimize disturbance from vessel and low-level aircraft traffic, a production platform in the Ledyard Bay Critical Habitat Area could displace some Steller's eiders from important spring staging areas for several decades and place sources of large or chronic spills in closest proximity to migrating Steller's eiders when they are most vulnerable. As the development scenario remains unchanged, we calculated that as many as one Steller's eider mortality would occur from collisions with structures associated with production from existing and new leases in the Chukchi Sea OCS. The level of incidental take for hypothetical development scenarios associated with this alternative presents the greatest potential for a moderate effect on spectacled eiders.

Cumulative Effects on the Spectacled Eider. Wetland fills from community and industry infrastructure development would immediately eliminate spectacled eider habitat compared to the more gradual habitat changes expected to result from climate change. Collisions with existing or future developments at these and other sites would continue to occur and small numbers of spectacled eiders would be expected to be killed. Unrestricted vessel and low-level aircraft traffic would continue to be chronic sources of disturbance, especially to spectacled eiders in the spring lead system (spring) and Ledyard Bay Critical habitat Area (summer/fall).

The MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to spectacled eiders in the Chukchi Sea. For example, oil and gas exploration vessels associated with MMS-authorized activities would not disturb molting spectacled eiders, because these vessels typically would not be permitted in the Ledyard Bay Critical Habitat Area after July 1 of each year, even if they were transiting to areas outside the Chukchi Sea.

Exploration and delineation activities present a risk that spectacled eiders would collide with a vessel or drilling structure. Despite mitigation measures to reduce the risk of this occurring, an incidental take of four spectacled eiders was calculated to be killed by collision with drilling structures during exploration and delineation activities associated with existing leases in the Chukchi Sea (USDOI, MMS, 2007d). While additional leases could be issued from the proposed lease sales, the anticipated activity level remains unchanged and the amount of estimated incidental take remains the same. The MMS considers the potential level of incidental take during exploration activities to be an unavoidable, but a minor level of effect to spectacled eiders. No population-level effect to the spectacled eider is anticipated.

The overall effects of potential production (considered speculative) include periodic interruption of post-breeding and molting spectacled eiders migrating in nearshore coastal areas, including the Ledyard Bay Critical Habitat Area. Despite mitigation measures to minimize disturbance from vessel and low-level aircraft traffic, a production platform in the Ledyard Bay Critical Habitat Area could displace large numbers of spectacled eiders from important molting areas for several decades and place sources of large or chronic spills in closest proximity to migrating or molting eiders when they are most vulnerable. Eventually, the abandonment of any and all surface and seafloor facilities would be removed, so no permanent adverse modification of critical habitat would occur.

Activity associated with the construction and operation or maintenance of onshore facilities (pipelines, roads, etc.) likely would result in a loss of eider nesting habitat and cause eiders nesting outside a zone of influence around these sites. The direct impact to eider nesting habitats would be 17.37 km^2 (4,291 acres), displacing an estimated 19 spectacled eiders. The zone of secondary influence associated with development facilities could have a collective areal extent of 193.13 km^2 (48,464 acres) in eider nesting habitats, resulting in an estimated indirect take of 216 spectacled eiders (Table 4.5.1.6.2-1).

As the development scenario remains unchanged, we calculated that as many as 17 spectacled eiders could die as a result of collisions with structures associated with production from existing and new leases in the Chukchi Sea OCS.

The level of incidental take for hypothetical development scenarios associated with this alternative presents the greatest potential for a major, population-level of effect on spectacled eiders.

Cumulative Effects on the Kittlitz's Murrelet. Relatively large numbers of Kittlitz's murrelet have recently been reported just west of Barrow. Foraging Kittlitz's murrelets could be periodically disturbed by existing and future vessel and low-level aircraft traffic. Mortality of Kittlitz's murrelets could occur from existing and future marine traffic or bulk fuel deliveries, but the number affected depends on the time and location of the spills.

The MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to threatened eiders in the Chukchi Sea. Most mitigation or conservation measures that benefit threatened eiders would benefit murrelets as well. This alternative, however, presents the greatest potential for exploration activity in areas used by Kittlitz's murrelets.

Alternative 2 is anticipated to have no more than a minor level of effect on Kittlitz's murrelets in the Chukchi Sea.

Determination of Effects on ESA-listed and Candidate Birds. It is determined through this analysis that the proposed Chukchi Sea Lease Sales 212 and 221 likely would have the following effects, as described by the ESA, on Steller's and spectacled eiders, Kittlitz's murrelets, and designated critical habitat:

- Lease sales 212 or 221 could result in activities in new areas that *may affect* listed eiders in the Chukchi Sea. Comprehensive mitigation measures will avoid or minimize potential adverse impacts to listed eider species, but long-term disturbance could still occur in sensitive habitats. Furthermore, a small number of eiders could still be killed by their collision with exploration structures and these mortalities are *likely to adversely affect* Steller's and spectacled eiders. This conclusion is based on the MMS considering potential levels of collision mortality to not be discountable or insignificant as defined by the ESA.
- Lease Sales 212 or 221 activities could result in long-term (20+ years) adverse effects to the Ledyard Bay Critical Habitat Area, but these activities *would not* result in a permanent adverse modification of this designated critical habitat, because any production facilities eventually would be removed or otherwise not remain above the seafloor in the critical habitat area.
- Lease Sales 212 or 221 could present new sources of disturbance that could affect Kittlitz's murrelets in the Chukchi Sea. Comprehensive mitigation or conservation measures will avoid or minimize potential impacts and the proposed project is not likely to adversely affect the Kittlitz's murrelet.

4.5.2.6.3. Polar Bear. The following analysis describes the anticipated effects to the polar bear if the entire lease sale took place with no deferrals in the Chukchi Sea. In this section, we describe the anticipated effects on polar bears under the Proposed Action with mitigation measures in place. Mitigation measures are previously described in Section 4.4.1.6.3.2.

A complete description of the Proposed Action and exploration and development scenarios is located in Section 2.2.

4.5.2.6.3.1. Direct and Indirect Effects Under Alternative 2.

Summary. The temporary displacement of some polar bears from preferred habitats is anticipated as a result of routine exploration activities. Chronic disturbance or displacement can have moderate effects over time. Mitigation measures such as locating and avoiding den areas, avoiding open lead systems where polar bears hunt for seals, and managing camp and work areas so that they do not become bear attractants could moderate potential effects to polar bear. Disturbance and displacement caused by exploration activities are anticipated to be temporary effects and to have only minor effects on the fitness or survival of individual bears.

Development and production activities could result from the proposed Chukchi Sea leases, although production would not take place unless another commercially viable discovery is made in the OCS. Production is considered speculative in the Chukchi Sea at this time, but effects from a production project are analyzed to determine the anticipated effects on the polar bear population if such a discovery is made and proposed for development in the more distant future.

The primary impacts to polar bears from production-related activities in the Chukchi Sea include habitat losses due to construction of development/production facilities, pipelines and the associated infrastructure; and the potential for oil spills. Potential habitat losses on barrier islands and along the coast could displace polar bears from denning areas that appear to be increasing in importance. Fischbach, Amstrup, and Douglas (2007) have found that more dens are being located onshore than on sea ice in the Beaufort Sea (a shift from 40% to 60% of dens located onshore). Smirnoff et al. has reported increases in numbers of polar bears onshore on the Russian Arctic coast and also reports large aggregations of bears at walrus haulouts and near beached whale carcasses (Smirnoff, unpublished report 1983). Long-term displacement from preferred denning and feeding habitats could have adverse effects and result in a major impact to the polar bear population. Direct mortality of polar bears from production activities, including habitat loss and hypothetical spills, are not expected but could represent a major level of effect, if they were to occur.

4.5.2.6.3.1.1. Anticipated Effects from Vessel Traffic. The anticipated effects from vessel traffic in the Chukchi Sea are expected to be the same as for the Beaufort Sea and are described in Section 4.4.2.6.3.4.1.

4.5.2.6.3.1.2 Anticipated Effects from Motorized Vehicle Presence and Noise. The anticipated effects of motorized traffic in the Chukchi Sea are expected to be the same as for the Beaufort Sea and are described in Section 4.4.2.6.3.4.2.

4.5.2.6.3.1.3. Anticipated Effects from Subsistence and Other Harvests. Mitigation measures currently in place have been very successful in reducing human-bear interactions in relation to oil and gas industry activities, and are expected to be applied to any future leases. Negligible additional impacts to polar bears due to DLP takes are expected under the Proposed Action. For more information on impacts to subsistence, see Section 4.5.2.12.

4.5.2.6.1.2.4. Anticipated Effects from Petroleum Spills. The MMS OSRA model assessments of oil-spill impacts are based on a combination of risk factors including the probability of a spill, spill size, spill duration, weather conditions, and the effectiveness of oil-spill response (i.e., containment and cleanup). Spills could occur on land or in the marine environment. Spills into the marine environment have the potential to travel with water currents and to spread rapidly, depending on season, wind, and weather conditions. Therefore, spills in the marine environment may have a greater potential to affect polar bears. The effects of exposure to oil on polar bears are reviewed in Section 4.4.1.6.3.1.4. This analysis assumes that polar bears contacted by oil would not survive, or those that ingest substantial amounts of oil through eating oiled prey would not survive. Polar bears could come into contact with oil in the open-lead system, in pack ice, on shorefast ice, along the coastline, or on barrier islands.

For the OSRA model, the probability that an oil spill would contact a specific resource area assumes no cleanup or mitigation is in place. A large spill from a well blowout is described as a very unlikely event, and we assume that no large oil spills will occur during exploration activities (Section 1.1.4).

The OSRA model quantifies the percent chance that a large spill (defined as >1,000 bbl for a platform spill and >4,600 bbl for a pipeline spill) could contact important resources areas. We analyze the potential effects from oil spills to determine which areas would be at highest risk for polar bears. In the following sections, we evaluate the vulnerability of polar bears to oil spills, describe the potential effects of disturbance from postspill-cleanup activities, the potential effects of prey reduction or contamination, and the anticipated effects to polar bear populations.

Vulnerability of Polar Bears to 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. Oil would remain highly toxic to polar bears, even after the aromatic hydrocarbons have dissipated. 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 will swim considerable distances from ice to shore, or vice versa. 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. 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. Ingesting oiled prey would be likely to be a secondary source of mortality from a spill.

Increasing trends in polar bear use of terrestrial habitat in the fall are likely to continue, as sea ice conditions continue to change. We realize that some OCS operations might pose a relatively high spill risk to polar bear aggregations and therefore to the polar bear population as a whole. In March 2006, more than 4,790-bbl (200,000 gal) of oil spilled onto the tundra on the North Slope as a result of a leak in a corroded pipeline that went undetected for an extended length of time. As demonstrated by this spill, small, chronic leaks in underwater pipelines could result in large volumes of oil being released underwater without detection. If such an event were to occur in offshore waters, there could be major impacts to the polar bear population. If such a spill occurred during winter, the release of oil trapped under the ice during spring breakup would be equivalent to the catastrophic release of the same amount of oil (Amstrup, Durner, and McDonald, 2000). The continued use of new technology, such as the LEOS leak-detection system, can greatly enhance the ability to detect small leaks so they do not become large spills over time. The MMS regulations require spill-prevention and equipment monitoring.

Oil-Spill Analysis. The potential for spills to contact polar bear habitats in the Chukchi Sea was analyzed in the Sale 193 final EIS (USDOI, MMS, 2007d). We have updated the assessment for the proposed Chukchi Sea lease sales below. The results of this analysis are similar to past analysis.

The following oil-spill analysis presents conditional and combined probabilities expressed as percent chance. Conditional probabilities assume that a large spill has occurred, and model the percent chance of that spill contacting particular resource areas (see Appendix A). Combined probabilities model the chance of one or more large spills occurring and contacting a particular resource area. The probabilities in the following discussions, unless otherwise noted, are conditional probabilities estimated by the OSRA model of a large spill contacting the environmental resource areas and land segments pr grouped land segments (GLSs). Environmental resource area locations are found in Appendix A, Maps A.1-2a through 2e and Maps A.1-3a through 3d. The OSRA model assumes that a spill starts at a specific launch area or pipeline segment. The launch areas and pipeline segments for the Chukchi Sea area are found in Appendix A, Map A.1-5. An ERA can represent an area important to one or several species or species groups during a discrete amount of time. This section analyzes risk to polar bears. Oil-spill impacts to ice seals, such as ringed seals, could impact polar bears by limiting prey available to them, or by causing mortality from secondary contamination. These impacts are analyzed in the nonendangered marine mammals section (Section 4.5.2.8).

Conditional Probabilities. This section discusses the chance that a large oil spill from the Chukchi Sea lease sale area would contact specific environmental resource areas that are important to polar bears. Conditional probabilities assume that a spill has occurred.

The estimated chance that one or more large platform or pipeline spills will occur as a result of production from Lease Sales 212 and 221 is 40% over the life of the project. This estimated chance of a large spill remains constant, regardless of the selection of any combination of deferrals. This model assumes that one field is developed, and that the life of the production field is 25 years (Appendix A, Table A.1-28). For development and production phases, the fate and behavior of a 1,500-bbl oil spill from a platform and a 4,600-bbl oil spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A).

A 1,500-bbl spill from a platform occurring during the summer season (July-September) would cover approximately 29 km^2 after 3 days and 577 km^2 of discontinuous area after 30 days, and would oil an estimated 25 km of coastline. A winter spill of the same size from a platform would cover 10 km^2 after 3 days and 188 km^2 of discontinuous area after 30 days, and would oil an estimated 30 km of coastline (Appendix A, Table A.1-11). A 4,600-bbl spill from a pipeline occurring during the summer season would cover approximately 51 km^2 after 3 days and 1008 km^2 of discontinuous area after 30 days, and would oil an estimated 42 km of coastline. A winter spill of the same size from a platform would cover 16 km^2 after 3 days and 332 km^2 of discontinuous area after 30 days, and would oil an estimated 51 km of coastline (Appendix A, Table A.1-12). These examples highlight the critical importance of an immediate response from onsite oil-spill response personnel and equipment, although winter cleanup would have limited effectiveness, particularly in broken-ice conditions.

A 1,500- or a 4,600-bbl spill could contact environmental resource areas where polar bears may be present (Appendix A, see especially Table A.1-17). Approximately 44% of a 4,600-bbl pipeline spill during the summer open-water period would remain after 30 days, covering a discontinuous area of 1008 km^2. A spill during broken ice in the fall or under ice in the winter would melt out in the following summer, potentially causing major impacts to polar bear. Approximately 55% of a 4,600-bbl pipeline spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2 (Tables A.1-11 and A.1-12).

The OSRA model calculates conditional probabilities (expressed as a percent chance) of a spill contacting identified polar bear habitats (environmental resource area polygons, land segments, or grouped land segments). Conditional probabilities are based on the assumption that a spill has occurred (for further explanation, see Appendix A). For a map of the hypothetical platform locations (launch areas) and the hypothetical pipeline routes that the model uses for the oil-spill-trajectory analysis, see Appendix A, Map A.1-5. There are 15 launch areas and 11 pipeline segments considered in the model.

Islands, Barrier Islands, and Coastline - Summer Oil Spills. A summer spill could impact polar bears coming ashore due to sea-ice retreat or in preparation for denning later in the fall/winter season. The areas in the Chukchi Sea that would be particularly important include Wrangel Island, Herald Island, and Ostrov Kolyuchin (Kolyuchin Spit), areas where polar bears come ashore to feed on walrus carcasses and to den. Polar bear dens also can be found along both the U.S. and Russian coast of the Chukchi Sea (unpublished polar bear den database, USGS, 2007). A large spill in the Chukchi Sea could impact the coastline of the Beaufort Sea, as well as the barrier islands near Point Barrow and Barrow. In winter, polar bears range throughout the ice-covered waters of the Chukchi Sea. They may be found near polynyas and open lead systems, where they prey on seals.

The OSRA model predicts the chance of a summer oil spill contacting the environmental resource areas and coastal areas that are important resource areas to polar bears. This information is summarized in Table 4.5.2.6.3-1. Wrangel Island and Herald Island are particularly important because of the large numbers of polar bears that are drawn to the islands to den and to feed on walrus in late summer and fall. A summer spill has a 2% chance or less of contacting Wrangel Island or Ostrov Kolyuchin and a 1% chance or less of contacting Herald Island 30 days after a spill, for all potential launch areas and pipeline spills. There is no difference 360 days after a spill, the percent chance remains at 1% or 2%. A summer spill has a 3% chance or less of contacting Point Barrow or the Plover Islands 30 days after a spill, for all potential launch areas and pipeline spills. The percent chance rises to 7% at 360 days after a spill. For the Barrow, Browerville, Elson Lagoon area, the percent chance of contact from a summer spill is 8% at 30 days after a large spill and 13% at 360 days after a spill. For more information see Appendix A, Table A.3-33, A.3-36, A.3-39, A.3-42.

If groups of land segments are considered, the chance of contact from a summer spill originating at a launch area or pipeline in the Chukchi Sea lease-sale area reaching the U.S. Beaufort Sea coastline within 30 days varies from <0.5% at 18 launch areas and pipelines, to a high of 10% at LA13. The level of risk is variable due to the effects of wind, current, and proximity to shore and depends on the launch area or pipeline segment where the spill originates (Table A.3-45, Maps A.1-3d and A.1-5). After 360 days, the percent chance remains at a low of <0.5% at 10 launch areas and pipelines, and rises to a high of 23% at LA8 (Table A.3-48). The chance of contact from a summer spill originating at a launch area or pipeline in the Chukchi Sea lease-sale area reaching the U.S. Chukchi Sea coastline within 30 days varies from <0.5-22% (LA 11) for launch areas, and from <0.5% (PLs 4 and 7) to 33% (PL 9) and 35% (PL 6) for pipelines. After 60 days, the percent chance rises to 31% (LA 11), 42% (PL 9), and 43% (PL 6). The chance of contact from a summer spill originating at a launch area or pipeline in the Chukchi Sea lease-sale area reaching the Russian Chukchi Sea coastline within 30 days varies from <0.5% at 12 launch areas and pipelines, to a high of 20% at LA9 and 20% at PL1 (Table A.3-45, Maps A.1-3d and A.1-5). After 360 days, the percent chance remains at a low of 1% at 8 launch areas and pipelines, and remains at a high of 20% at LA9 and PL1 (Table A.3-48.)

The percent chance that an oil spill originating at a launch area or pipeline in the Chukchi Sea lease-sale area would contact the Chukchi Sea spring lead system is <0.5-14% at 30 days after a spill, and the percent chance remains the same at 360 days after a spill. The percent chance that an oil spill originating at a launch area or pipeline in the Chukchi Sea lease-ale area would contact the Chukchi Sea polynyas, important polar bear foraging habitat, within 30 days of a spill ranges from <0.5% to highs of 84% at LA11 and 82% at PL5. After 360 days, this rises to a range of <0.5-85% at LA11 and 82% at PL5 (Appendix A, Table A.3-33 and A.3-36).

Barrier Islands and Coastline- Winter Oil Spills. A winter spill could impact polar bears on nearshore or offshore ice. A large spill in winter would be difficult to clean up, and oil could become entrained in the ice, melting out in spring and contacting lead systems and coastal areas. The areas in the Chukchi Sea that would be particularly important include Wrangel Island, Herald Island, and Ostrov Kolyuchin (Kolyuchin Spit), areas where large concentrations of polar bears come ashore to feed on walrus carcasses and to den. Polar bear dens also can be found along both the US and Russian coast of the Chukchi Sea (unpublished polar bear den database, USGS, 2007). A large spill in the Chukchi Sea could impact the U.S. and Russian coastlines of the Chukchi Sea, the coastline of the Beaufort Sea, as well as the barrier islands near Point Barrow and Barrow. In winter, polar bears range throughout the ice-covered waters of the Chukchi Sea. They may be found near polynyas and open lead systems where they prey on seals.

The OSRA model predicts the chance of a winter oil spill contacting the environmental resource areas and coastal areas that are important resource areas to polar bears. This information is summarized in Table 4.5.2.6.3-2. A winter spill has a <0.5% chance of contacting Wrangel Island, Herald Island, or Ostrov Kolyuchin 30 days after a spill, and a <0.5-1% chance of contacting these areas 360 days after a spill, for all potential launch areas and pipeline spills. A winter spill has a <0.5% chance of contacting Point Barrow or the Plover Islands 30 days after a spill for all potential launch areas and pipeline spills. The percent chance rises to <0.5-3% at 360 days after a spill. For the Barrow, Browerville, Elson Lagoon area, the percent chance of contact from a winter spill is <0.5-2% at 30 days after a large spill and <0.5-16% at 360 days after a spill. For more information, see Appendix A, Table A.3-57 and A.3-60.

If groups of land segments are considered, the chance of contact from a winter spill originating at a launch area or pipeline in the Chukchi Sea lease-sale area reaching the U.S. Beaufort Sea coastline within 30 days varies from <0.5-1%. After 360 days, the percent chance of contact ranges from <0.5-11%. The chance of contact from a winter spill originating in the Chukchi Sea lease-sale area reaching the U.S. Chukchi Sea coastline within 30 days varies from <0.5-13% (LA 10) and from <0.5% (PLs 4,7 and 10) to

21% (PL 6). After 360 days, the percent chance ranges from <0.5-28% for launch areas and 2-38% for pipelines. The chance of contact from a winter spill originating in the Chukchi Sea lease-sale area reaching the Russian Chukchi Sea coastline within 30 days varies from <0.5-8% for launch areas and pipelines. After 360 days, the percent chance remains <0.5-8% for launch areas and from <0.5-9% for pipelines. The level of risk is variable due to the effects of wind, current, and proximity to shore and depends on the launch area or pipeline segment where the spill originates (Tables A.3-69 and A.3-72, Maps A.1-3d and A.1-5).

The percent chance that an oil spill originating in winter at a launch area in the Chukchi Sea lease-sale area would contact the Chukchi Sea spring lead system is <0.5-16% at 30 days after a spill, and <0.5-23% at 360 days after a spill. The percent chance that an oil spill originating in winter at a pipeline in the Chukchi Sea lease-sale area would contact the Chukchi Sea spring lead system is <0.5-26% at 30 days after a spill and <0.5-35% at 360 days after a spill. The percent chance that an oil spill originating in the Chukchi Sea lease-sale area would contact the Chukchi Sea polynya areas within 30 days of a spill ranges from <0.5-18% at launch areas and <0.5-32% at pipelines. After 360 days, this rises to a range of <0.5-33% at launch areas <0.5-39% at pipelines (Appendix A, Table A.3-57 and A.3-60).

Combined Probabilities. Combined probabilities differ from conditional probabilities in that there is no assumption that a spill has occurred. Instead, combined probabilities reflect the percent chance of a spill occurring and of any portion of that spill contacting any portion of a particular resource. Combined probabilities do not factor in any cleanup efforts. For more background, see Appendix A, Section 4.3.

The combined probabilities of a large spill (>1,000 bbl) occurring and any portion of that spill contacting any portion of Wrangel Island, Herald Island, Ostrov Kolyuchin, Barrow, Browerville, or Elson Lagoon is <0.5% from 3 days after a spill until 360 days after a spill. The model does not predict the percent chance of contact beyond 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the Chukchi Sea spring lead system is 5% after 30 days and 7% after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the Point Lay area polynya system (also identified as a subsistence area) is 5% after 30 days and 8% after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the Wainwright area polynya system (also identified as a subsistence area) is 5% after 30 days and 7% after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of Point Barrow or the Plover Islands is <0.5% after 30 days and 1% after 360 days.

For grouped land segments, the combined probabilities of a large spill occurring and any portion of that spill contacting the Chukchi Sea polynya area offshore is 13% after 30 days and 17% after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the Russian Chukchi coastline is 1% after 30 days and after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the U. S. Beaufort Sea coastline is <0.5% after 30 days and 1% after 360 days. The combined probabilities of a large spill occurring and any portion of that spill contacting any portion of the U. S. Chukchi coastline is 6% after 30 days and 11% after 360 days (Appendix A, Tables A.3-79, A.3-80 and A.3-82). The combined probabilities do not factor in any oil-spill-cleanup efforts and do not differentiate between amounts of oil contacting the coastline.

Chronic Low-volume Spills. An estimated 178 small crude oil spills <500 bbl could occur during the 25-year oil-production period (Appendix A, Table A.1-32), an average of more than 7 per year. The average crude oil spill size is 126 gal (3 bbl) for spills <500 bbl. The average refined oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined oil spills could occur during the 25-year oil-production period

(Appendix A, Table A.1-32), an average of 17.6 per year. Overall, an estimated 25 small-volume oil spills could occur during each year of the 25-year production period.

The effects of small-volume spills on polar bear would depend on the location and timing of each spill, as well as the speed and success rate of clean up efforts, and of efforts to haze bears away from the spill area. Small-volume spills from the Chukchi Sea lease-sale area are unlikely to reach the Russian Arctic coasts or Wrangel or Herald islands. If one or more small-volume spills were to occur in close proximity to polynya or lead systems where bears were foraging, they may become oiled. There also is the potential for bears to be drawn to forage on oiled carcasses, which would bring them into contact with oil.

Spill-Response Activities. Spill-response efforts are expected to be similar in the Beaufort and Chukchi seas. See Beaufort Sea Spill Response Activities, Section 4.4.2.6.3.4.4.

Currently, there are no sensitive areas identified for polar bears in the Chukchi Sea. If the FWS identifies sensitive areas or establishes critical habitat through the ESA process, these areas would be identified in the Alaska Clean Seas Manual and would receive special attention in the event of a spill.

Prey Reduction or Contamination. Prey reduction or contamination effects are likely to be similar to those described for the Beaufort Sea in Section 4.4.2.6.3.4.4.

Summary of Spill Effects. We conclude that if an offshore oil spill occurred, a potentially significant impact to polar bears could result, particularly if areas in and around polar bear aggregations were oiled. This is because the biological potential for polar bears to recover from any perturbation is low due to their low reproductive rate (Amstrup, 2000). Based on OSRA analysis, the estimated chance of a large spill occurring over the 25-year life of production is 40% (Table A.1-28). The combined probability of one or more large oil spills occurring and contacting any portion of the U.S. Chukchi Sea coastline is 8% within 60 days, and 1% for the Russian Chukchi Sea coastline.

The MMS regulations are designed to reduce potential impacts by requiring specific mitigation measures for specific exploration and development activities associated with Lease Sale 212 or 221. Prior to the start of exploration, development, and production activities, operators will be advised to apply for a Letter of Authorization with FWS. Proposed activities will be analyzed by FWS on a case-by-case basis and effective mitigation measures developed accordingly, based on the latest polar bear population estimates, distribution information, other research results, and the location and timing of the activity.

Mitigation measures implemented in the Chukchi Sea are expected to be as effective as those in the Beaufort Sea, and documented impacts to polar bears to date in the Beaufort Sea by the oil and gas industry appear minimal. Due primarily to increased concentrations of bears on parts of the coast, the relative oil-spill risk to the population may be increasing. Close cooperation among MMS, the FWS, OCS operators, and oil-spill-response personnel will help to ensure that the level of effect does not increase. Therefore, our overall finding is that the Proposed Action, with existing MMS operating regulations and the standard mitigation measures imposed by FWS, will have negligible effects and is not likely to adversely affect the polar bear.

4.5.2.6.3.1.5. Anticipated Effects from Habitat Loss and Degradation. A temporary loss of polar bear habitat could result from exploration activities. This would have minor effects on denning habitat availability and foraging habitat availability. The level of displacement would depend on the level of exploration occurring, and the duration of the activity.

Under the Proposed Action, the footprint of activities ongoing on the North Slope could increase. Permanent habitat loss would be associated with production activities, which are not considered reasonably foreseeable from this lease sale at this time. Critical habitat has not yet been designated for polar bears. This lease sale would add incrementally to the level of exploration currently ongoing on the North Slope, and to temporary losses of habitat for the polar bear and their prey species. We expect the lease sale to have negligible effects on polar bears.

4.5.2.6.3.1.6. Anticipated Effects from Seismic Noise. Polar bears are less sensitive to disturbance from open-water seismic activities than many marine mammal species. However, females in dens, both on sea ice and onshore, are at risk to disturbance from any vehicular traffic or noise that occurs as a result of on-ice seismic activities or in support of open-water seismic activities. Mitigation measures currently in place require industry to locate and avoid polar bear dens. With these mitigation measures in place, we expect negligible effects to polar bears.

4.5.2.6.3.1.7. Anticipated Effects from Changes in the Physical Environment. Negligible effects on long-term trends associated with anthropogenic effects on climate change are expected under the Proposed Action. At this point, production from this lease sale is considered speculative. Should production occur in the future as a result of this lease sale, it is unlikely to have a profound effect on the level of oil produced or consumed on a worldwide basis. Ongoing climate change is expected to have a major effect on polar bears within the next 40-50 years. This lease sale, whether it occurs or not, is not expected to add to that effect in any consequential way.

4.5.2.6.3.2. Cumulative Effects Under Alternative 2. The anticipated effects under Alternative 2, the Proposed Action, are combined with the anticipated effects under Alternative 1, the no-action alternative, to determine the cumulative effects under this alternative. This cumulative effects analysis assumes that mitigation measures (described in Section 4.4.1.7.3.2) will be in place, and that none of the proposed deferrals are selected. Lease sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS. Given the history to date in the OCS in Alaska, it is reasonable to assume (1) that many available leases will not be purchased, (2) that not all leases purchased will be explored, and (3) that most exploration will not lead to development. The MMS estimates that operators would need to locate a >1 Bbbl-field to make production from the Chukchi Sea financially feasible, given the lack of existing infrastructure that is available. Leases that are purchased would revert to the Federal Government after 10 years if no development occurs. There may be an initial increase in the number of active leases following a lease sale and a corresponding increase in exploration activities, but there would be a gradual decline in active leases from these sales over time.

Seismic surveys and exploration drilling could continue at existing levels due to a limited number of suitable or specialized vessels for conducting these activities, or could increase if the operators secure additional vessels and equipment. The NMFS and/or FWS may choose to limit the number of active seismic operations, or to limit the operating area to decrease impacts to marine mammals, including polar bears. The FWS also may determine that certain areas are critical habitat for polar bears, and these areas may not be available for production activities. If current equipment constraints hold, no more than two drill rigs could operate in the Chukchi Sea at any one time. Similarly, no more than six seismic surveying activities could be completed during a season simultaneously in the Chukchi Sea. This level of activity would represent a continuation of the same level of effect as described for anticipated Federal oil and gas activities under the Reasonably Foreseeable and Speculative Future Events (Section 4.2), except that these activities likely would extend further into the future as new leases are granted. While MMS actions would likely result in an incremental increase in sources of potential impacts, required mitigation measures could limit these impacts. The MMPA requires that impacts to marine mammals must be negligible, or the proposed activities will not be permitted or authorized.

Impacts to polar bears are greatest from ongoing climate changes, sea-ice reductions, and potential changes in prey availability. Impacts from local community travel and subsistence activities are expected to continue at current levels. Impacts from oil and gas infrastructure developments eventually may increase from these lease sales, but it is difficult to predict whether or to what extent this will happen. Disturbances to polar bears in nearshore areas from unrestricted vessel, snow machine, and low-flying aircraft traffic unrelated to OCS leasing activities, as well as from regulated OCS activities, would continue to have some effects on polar bears. In summary, documented impacts to polar bears to date in Alaska by the oil and gas industry appear minimal. Close cooperation between MMS, FWS, and OCS operators would help to ensure that the level of effect does not increase. Therefore, our overall finding is that under Proposed Action, if properly mitigated through the LOA process, negligible effects to polar bear populations are likely.

4.5.2.7. Marine and Coastal Birds.

Summary. In the following analysis, we determined that there likely would be few direct or indirect effects if the lease sales were held: there would be a negligible level of effect from vessel presence and noise, aircraft presence and noise, seismic-airgun noise, petroleum spills, increased bird predator populations, and subsistence hunting, and a minor level of effect from collisions with structures and moderate effects from habitat losses from exploration drilling activities in sensitive habitats. While the greatest potential for a major level of cumulative effect is associated with continuing physical changes in the Arctic environment, the lease sales will not result in a direct effect on this impact category. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1, and the resultant levels of effect are comparable to those under Alternative 1, except for the potential of increased adverse effects from exploration drilling in sensitive bird habitats. Mitigation measures imposed by MMS on future exploration activities on existing or new leases and surrounding waters avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea. While MMS-authorized actions could result in a small, incremental increase in or longer duration of some activities, the total effect would be proportionately lower when compared to similar, but unrestricted activities in the area.

4.5.2.7.1. Potential Effects to Marine and Coastal Birds. Marine and coastal birds in the Chukchi Sea are subject to the same potential effects described in Section 4.4.1.6.2.1 and 4.5.1.6.2.1. These potential effects are not repeated here.

4.5.2.7.2. Mitigation Measures. The potential effects are moderated by the same mitigation measures listed in Section 4.5.2.6.2.2.

4.5.2.7.3. Anticipated Effects Under Alternative 2. In this section, we determine the anticipated level of effect to marine and coastal birds if MMS opens the entire lease sale area (no deferrals) in the Chukchi Sea. Our effects analysis considered other important factors (timing, residence time and periodicity, spatial extent, environmental factors, etc.) described in Section 4.4.1.6.2.3. We also defined the level of effect terms in Section 4.4.1.6.2.3. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.2.7.3.1) and cumulative effects (Section 4.5.2.7.3.2). As marine and coastal birds are a resource group, we address differential effects to specific species separately in Section 4.5.2.7.4.

4.5.2.7.3.1. Direct and Indirect Effects Under Alternative 2.

Summary. The loss of a small number of marine and coastal birds, particularly waterfowl species, as a result of collisions with offshore structures from routine exploration activities are anticipated to result in a minor level of effect on these species. Disturbance in or displacement from important habitats from exploration activities are anticipated to have a negligible level of effect on the fitness or survival of individual birds or production of the population as a whole.

4.5.2.7.3.1.1. Anticipated Level of Effect from Vessel Presence and Noise. Additional Federal leases could result in a continuation or limited expansion of existing levels of OCS-related vessel activity in the Chukchi Sea (compared to 2006 and 2007), but the incremental increase in the total number of vessels operating in the Chukchi Sea would have proportionately fewer impacts to marine and coastal birds compared to other unrestricted vessels operating in this area. Mitigation measures imposed by MMS on future exploration activities avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea and, a negligible level of effect is anticipated.

4.5.2.7.3.1.2. Anticipated Level of Effect from Aircraft Presence and Noise. The number of nesting marine and coastal birds that would be exposed to low-level flights associated with OCS oil and gas development is low, because the potential direct flight from an airbase to offshore drilling sites within the OCS primarily would be over coastal waters. While additional Federal leases likely would result in a continuation or limited expansion of existing levels of exploration activity in the Chukchi Sea (compared to 2006 and 2007), the incremental increase in the total number of aircraft associated with this activity would have proportionately fewer impacts compared to other unrestricted aircraft operating in this area. Mitigation measures imposed on future exploration activities avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea, and negligible effects are anticipated.

4.5.2.7.3.1.3. Anticipated Level of Effect from Collisions. Oil and gas exploration activities likely would increase the total number of structures in the project area. Mitigation measures imposed on exploration activities are believed to minimize collision mortality to marine and coastal birds in the Chukchi Sea. For example, vessels and drillships must operate their lights to minimize collisions. While the Lease Sale 193 boundary excluded nearshore areas used by migrating birds, this alternative does not exclude this area. The MMS cannot assume that recommendations for the design and implementation of lighting of structures would result in no strikes by marine and coastal birds, and these potential strikes are anticipated to result in a minor level of effect.

4.5.2.7.3.1.4. Anticipated Level of Effect from Petroleum Spills. 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 marine and coastal birds because of their ability to spread and persist. Exposure of marine and coastal birds is expected to result in the general effects reviewed in Section 4.4.1.3.6.2.1.4. This analysis assumes that all birds contacted by oil would not survive, and that secondary effects may cause impaired physiological function and production of fewer young. The same mitigation measures described in Section 4.5.2.6.2.2 would be implemented for this alternative. A large spill from a well blowout is described as a very unlikely event, and no large oil spills are assumed to occur during exploration activities (Section 1.1.4).

It is important to remember that a large spill event associated with OCS oil and gas activities likely would occur only during the production phase, when oil or gas product is being moved to production facilities in the existing facilities at Kuparuk or Prudhoe Bay. Section 4.5.1.6.2.3.2.4 (Anticipated Effects to Threatened and Endangered Birds: Oil Spills) describes the basis for concluding that oil or gas production resulting from the proposed lease sales is considered speculative, and production effects are not considered reasonably foreseeable. Such a commercial discovery warranting production has not been identified or proposed for development. In other words, the MMS can describe how a large spill could have a major level of effect on some marine and coastal bird populations, but a spill from production activities is not considered a reasonably foreseeable future event.

The MMS models large spills to estimate the percent chance that a large spill could contact important environmental resource areas and then analyzes the potential effects from oil spills to determine which areas would have the highest chance of contact. In the following sections we evaluate the vulnerability of certain groups of marine and coastal birds to oil spills (oil-spill analysis), then we describe the effect of disturbance from oil-cleanup activities, the effects of prey reduction or contamination, and the anticipated effects of that mortality on these bird populations.

Oil-Spill Analysis. The potential for spills to contact marine and coastal birds in the Chukchi Sea was described in the Chukchi Sea Lease Sale 193 EA (USDOI, MMS, 2007d). Due to small adjustments in the environmental resource areas (size/shape), changes in lease area, and other model refinements, we have updated the assessment for the proposed Chukchi Sea lease sales below. The results of this analysis are much the same as those for the previous lease sale in the Chukchi Sea.

The spill rate of large platform and pipeline spills during production is 0.51 (95% confidence interval = 0.32-0.77) per billion barrels, with a 40% chance of one or more large spills occurring over the 25-year production life of the project (Table A.1-28). For the development and production phases, the fate and behavior of a 1,500-bbl spill from a platform and a 4,600-bbl spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A). The 1,500-bbl spill would cover a smaller area (577 km^2) (Table A.1-11) than a 4,600-bbl spill (1,008 km^2) (Table A.1-12) after 30 days. The OSRA uses the center of the spill mass as the contact point, so the probabilities of either spill contacting specific environmental resource areas would be the same. Because of this similarity, only the 4,600-bbl spill is analyzed from this point on.

A 4,600-bbl spill could contact environmental resource areas where marine and coastal birds may be present. Approximately 44% of a 4,600-bbl spill during the open-water period would remain after 30 days, covering a discontinuous area of 1,008 km^2. A spill during broken ice in fall or under ice in winter would melt out in the following summer. Approximately 55% of a 4,600-bbl spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2.

The following paragraphs present conditional probabilities (expressed as a percent chance) estimated by the OSRA model of a large spill contacting or combined probabilities of one or more large spills occurring and contacting many of the best known habitats that are important to marine and coastal birds. Given the wide variety of bird species that use the proposed lease-sale area and factoring in continuous changes in prey abundance and other biotic and abiotic factors that affect bird distribution, it is possible that large aggregations of birds could be at risk from a large spill anywhere in the lease-sale area. For instance, short-tailed shearwaters and some auklet species occur during the summer throughout the lease-sale area, but a large spill could contact large numbers of them or none at all, depending on the location of the spill and location of the birds at the time of the spill.

For many marine species, it is not possible to assess the chance of contact with oil with a high degree of confidence. Conditional probabilities are based on the assumption that a large spill has occurred (see Appendix A). Combined probabilities, on the other hand, factor in the chance of one or more large spills occurring. The probabilities in the following discussions, unless otherwise noted, are conditional probabilities estimated by the OSRA model of a large spill contacting the resource areas being discussed within 180 days during summer or winter (Tables A.3-35 or A.3-59). The environmental resource area references locations are found in Table A.1-14, and Maps A.1-2a through 2e, and the launch areas and pipeline segments are found in Appendix A, Map A.1-5 (Chukchi Sea). An environmental resource area can represent an area important to one or several species or species groups during a discrete amount of time.

Conditional Probabilities. This section describes the conditional probabilities estimated by the OSRA model of a large oil spill in the Chukchi Sea contacting specific environmental resource areas that are important to marine and coastal birds. No large oil spills are assumed to occur during exploration activities.

The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting marine and coastal bird habitats (ERAs 1, 2, 8, 9, 10, 14, 15, 17-19, 64, 65, 68, 69-73, 77-79, and 96). Conditional probabilities are based on the assumption that a large spill occurs (see definition and applications, Appendix A).

Summer Spill. The following discussion summarizes the results for LAs 1-15 and PLs 1-11 during summer within 180 days, unless otherwise specified. The OSRA model estimates a <0.5-43% chance that a large oil spill from launch areas contacts environmental resource areas important to marine and coastal birds within 180 days, and a <0.5-56% chance from pipelines (Table A.3-35). The highest chance of contact from a launch area occurs from LA9 to ERA18, murre rearing and molting area, which has a 43% chance of contact within 180 days. The chance of contact to this resource area is highest, because the OSRA model's launch area and the environmental resource area are in close proximity to or overlap each other. The highest chance of contact from pipeline segments occurs at ERA10, Ledyard Bay Critical Habitat Area (LBCHA), which has a 56% chance of contact from PL6. There is a 42% chance of contacting ERA10 from LA10. The chance of contact to this resource area is highest, because the OSRA model's pipeline segments and the environmental resource area are in close proximity to or overlap each other.

Many pre- and postbreeding shorebirds and waterfowl stage at Kasegaluk Lagoon, while other bird species breed or molt in or near the lagoon. A large spill originating from PL6 or LA11 has a 34% or 17% chance, respectively, of contacting ERA1 (Kasegaluk Lagoon) within 180 days (Table A.3-35). Waterfowl and shorebirds also use Peard Bay, especially in the summer and fall to breed, molt, and forage during migration. A large spill originating from PL11 or LA13 has a 49% or 23%, respectively, chance of contacting nearby ERA64 (Peard Bay) (Table A.3-35).

Many marine and coastal birds must stage offshore in the spring if their breeding habitats are unavailable. ERA19 represents the Chukchi spring lead system used by many of these birds during spring (April-June), and the highest percent chance of contacting this environmental resource area is 9% from any launch area within 180 days, as they move east to breeding areas or stage offshore if breeding habitats were unavailable. Similarly, a large spill originating from PLs 6, 9, or 11 has a 12-14% chance of contacting ERA19, which marine and coastal birds use, within 180 days (Table A.3-35).

The OSRA model estimates a 46% and 28% chance, from PL1 and LA10, respectively, of a large spill contacting ERA15, directly adjacent to the murre breeding colonies near Cape Lisburne (Table A.3-35). This chance of contact also applies to other seabirds breeding at Cape Lisburne, including black-legged kittiwakes, puffins, and smaller numbers of glaucous gulls and pelagic cormorants. Similar species are located at colonies near Cape Thompson. The OSRA model estimates a much smaller chance of a large oil spill contacting ERA14 (Cape Thompson).

Many postbreeding birds leave their nesting grounds and stage offshore in the Ledyard Bay (ERA10) area as they begin migration to the Bering Sea. A large spill originating from LAs 9, 10, and 11 has an 11%, 42%, and 29% chance of contacting migrating marine and coastal birds in the ERA10 within 180 days (Table A.3-35).

Murres forage over a wide area of the Chukchi Sea during the breeding season and cover a much larger area later in the summer and fall when juveniles are floating flightless at sea during their at-sea rearing period. Attendant male murres also are flightless while molting during this period. The core of this area is represented by ERA18. The OSRA model estimates a 43% and 41% chance of a large spill contacting ERA18 from LA9 and PL1, respectively (Table A.3-35).

Winter Spill. The following discussion summarizes the results for LAs 1-15 and PLs 1-11 during winter within 180 days, unless otherwise specified. 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 could contact one or more important habitat areas after ice breakup. For conditional probabilities, assuming a large spill occurs, the OSRA model estimates a <0.5-25% chance of a large oil spill starting at any launch area contacting environmental resource areas important to marine and coastal birds within 180 days and a <0.5-34% chance from any pipeline segment.

Many sea ducks must stage offshore in the spring if their breeding habitats are unavailable. The spring lead system (ERA19) is used by nonlisted eiders and other sea ducks during spring. The highest percent chance of contact from a launch area occurs at ERA19, the spring lead system (April-June), which has a 26% chance of contact from a spill occurring at LA10 and 35% from PL9 (Table A.3-59). The chance of contact in this environmental resource area is highest, because the OSRA model's launch area or pipeline and the environmental resource area are in close proximity to or overlap each other (Table A.3-59, maps). Similarly, a large spill originating from LA8 has a 4% chance of contacting sea ducks staging offshore Barrow in the Plover Islands (ERA2; Table A.3-59).

Whereas Kasegaluk Lagoon and Peard Bay are important areas during open water in summer and fall, there would be less of a direct chance of contact to birds in these areas during the winter, because most birds have migrated elsewhere for the winter and the bays and lagoons are frozen. However, if Peard Bay and Kasegaluk Lagoon were to become oiled in winter, there likely would be effects to the habitat and the birds as they return in spring and begin to forage and breed in these areas. A large spill originating from LA10 or PL6 has a 10% or 13% chance, respectively, of contacting marine and coastal birds in ERA1, Kasegaluk Lagoon (Table A.3-59). Similarly, a large spill originating from LAs 12 and 13 or P11 has a 9% or 17% chance, respectively, of contacting marine and coastal birds in ERA64, Peard Bay (Table A.3-59).

Combined Probabilities. Combined probabilities are defined in Appendix A (Section 4.3). 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 areawide chance of a large spill contacting an environmental resource area to estimate a combined probability that both would occur simultaneously. The combined probabilities for one or more large spills occurring and reaching two environmental resource areas that are important to marine and coastal birds are in Table 4.5.2.6.2-1. These probabilities are broken into different periods to indicate volatility, weathering, and movement of the spill over time.

Chronic Small Spills. Small or low-volume spills are <1,000 bbl. The average crude-oil spill size is 126 gal (3 bbl) for spills <500 bbl. An estimated 178 small crude oil spills would occur during the 25-year oil production period (Table A.1-32), an average of more than 7 per year. The average refined-oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined-oil spills would occur during the 25-year oil production period (Table A.1-32), an average of 17.6 per year. Overall, an estimated 25 small-volume oil spills would occur each of the 25 years of production.

It is unknown how many small-volume spills or what total volume would reach areas used by marine and coastal birds. Chronic low-level spills are not modeled by the OSRA but could adversely affect marine and coastal birds. Although difficult to state with any certainty, a small-volume spill in close proximity to concentrations of marine and coastal birds could result in adverse impacts to pelagic species that tend to forage in dense concentrations. Given the wide distribution of pelagic seabirds, a spill may contact tens of thousands of pelagic birds, if they are foraging in dense concentrations near the spill site or could completely miss them, if they are concentrated in another area. Depending on the chronic nature of small spills, this situation could occur repeatedly.

The location of these small-volume spills would be an important factor in assessing impacts. While it is not possible to predict where these spills might occur given the large lease-sale area, important areas known to receive frequent use such as Peard Bay and Kasegaluk Lagoon could be impacted. Such areas are considered "hot spots." The bird activity in these areas fluctuates widely based on the time of year and, for many shorebirds, can vary greatly from day to day. For shorebirds in this area, a spill could impact tens of thousands of birds or very few, depending on the time of the spill and the persistence of the oil and its effects.

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 production.

Activities such as hazing and other human activities (vessel and aircraft traffic) could impact threatened eiders and Kittlitz's murrelets. 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 July through September are likely to adversely affect listed eiders.

The presence of large numbers of cleanup workers, boats, and additional aircraft is 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 6 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 would not be likely to result in more than 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 Deadhorse, about 150 mi east of Barrow. 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 FWS and state officials on wildlife management activities in the event of a spill. In an actual spill the two aforementioned groups would most likely 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, FWS personnel would be largely responsible for providing critical information affecting response activities to protect listed 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 would be assumed to cycle their use to ensure that the birds don't habituate to their effect.

For the purposes of evaluating the potential impact of a large spill on marine and coastal birds, 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 hours).

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 marine and coastal bird populations, 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 (for details, see USDOI, MMS, 2002a: Section III.C.2.c).

Anticipated Mortality from a Large Oil Spill. Most marine and coastal birds essentially are absent from the Chukchi Sea from late October to late April. Many 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. Many of these birds congregate in the spring lead system, the only open water available.

Several species use the open waters of the Chukchi Sea for provisioning chicks, including loons, guillemots, puffins, murres, and murrelets. Postbreeding birds move to coastal areas for molting, staging, or broodrearing. Molting or other flightless birds are particularly vulnerable to oiling because of their limited mobility and the amount of time they spend in the water or in restricted habitats (i.e., coastal lagoons).

For the purposes of analysis, we assume that any birds in an environmental resource area are killed if a large spill makes contact with that resource area. A large oil spill contacting the spring lead system could contact several thousand marine and coastal birds staging enroute to their nesting grounds further east. The most abundant species are king and common eiders, long-tailed ducks, and smaller numbers of scoters, gulls, and loons. The OSRA model estimates that the percent chance of a large spill contacting marine and coastal birds using the Chukchi lead system in spring would be a low likelihood event, because to persist to that time and location, it would have to be released in the preceding winter.

After the lead system opens up to the open-water season, few birds are in this area because they have headed east to coastal or tundra breeding grounds. Later in the summer, however, several prominent species congregate in coastal lagoons (Kasegaluk Lagoon in particular) to molt. These coastal lagoons are somewhat protected by barrier islands. Kasegaluk Lagoon, for example, contains aquatic plants used by large numbers of brant during the molt. If a spill were to enter the lagoon, it could impact a large proportion of the Pacific flyway population.

Potentially much greater mortality could occur during migration periods as new migrants enter the spill area. However, unless migrant sea ducks alight on the water during migration, they are not particularly susceptible to oiling. In addition, a spill in a particular area during summer could substantially affect those birds moving offshore from nesting areas much farther to the west. For example, a spill near Peard

Bay would affect a substantial proportion of birds that nest on the eastern coastal plain as they moved eastward toward the Bering Sea.

Juvenile murres are floating flightless at sea during their rearing period. Attendant male murres also are flightless while molting during this period. Spilled oil contacting ERA18 could result in extensive mortality, having major effects on murres nesting at the Cape Lisburne and Cape Thompson colonies.

A large spill contacting ERA15, directly adjacent to the murre breeding colonies near Cape Lisburne, could affect other seabirds breeding at Cape Lisburne including black-legged kittiwakes, puffins, and smaller numbers of glaucous gulls and pelagic cormorants. Similar species are located at colonies near Cape Thompson. Spilled oil contacting this environmental resource area during the May-October open-water period could result in major adverse effects.

Summary of Spill Effects. A large oil spill contacting critical coastal habitats of the Chukchi Sea could result in major population-level effects to a variety of marine and coastal birds. However, to put the chance of a large spill having this degree of population-level impact in perspective, one has to consider several variables. First of all, to ever have a large oil spill, production would have to occur. The most likely scenario states the probability of a successful commercial find is <10%, indicating that production is unlikely (USDOI, MMS, 2007d). Secondly, the location of the oil or gas find and subsequent development platform could influence the chance that a large spill would occur as well as the chance that it would reach areas important to marine and coastal bird species when the species are present, or, in the case of a winter spill, when those birds return. Finally, the number and sex/age of birds affected would have differing degrees of population-level effects, from a few birds in an area to all birds in an area during particular time periods. Given the stated low probability for successful oil field development, the probability that one or more large spills would occur, and the probability that a large spill would reach an area important to marine and coastal birds, an adverse effect of this magnitude appears to be a low likelihood event and negligible effects are anticipated.

If a commercially viable resource discovery is made and is considered for development, MMS must complete section 7 consultation with FWS on a production plan. As with the Sale 193 final EIS (see Information to Lessees, Appendix F), a future project would not be authorized by MMS if it was likely to jeopardize the continued existence of ESA-protected birds or result in adverse modification of designated critical habitat as determined by FWS. The MMS believes that this condition will help industry incorporate stringent spill prevention measures into their plans that not only avoids the risk of population-level effects on ESA-protected species in the Chukchi Sea, but other marine and coastal birds species that occur there as well.

Chronic low-level spills are not modeled by the trajectory analysis, but could adversely affect a moderate number of marine and coastal birds. Although difficult to state with any certainty, a small volume spill in close proximity to a large dense flock of some of the more common species could result in mortality to perhaps several hundred birds, maybe more. Depending on the chronic nature of small spills, this situation could occur repeatedly.

4.5.2.7.3.1.5. Anticipated Level of Effect from Increased Bird Predator Populations. Should development ever be proposed, mitigation measures would avoid or minimize adverse effects to marine and coastal birds. While there likely would be an incremental increase in the total number of structures or facilities that could be used by bird predators, such as ravens or foxes, these facilities would not be constructed or operated in a manner that would support bird predators.

A lease stipulation (requiring that new infrastructure would avoid the artificial enhancement of predator populations) has recently been implemented for the Liberty project and is anticipated to be implemented for future developments associated with Federal leases. Implementation and enforcement of a leasing stipulation could be expected to minimize any effects of increased predator populations resulting from MMS actions in the OCS and a negligible level of effect is anticipated.

4.5.2.7.3.1.6. Anticipated Level of Effect from Subsistence-Hunting Activity. There would not be any change in subsistence-hunting activity due to exploration activities, and negligible effects are anticipated. Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2.4, Petroleum Spills). If development and production were to occur, we assume that a pipeline would carry products to pre-existing infrastructure for transport to processing facilities. The pipeline would need a road for periodic maintenance, and this road could increase access of local hunters to previously inaccessible areas. Waterfowl hunters may be able to access pipeline roads during the period immediately following spring breakup to hunt geese and nonlisted eiders.

4.5.2.7.3.1.7. Anticipated Level of Effect from Habitat Loss. There would not be any permanent loss or alteration of marine and coastal bird habitat during exploration and delineation activities. Small amounts of temporary habitat loss of marine and coastal bird migration habitats could occur from drilling exploration or delineation wells into the seafloor. Increased exploration drilling could result from multiple companies exploring more leases. Exploration and production wells/platform could be proposed on any leases issued for blocks within the LBCHA. Exploration wells would result in a temporary loss (via displacement) of marine and coastal bird habitat, resulting in a moderate level of effect.

Future production of oil or gas resources on the Chukchi Sea OCS remains speculative (Section 4.4.1.6.2.3.2.4, Petroleum Spills). Permanent habitat loss could occur if production facilities (offshore platform, an undersea pipeline, a pipeline landfall to an onshore base, and a pipeline linking to existing infrastructure) are located in areas used by marine and coastal birds. An offshore production platform, if located within the LBCHA, would have multi-decadal displacement effects on marine and coastal birds using this area.

It was assumed that onshore developments would originate at a pipeline landfall, the location of which is unknown at this time. The pipeline and associated developments conceivably would then be the shortest, most cost-effective route to connect with pre-existing support infrastructure. Additional airstrip construction or use of overland ice roads/pads is not anticipated. Indirect habitat losses could result from eiders and murrelets not using habitats near sites of industrial activity.

The MMS can only speculate about the size and location of permanent onshore developments associated with a future phase of oil production. The estimated size of these facilities would remain the same as those from the Sale 193 final EA, detailed in Section 4.5.1.6.2.3.2 and Table 4.5.1.6.2-1.

4.5.2.7.3.1.8. Anticipated Level of Effect from Seismic Airgun Noise. Offshore surveys on Federal lands are conducted by vessels during the open-water period. Additional leases in the Chukchi OCS would be investigated for the potential for oil or gas production. Exploratory or delineation drilling, seismic work, and related support activities generally would occur primarily during the ice-free, open-water period. Benthic habitats in used by marine and coastal birds could be temporarily disturbed and/or altered by drilling exploratory or delineation wells in the seafloor. These well site areas would be small and would be expected to return to predrill condition in fewer than 3 years.

More leasing likely would result in a continuation or limited expansion of existing levels of seismic activity and increased exploration drilling in the Chukchi Sea compared to 2006 and 2007. The MMS will impose mitigation measures on future exploration activities to avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea. Some marine and coastal birds could be displaced from important feeding areas in the LBCHA during the open-water period. This disturbance and displacement would result in a moderate level of effect on marine and coastal birds of the Chukchi Sea.

4.5.2.7.3.1.9. Anticipated Level of Effect from Changes in the Physical Environment. Changes in the physical environment are believed to result from climate changes superimposed on the vagaries of regional weather patterns. These long-term trends are outside the influence of the Proposed Action. The argument that potential sources of energy that could be generated from Arctic OCS oil or gas development contributes to further changes in the physical environment fails to recognize that America has large energy needs, and energy not produced from the Alaska OCS would continue to be replaced by foreign imports. Overall, as America uses these fuels, it affects worldwide CO_2 levels/climate change to the same extent, regardless of their source. This alternative is anticipated to result in a negligible level of direct effect on greenhouse gas emissions.

4.5.2.7.3.2. Cumulative Effects Under Alternative 2. The anticipated effects under this alternative are combined with the cumulative effects under the no-action alternative (Alternative 1) to determine the net cumulative effects under this alternative. Lease sales 209 and 217 could result in a small increase in the number of leases in the Chukchi Sea OCS. Some of the existing leases will not be explored, and some were explored and will not be evaluated further by the time the lease lapses. While there may be an initial increase in the number of active leases following the proposed sales, there will be a gradual decline in active leases over time.

Seismic surveys and exploration drilling could continue at existing levels due to a limited number of suitable or specialized vessels for conducting these activities. No more than two drill rigs could operate in the Chukchi Sea at any one time. Similarly, no more than six seismic-surveying activities could be completed during a season, an unrealistic number, because there are not six seismic-surveying vessels available. It is more reasonable to assume that no more than three seismic surveys could be completed simultaneously in the Chukchi Sea. This level of activity would represent a continuation of the same level of effect as described for anticipated Federal oil and gas activities under the Reasonably Foreseeable and Speculative Future Events (Section 4.2), except that these activities likely would extend further into the future as new leases are granted. While MMS-authorized actions could result in a small incremental increase in some sources of potential effects (e.g., vessel and aircraft traffic), required mitigation measures would limit these sources to proportionately fewer impacts compared to similar, but unrestricted sources of impact in this area.

Impacts to marine and coastal birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic (all unrelated to OCS leasing activities) are anticipated to continue to have a moderate level of effect on marine and coastal birds. The greatest source of large noncrude oil spills would continue to arise from bulk-fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major adverse level of effect on marine and coastal bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to marine and coastal birds.

4.5.2.7.4. Species-Specific Level of Effect. As the anticipated cumulative effects under the Proposed Action are the same as those determined for Alternative 1, the species-specific level of effects to marine and coastal birds are the same as those described in Section 4.5.1.7.4.

Mitigation measures imposed on future exploration and development activities would avoid or minimize direct and indirect adverse effects to marine and coastal birds in the Chukchi Sea.

4.5.2.8. Other Marine Mammals. This section addresses marine mammals not currently listed under the ESA that commonly occur in Alaska Chukchi Sea habitats and that may be affected by the proposed sales. Species addressed include ribbon, ringed, bearded, and spotted seals; walruses; beluga and killer whales; harbor porpoise; and minke and gray whales. All four species of pinniped have been petitioned for listing as threatened or endangered under the ESA. The principle anthropogenic sources of adverse effects to marine mammals in the Chukchi Sea are marine vessel and aircraft traffic and noise, seismic activities, exploration drilling, collisions, habitat loss, and environmental contaminants.

Ringed, Spotted, Ribbon, and Bearded Seals. The vast majority of ice seals occurring in the Chukchi Sea are ringed seals. After conducting an informed and detailed analysis, the overall conclusion has been made that ongoing climate change poses the greatest risk to ice seals in the Proposed Action area and that with proper mitigation, any effects arising from the proposed lease sales would have negligible effects on ice seal populations.

Pacific Walrus. The bulk of the Pacific walrus population inhabits the Chukchi Sea from late winter through fall. Recent information indicates that terrestrial haulout areas adjacent to the planning area may be increasing in importance. The planning area also encompasses walrus foraging habitat. Continued monitoring of walrus distribution and monitoring of physical parameters such as fecundity, contaminant loads, parasite loads, and other measures of health, would allow managers to identify problems as they arise and would supply the information needed for effective adaptive management plans. The proposed lease sales could have moderate impacts to walruses. Careful, ongoing mitigation and avoidance of aggregations of walrus and of important foraging areas could lower impact levels from moderate to negligible or minor.

Beluga Whale, Killer Whale, and Harbor Porpoise. Beluga whales are common in the Chukchi Sea with an estimated population of 32,000, but the population trend is unknown. Killer whales and harbor porpoises are much less common in the Chukchi Sea. Narwhales are quite rare. The annual subsistence harvest of about 186 belugas is expected to continue and is the largest known source of removal.

There may be small increases in vessel and aircraft activity associated with new leases from the proposed sales over existing levels within the Chukchi Sea lease-sale area. Close cooperation between MMS, NMFS, and OCS operators will help ensure that no more than a negligible level of effect occurs. Any exploration drilling activities also would be conducted in a manner consistent with the MMPA. Overall the oil and gas exploration activities are anticipated to have a negligible level of effect on beluga whales in the Chukchi Sea lease area.

An expected increase in traffic from tourism, research, and shipping would increase the noise in the marine environment and potential for marine accidents and oil spills. The greatest potential effect to beluga whales would be the unlikely event of a large oil spill occurring within the Chukchi Sea spring lead system at a time and place when large numbers of migrating beluga whales could contact fresh oil and inhale aromatic hydrocarbons for a prolonged period. The impacts to beluga whale subsistence activities from non-OCS-related vessel traffic are expected to continue at current levels. The greatest potential for a effects on beluga whales in the Chukchi Sea could result from changes in the physical environment associated with arctic warming/climate change, but such effects are considered speculative at this time.

Minke and Gray Whales. Alternative 2 would result in negligible to minor direct, indirect, and cumulative effects to non-ESA listed baleen whales in the Proposed Action area. As per the following analysis, if the lease sales were conducted, effects would be negligible to minor from presence and noise of seismic surveys (2D, 3D, high resolution); vessels; aircraft; drilling and production facility placement and operation and abandonment; petroleum spills; discharge; subsistence hunting; vessel collision and injury; and physical changes or alteration of habitat. The greatest potential for effects may be habitat change resulting from arctic warming, and effects may be beneficial or adverse, remain speculative at this time, and the lease sales would not affect effects of arctic warming. Direct and indirect effects under this alternative, combined with the cumulative effects under Alternative 1 (No Lease Sale), result in minor cumulative effects levels.

The following analysis describes the anticipated effects to non-ESA-listed marine mammals under Alternative 2 and the lease sale took place with no deferrals in the Chukchi Sea. We describe the potential effects to marine mammals from a variety of existing sources in Section 4.5.1.8.1. Section 4.5.1.8.2 describes mitigation measures that would avoid or minimize some of adverse impacts. The anticipated effects under this alternative considers mitigation measures (Section 4.5.2.8.2) and other important factors (from Section 4.4.1.8.3). The anticipated effects are separated into direct and indirect effects (Section 4.5.2.8.3.1) and cumulative effects (Section 4.5.2.8.3.2). We defined the terms (negligible, minor, moderate, and major) used to describe the anticipated level of effect or impact effect in Section 4.4.1.8.3.

4.5.2.8.1. Potential Effects to Marine Mammals. The potential effects to marine mammals were described in Section 4.5.1.8.1. Additional information applicable to potential effects to cetaceans is in Section 4.4.1.6.1.1.

4.5.2.8.2. Mitigation Measures. The MMPA requires that human activities have no more than a negligible impact to a marine mammal species. Under the MMPA, it is illegal to harm, harass or disturb marine mammals. In some incidences, a company may receive a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) from FWS or NMFS, respectively. An LOA or IHA authorizes the taking of small numbers of marine mammals under specific conditions and as long as all of the conditions of the LOA/IHA are met. The LOAs and IHAs are given only after a thorough review of the proposed activity and generally include specific mitigation and monitoring requirements designed to minimize potential effects on marine mammals. An LOA or IHA will not be given if the activity produces adverse effects that rise above the level of "negligible impact." LOAs/IHAs are only available for Level B harassment, defined as "the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild."

The potential effects of MMS-authorized activities would be moderated by the mitigation and monitoring measures (NTLs and ITLs) listed in Appendix F and by the Lease Stipulations described fully in Section 2.2. Under the MMPA, MMS cannot authorize or permit activities that are likely to have more than a negligible impact upon marine mammals. Mitigation and monitoring measures have typically included an adequate OSRP (USDOI, FWS, 1999), which requires staff training and oil-spill-response equipment on hand, avoiding marine mammals by distances proscribed by NMFS and FWS, having marine mammal observers on board vessels, and avoiding marine mammals by changing vessel course or speed to maintain a sufficient distance from the marine mammals in order to avoid disturbance events, or by avoiding some habitat areas entirely. Any MMS-required measures would be in addition to or superseded by those mandated under an IHA or LOA.

Stipulation 1 proposed in this lease sale includes conducting an annual orientation program for all industry personnel which would include information on appropriate ways to avoid disturbing or interfering with marine mammals. This orientation program educates personnel on minimizing potential disturbances to marine mammals. The NTL No. 08-A04 clarifies that MMS will not authorize or permit activities that may result in the take (as defined by the MMPA) of any marine mammal, unless the FWS or NMFS has determined that any potential take that occurs incidentally to the proposed activity would result in a negligible impact to the species and the lessee is in possession of an LOA or IHA. This ensures that lessees are advised to consult with the FWS and NMFS prior to beginning any industry activities in areas that may be used by marine mammals.

4.5.2.8.3 Anticipated Effects Under Alternative 2. The following analysis describes the anticipated effects to marine mammals, if the entire lease sale took place with no deferrals in the Chukchi Sea. In this section, we describe the anticipated effects to marine mammals under the proposed action considering mitigation measures (Section 4.5.2.8.2) and other important factors (Section 4.4.1.8.3). The anticipated effects under this alternative are separated into direct and indirect effects (Section 4.5.2.8.3.1) and cumulative effects (Section 4.5.2.8.3.2). We defined the terms used to describe the anticipated level of effect in Section 4.4.1.8.3. Oil and gas development in the Chukchi Sea is not considered reasonably foreseeable, and adverse effects are not anticipated from production activities.

4.5.2.8.3.1. Direct and Indirect Effects Under Alternative 2. The principal sources of potential adverse effects to marine mammals in the Chukchi Sea include: (1) underwater noise; (2) vessel and aircraft disturbance; (3) subsistence; (4) habitat loss; (5) environmental contaminants; (6) petroleum spills; and (7) changes in the physical environment.

Ringed, Spotted, Ribbon, and Bearded Seals. Direct impacts to ice seals may include the temporary displacement of a number of ringed seals from preferred habitats. A smaller number of bearded, spotted, and ribbon seals may also be temporarily displaced.

Chronic disturbances can have moderate effects over time; however, mitigation currently in place is expected to moderate impacts to ice seals. Disturbances that do occur are expected to be brief, mostly resulting in negligible effects on the fitness and survival of marine mammals. Seismic activity appears to present only minor impacts to most ice seals, resulting in temporary displacement from an area at worst.

Vibroseis activities may drive ringed seal pups from their lairs resulting in a minor level of effects on ringed seal pups. The effects of vibroseis on bearded, spotted, and ribbon seals has not been adequately investigated.

Vessel traffic in the Chukchi Sea is assumed to present a negligible level of disturbance during the ice-free season. Activity from icebreakers may pose a moderate threat to ringed seals. Ringed seal pups often can avoid being crushed by icebreakers by retreating to nearby lairs, but not always. Adult and young ringed seals have been crushed by icebreakers on occasion (Reeves, 1998). Positive effects from icebreaker activity include the creation of new leads and openings in the ice. In these areas, ice seals can hunt, rest, and build new dens as conditions permit. The overall level of effect of vessel traffic to ice seals is moderate.

Offshore development activities have not been shown to adversely impact the distribution and numbers of ice seals. At times ringed seals and bearded seals have been known to occur in slightly higher densities around manmade islands and drilling platforms in the Beaufort Sea. There currently are no offshore developments in the Chukchi Sea.

Pacific Walrus. Direct impacts include the displacement of some walruses temporarily from preferred foraging and resting habitats by exploration activities. Chronic low levels of disturbance can have moderate effects over time and the disturbance of large aggregations of walrus, particularly at terrestrial haulouts, can have immediate major impacts. For example, in fall 2007, at least 863 walrus died during a panic and the ensuing stampede. The animals panicked in response to helicopter and aircraft traffic at a terrestrial haulout site in Chukotka (Pravda, 15-08-08). Mitigation currently in place is expected to moderate potential impacts to walrus from industry activities. Disturbances that do occur are expected to be transient in nature, resulting in only negligible to minor effects on the fitness and survival of walrus.

Vessel traffic from OCS activities in the Chukchi Sea is assumed to present a negligible to minor level of disturbance during the ice-free season. Activity from icebreakers potentially may pose a minor to moderate impact on walruses, depending on the timing and extent of the activities. Icebreakers that are active along the ice edge and spring lead system could encounter and disturb large aggregations of walruses, disrupting groups of females with calves. These potential impacts could be mitigated by avoiding the spring lead system and using aerial surveys to identify areas with large groups of walruses, which could then be avoided by ship traffic.

Very little data are available on the specific effects of seismic activities on walruses. As with other pinniped species, potential effects include effects on hearing, such as temporary or permanent shifts in hearing thresholds; the disruption of communication; and the disruption of breeding, foraging, or resting behavior. However, seismic operations cannot operate in the broken-ice environment that walruses prefer. Mitigation measures required by FWS through the LOA process typically have required that operators shut down seismic operations when walruses are present within the 180-dB range.

There currently are no offshore developments in the Chukchi Sea Proposed Action area, and offshore production is not considered reasonably foreseeable in the Chukchi Sea at this time.

Beluga Whale, Killer Whale, and Harbor Porpoise. These species benefit from provisions of IHAs to avoid or minimize adverse effects from underwater noise and other disturbances associated with any increase in exploration activity that could arise from additional leases in the Chukchi Sea. The Proposed Action is anticipated to result in a negligible level of effect on harbor porpoises and beluga or killer whales. The narwhale is so rare in the Chukchi Sea that it will not be further evaluated.

Minke and Gray Whales. Temporary and nonlethal effects to gray whales are the anticipated displacement and disturbance from routine exploration, seismic, and drilling activities. Potential whale injury or mortality of very few individuals is not anticipated to occur from whale-vessel interaction and collision associated with routine exploration activities. Negligible effects are anticipated.

The proposed lease sales could result in development and production activities; however, such activities remain speculative. Activities associated with development and production were analyzed to determine effects on beluga, minke, and gray whales, if a discovery occurs and production is proposed in the future. Temporary, nonlethal effects to beluga, minke, and gray whales are anticipated to occur as result of support-vessel traffic and noise; support construction, operation, and maintenance activities associated with development and production facilities; and abandonment. Collective effects of frequent disturbance, displacement from, ineffective use of important habitats, and increased opportunity for vessel-whale interaction injury are anticipated to result in minor, temporary, nonlethal effects, and some individuals would experience lower fitness, reproductive capability, survivorship, injury, or mortality (not anticipated) not detectable at a population level. The extent, intensity, and magnitude of development and production activities and the exposures beluga, minke, and gray whales could encounter remain speculative at this time. The unlikely occurrence of one or more large oil spills in the spring lead system could expose large numbers of beluga whales and newborn calves to fresh oil and associated toxic aromatic hydrocarbon fumes, and could represent moderate and major population-level effects, depending on the numbers and age of whales contacted and the duration of contact. Moderate effects are anticipated if a large fresh oil spill results in prolonged contact to large numbers of feeding whales concentrated in high-density prey concentration areas during open-water periods.

4.5.2.8.3.1.1. Anticipated Level of Effect from Underwater Noise. There are four sources of underwater noise that could cause effects to marine mammals under this alternative: (1) vessel traffic noise, (2) aircraft noise, (3) seismic-survey noise, and (4) exploration drilling noise.

4.5.2.8.3.1.1.1. Effects from Vessel Traffic Noise. Additional sales may increase the number of active leases in the Chukchi Sea. This increase in the number of leases, however, would not necessarily result in a corresponding increase in vessel activity associated with oil and gas exploration because of limited vessels available for seismic surveys or exploration drilling, and limited access during the open-water periods. These limitations would affect a small increase in vessel traffic that could result from increased leasing activity, keeping these effects to near present levels.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects of vessel traffic noise on ice seals are similar to those described in Section 4.5.1.8.3.2.1.1. A moderate level of effect from vessel traffic noise is expected for ice seals under Alternative 2.

Pacific Walrus. An increase in active leases may increase the area of exploration activities in the Chukchi Sea. This could lead to increases in the level of impact from vessel activities under the Proposed Action, in addition to ongoing increases in shipping traffic and tourism in the Chukchi Sea. More icebreaker traffic, particularly in the Chukchi Sea spring lead system and along the ice edge, could result in minor or moderate impacts to walrus, depending on the season. Disturbances during the breeding or calving season, when walrus tend to be more congregated, could disrupt breeding behaviors, separate females from their calves, and generally would have more serious impacts. Offshore exploration activities taking place in the Chukchi Sea during the open-water season are likely to have negligible effects on walrus. Mitigation measures imposed by MMS and FWS on future exploration and development activities are designed to avoid or minimize adverse effects to walrus in the Chukchi Sea from vessel traffic. Mitigation measures include an adequate OSRP (USDOI, FWS, 1999), which requires staff training and oil-spill-response equipment on hand, having marine mammal observers on board, and avoiding marine mammals by changing course or speed or by avoiding some areas altogether.

Beluga Whale, Killer Whale, and Harbor Porpoise. Any potential increase in vessel activity associated with new leases in the Chukchi Sea OCS would be conducted with the required mitigation under the MMPA that limits adverse effects to marine mammals. The anticipated level of effect is anticipated to be the same as that associated with the near present level of OCS vessel-related activity. The increase in vessel traffic is most likely small and would result in no more than a negligible level of effect on these whales.

Minke and Gray Whales. The anticipated effects from vessel presence and noise are similar to those described in Sections 4.5.2.6.1.3.3 and will not be repeated here. Gray whales could experience temporary, nonlethal avoidance-behavior responses to vessel traffic noise. The NMFS' IHA and MMS-imposed mitigation measures on vessels associated with OCS oil and gas exploration activities would avoid or minimize effects to gray whales. As a result, MMS-authorized vessel activity would have proportionately fewer or lower level impacts to gray whales than unrestricted non-OCS-related vessel operations. Noise and movement under the Proposed Action OCS-authorized vessel-related effects are anticipated to have a negligible level of effect.

4.5.2.8.3.1.1.2. Effects from Aircraft Noise.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from air traffic to ice seals in the Proposed Action area would be very localized and brief. Some groups of ice seals occasionally are disturbed from their haulouts and enter the water, although their responses are highly variable and brief in nature. Mitigation should greatly reduce these impacts associated with aircraft presence and noise. The anticipated effects from aircraft noise to ice seals is the same as described in Section 4.5.1.8.3.2.1.2.

Pacific Walrus. An increase in active leases in the Chukchi Sea also may incrementally increase the level and area of air traffic. Air traffic associated with offshore oil and gas leases typically would be required to avoid walrus haulout areas by a minimum of 1 statute mile and to fly at a minimum altitude of 1,500 ft, unless weather conditions made these stipulations unsafe. Avoidance of walruses by these minimum distances would reduce the risk of major disturbance events, such as stampedes. In addition to causing injuries and mortalities, stampedes have a huge energetic cost. Walruses that are repeatedly disturbed will abandon an area and may move to less desirable habitats as a result. Mitigation measures that require aircraft to avoid walrus haulouts and aggregations of walruses by at least these minimum distances are expected to decrease potential adverse effects to no more than minor impacts to walruses.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. The anticipated direct effects from aircraft noise to these species are negligible because of flight restrictions imposed on these activities by MMS and/or MMPA authorization.

4.5.2.8.3.1.1.3. Effects from Seismic-Survey Noise.

Ringed, Spotted, Ribbon, and Bearded Seals. Based on the reviewed literature, most impacts from seismic activity can be expected to be brief. While ringed seals have been known to abandon their dens at times during vibroseis, other seals species have shown conflicting responses. The effects of vibroseis on bearded, spotted, and ribbon seals has not been adequately investigated. However, because bearded seals normally are found in broken ice that is unstable for on-ice seismic operation, bearded seals should rarely be encountered during seismic operations. Spotted and ribbon seals also usually are found along the ice front and should be encountered rarely during vibroseis activities. Vibroseis may be expected to result in a minor level of effects for ringed seals in an area and a negligible level of effects for other ice seal species.

Existing literature indicates that seismic projects in the Chukchi Sea analysis area should result in brief disturbances to ice seals. More seismic activity is expected to occur under Alternative 2. Open-water seismic surveying is expected to have a negligible level of effects on ice seals in the Chukchi Sea.

Pacific Walrus. Seismic activities taking place in the open-water season in the Chukchi Sea are unlikely to have more than negligible or minor impacts on walrus. Most walrus are expected to be concentrated in ice-infested waters or nearshore, where seismic vessels cannot operate. Vessel traffic associated with seismic activities, particularly icebreakers and smaller chase vessels, could displace walruses from important resting and foraging areas. Based on standard operating procedures, MMS expects that seismic operators will request and receive an LOA from FWS and will follow the mitigation measures required in the LOA. These required mitigation measures typically include avoiding aggregations of walruses by a minimum distance, shutting down seismic operations when walruses appear within range of the 180-dB level, conducting surveys to ensure that the area is clear of marine mammals prior to the onset of operations (ramp up), and having marine mammal observers on board surveying for the presence of marine mammals during operations. With these mitigation measures in place, we expect that seismic operations and the associated vessel and air traffic would have no more than minor impacts to walrus. Some temporary displacement from foraging or resting habitat may occur seasonally. For more specific information on mitigation measures, see Section 4.5.2.8.2.

Beluga Whale, Killer Whale, and Harbor Porpoise. Seismic activities taking place in the open-water season in the Chukchi Sea are unlikely to have more than negligible impacts to these whales.

Beluga whales are expected to be concentrated in ice-infested waters or nearshore, where seismic vessels cannot operate. Some temporary displacement from foraging or resting habitat occasionally may occur, but the most important beluga habitats in the Chukchi Sea Planning Area are far from where seismic operations are expected to be conducted. Based on the procedures required for past surveys, MMS expects that seismic operators will request and receive an IHA from NMFS, and will follow the mitigation measures required in the IHA. For example, required mitigation measures typically have included that the vessels avoid aggregations of marine mammals, have onboard marine mammal observers surveying for the presence of marine mammals so that seismic operations can be shut down when cetaceans appear within the 180-dB level range, and conduct surveys to be sure that the area is clear of marine mammals prior to the onset of operations (ramp up). With these mitigation measures in place, we anticipate that seismic noise would result in no more than a negligible level of effect on beluga and other small whales.

Minke and Gray Whales. The high numbers of gray whales that occur in the nearshore and offshore shallow-shoal shelf waters of the Beaufort Sea could be affected by 2D/3D/4D and high-resolution surveys as described for endangered baleen whales in Section 4.4.2.6.1.3.1. Displacement from feeding areas and avoidance of active seismic activity noise are typical responses of gray whales to seismic noise. Seismic activities would be subject to mitigation measures, terms and conditions of IHAs issued by NMFS under the MMPA, and effects are anticipated to remain at minor levels. Section 4.5.2.6.1.3.1 describes the anticipated effects from seismic activity to endangered baleen whales and are applicable to non-ESA listed baleen whales, including minke and gray whales, in the Chukchi Sea analysis area.

4.5.2.8.3.1.1.4. Effects from Exploration Drilling Noise.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects of exploration drilling noise on ice seals are similar to those described in Section 4.5.1.8.3.2.1.4. A negligible level of effects from exploration drilling noise is expected for ice seals under Alternative 2.

Pacific Walrus. Drilling activities may displace some walruses from the area. The noise associated with drilling and vessel and aerial traffic between the drilling location and shore typically may displace walruses from the immediate area. The effects of this displacement would depend upon the number and location of the exploration wells. For example, exploration wells in deepwater not typically used by walruses would have no or negligible impacts, while exploration wells in the Hanna Shoal area or other areas heavily used by walruses for foraging could have minor to moderate impacts. It is likely that no more than two drilling rigs would be active in the Chukchi Sea at any given time. In addition, each exploration plan will be evaluated with an EA. If the outcome of the EA indicates the potential for substantial impacts to walruses or other species, then the exploration plan would be evaluated with an EIS. Potential impacts and appropriate mitigation measures to moderate any potential impacts to walruses would be determined at that time.

Beluga Whale, Killer Whale, and Harbor Porpoise. Belugas tend to avoid stationary sounds by altering their travel. Belugas possibly habituate to stationary sound sources not associated with hunting. Specific drillship operations, drill location, platform placement and construction, and support activities are subject to further MMS exploration plan (EP) and development and production plan (DPP) assessment and mitigation measures that avoid or minimize adverse effects to toothed whales. Effects from drilling operations can cause deflection of migrating whales from intended travel routes. However, the deflection is transitory after passage of a drillship or platform after an avoidance deflection occurs. However, the effects of this displacement cannot be fully determined until the location and timing of the potential drilling activity is evaluated under a subsequent NEPA document and authorizations needed to remain compliant with the MMPA. A negligible level of effect is anticipated.

Minke and Gray Whales. Gray and minke whale response to stationary sound sources indicates avoidance and behavioral modification that includes altering travel path or deflecting slightly around drill operations (Malme et al., 1984). Gray and minke whales are not present during winter and early spring when ice cover predominates. Summer feeding concentrations associated with offshore shoals, such as Hanna Shoal, and fall migrating gray whales in the Chukchi Sea could be exposed to the drilling operations noise introduced to the marine environment, and avoidance or displacement response would be anticipated. Specific drillship operations, drill location, platform placement and construction, and support activities are subject to further MMS EP and DPP assessment and mitigation measures that avoid or minimize adverse effects to gray whales. Effects from drilling operations can cause slight deflection of some migrating whales from original travel route; however, the deflection is transitory after passage of a drillship or platform after an avoidance deflection occurs. Adverse effects as a result of platform placement and construction, drilling, and other concurrent activities are avoided or minimized by application of IHA and MMS mitigation measures that avoid or minimize the footprint of multiple activities relative one another and to the gray whale biological activities, habitat and movement. Localized prey concentrations, in part, may be locally avoided by some whales when in close proximity to active drilling operations; however, gray whales, like bowhead whales, may be more likely to tolerate sound when motivated to feed in such areas. Similar tolerance responses of gray whales under similar circumstances are uncertain. It is unknown whether tolerating higher level sound exposure in high-concentration feeding areas results in temporary threshold shift (TTS no tissue damage, but temporary reduction in hearing sensitivity) or permanent threshold shift (PTS-resulting in tissue damage and permanent loss of hearing sensitivity) in gray whales. Some individuals could experience TTS or PTS, but it is uncertain at this time. Negligible level effects are anticipated.

4.5.2.8.3.1.2. Anticipated Level of Effect from Vessel and Aircraft Disturbances.

4.5.2.8.3.1.2.1. Effects from Vessels.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from vessel disturbance to ice seals are similar to those described in Section 4.5.1.8.3.2.2.1. A moderate level of effect from vessel disturbance is expected for ice seals under Alternative 2.

Pacific Walrus. The potential effects from vessel disturbances are largely described in Section 4.4.1.8.1.2**.** However, Pacific walruses may be much more vulnerable to these disturbance events in the Chukchi Sea. As the sea ice continues to retreat off of the continental shelf, walruses are more often forming large terrestrial haulouts along the Chukchi sea coastline near Point Lay, Cape Lisburne, Icy Cape, Wainwright, and in the Russian Far East. Walruses are very vulnerable to injury from stampedes caused by disturbance events such as vessels passing nearshore. Females and females with calves are especially vulnerable. The increased energetic costs of fleeing from disturbance events may have profound consequences for a population that may already be forced to travel long distances between foraging and resting areas by the retreating sea ice. Multiple large scale disturbance events could have moderate impacts on walruses, particularly if walruses become more concentrated in smaller areas due to a lack of available sea ice or other factors.

Beluga Whale, Killer Whale, and Harbor Porpoise. Any potential increase in vessel activity associated with new leases in the Chukchi Sea OCS would be conducted under the required mitigation under the MMPA that limits adverse effects to marine mammals. The anticipated level of effect is anticipated to be the same as that associated with the near present level of OCS vessel-related activity. The increase in vessel traffic is most likely small and would not result in more than a negligible level of effect on these whales.

Minke and Gray Whales. The potential effects of vessel disturbances are described in Section 4.4.1.8.1.2. More frequent encounters with gray whales are likely to occur where whale habitats overlap vessel-travel corridors. Anticipated effects to minke and gray whales are negligible.

4.5.2.8.3.1.2.2. Effects from Aircraft.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects of aircraft disturbance on ice seals are similar to those described in Section 4.5.1.8.3.2.2.2. A negligible level of effects from aircraft disturbance is expected for ice seals under Alternative 2.

Pacific Walrus. The potential effects from aircraft disturbances are largely described in Section 4.4.1.8.1.2. However, Pacific walruses may be much more vulnerable to these disturbance events in the Chukchi Sea. As the sea ice continues to retreat off of the continental shelf, walruses are more often forming large terrestrial haulouts along the Chukchi sea coastline near Point Lay, Cape Lisburne, Icy Cape, Wainwright, and in the Russian Far East. Walruses are very vulnerable to injury from stampedes caused by disturbance events such as airplanes passing overhead. Females and females with calves are especially vulnerable. The increased energetic costs of fleeing from disturbance events may have profound consequences for a population that already may be forced to travel long distances between foraging and resting areas by the retreating sea ice. Multiple large-scale disturbance events could have moderate impacts to walrus, particularly if walruses become more concentrated in smaller areas due to a lack of available sea ice or other factors.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. Aircraft operations on the OCS that may result from Lease Sales 212 and 221 would be subject to MMS mitigation measures to avoid or minimize effects to whales. A negligible level of effect is anticipated.

4.5.2.8.3.1.3. Anticipated Level of Effect from Subsistence. The MMS-authorized activities resulting from additional lease sales are not anticipated to affect subsistence use of seals, walrus stocks, or whales in the Chukchi Sea. Section 4.5.2.12 contains a detailed analysis of subsistence activity under Alternative 2.

4.5.2.8.3.1.4. Anticipated Level of Effect of Habitat Loss. This section describes the effect from the direct loss of marine habitats. Loss of marine habitats could result from community and industrial development, including loss of seafloor from drilling waste discharges and the construction of industrial facilities in the marine environment.

4.5.2.8.3.1.4.1. Community Development. This alternative is not anticipated to have a direct effect on community development.

4.5.2.8.3.1.4.2. Industrial Development. Some marine mammal habitat may be altered by activities associated with oil and gas exploration in the Chukchi Sea. These include drilling wastes and industrial facilities.

Drilling Wastes. Exploratory drilling may cause some displacement of the benthic invertebrates, which are a primary food source for some ice seals, whales, and walruses. The amount of habitat that could be affected is small compared to the amount of habitat available and the number of marine mammals using it. A negligible level of effect is anticipated.

Industrial Facilities. Production activities are not currently considered to be reasonably foreseeable from this lease sale. Effects from a production project would be analyzed on a project-by-project basis to determine the anticipated effects to the ice seal, whale, and walrus populations if such a discovery is made and proposed for development in the more distant future.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from industrial development to ice seals are similar to those described in Section 4.5.1.8.3.2.4.2. A negligible level of effect from industrial development is expected for ice seals under Alternative 2.

Pacific Walrus. Effects from habitat loss in the Chukchi Sea would depend on the location and extent of alteration. At this point, production activities are not considered reasonably foreseeable, and we do not have sufficient information on potential locations of facilities to be able to analyze any potential impacts. These impacts would be analyzed when a DPP is submitted to MMS. Some habitat may be altered by activities associated with exploration. For example, exploratory drilling may cause some displacement or contamination of the benthic invertebrates which are a primary food source for walruses. Walruses typically have not formed large terrestrial haulouts on the U.S. side of the Chukchi Sea; however, that appears to be changing as sea ice recedes farther north. In 2006-2008, large aggregations of walruses have hauled out in late summer near Icy Cape and/or Cape Lisburne. As sea ice continues to retreat, walrus-movement patterns and terrestrial-haulout use may change. Continued monitoring of movements of the walrus population would ensure that changing migration patterns and habitat use would not be adversely impacted by ongoing oil and gas activities in the Chukchi Sea. Impacts from habitat loss due to exploration are anticipated to be negligible.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. Effects from habitat loss in the Chukchi Sea would depend on the location and extent of alteration. Production activities are not considered reasonably foreseeable, and we do not have sufficient information on potential locations and types of facilities to be able to analyze potential impacts. These impacts would be analyzed when a DPP is submitted to MMS. Some habitat may be altered by activities associated with exploration. Impacts from habitat loss due to exploration are anticipated to be negligible through application of MMS and NMFS IHA-generated mitigation measures to ensure negligible effects.

4.5.2.8.3.1.5. Anticipated Level of Effect from Environmental Contaminants. Discharges containing contaminants could be released onto the seafloor and marine environment during the drilling of exploration wells. Drilling wastes (cuttings) may contain naturally occurring heavy metals, such as cadmium, which formerly were sequestered in the seafloor and were then released onto the seafloor surface. These naturally occurring contaminants may then be picked up by benthic invertebrates and move up the food chain, becoming more concentrated in higher trophic levels. Local sites where releases may occur depend on the number and location of exploration wells. Mitigation measures require that most discharges (cuttings and drilling mud) from production wells be re-injected into an authorized disposal well.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects from environmental contaminants to ice seals are similar to those described in Section 4.5.1.8.3.2.5. A negligible level of effect from environmental contaminants is expected for ice seals under Alternative 2.

Pacific Walrus. There is insufficient information to determine current trends in contaminant levels for Pacific walruses. The most recent studies published rely on samples collected in the early 1990s. Past studies have detected very low levels of organochlorine pesticides and aliphatic hydrocarbons, and low levels of metals. If a spill were to occur, exposure to petroleum pollutants could increase aliphatic hydrocarbon levels. Exploratory drilling may deposit cuttings onto the seabed, and these cuttings may contain some naturally occurring heavy metals such as cadmium and lead. These, in turn, may be absorbed by benthic invertebrates and then by walrus. Any deposits from exploratory drilling are expected to disperse over a few seasons from ocean currents and ice gouging. Impacts are anticipated to be negligible.

Beluga Whale, Killer Whale, and Harbor Porpoise. Belugas are threatened everywhere by pollution of their environment. Researchers recently demonstrated that mercury levels in beluga muscle tissue reflect biomagnification processes rather than bioaccumulation over time. Researchers found that beluga length defined habitat specificity, and the consequent difference in habitat use resulted in different diets and dietary mercury sources (Loseto, Stern, and Ferguson, 2008). Contaminants that enter the sea tend to become concentrated as they move up the food chain and could pose a health risk to belugas. Elsewhere, belugas found dead have contained high levels of organochlorines, lead, and mercury. The population-level effects of the presence of such levels of contamination are unknown. We are unable to determine how environmental contaminants might affect belugas in the Chukchi Sea lease-sale area. Due to prey selection, beluga whales accumulate contaminants to a higher degree than baleen whales, such as gray whales.

Minke and Gray Whales. There could be alterations in gray and minke whale habitat as a result of exploration drilling, including localized pollution. We refer readers to the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a) for a detailed discussion of drilling muds and other discharges associated with exploration drilling, with probable scenarios regarding the disposal of these substances and for discussion of the potential effects on water quality from their discharge. Any potential adverse effects on baleen whales from discharges are directly related to whether or not any potentially harmful substances are released, if they are released to the marine environment, what their fate in that environment likely is (e.g., different hypothetical fates could include rapid dilution or biomagnification through the food chain) and, thus, whether they are bioavailable to the species of interest.

Effects to minke whales, their habitat use, and their habitat selection are uncertain but likely inconsequential for the localized effects from discharge from 8-14 exploration drill sites on existing leases in relation to habitat availability.

4.5.2.8.3.1.6. Anticipated Level of Effect of Petroleum Spills. The MMS assessments of oil-spill impacts are based on a combination of estimates, including the chance of one or more large spills occurring, spill size, spill duration, and weather conditions. Spills could occur on land or in the marine environment. Spills into the marine environment have the potential to travel with water currents or the ice and to spread rapidly, depending on season, wind, and weather conditions. Spills in the marine environment have the greatest potential to affect marine mammals in the Chukchi Sea.

The oil spill mitigation measures described for existing leases in the Chukchi Sea (USDOI, MMS, 2007d:Section II.B.3, USDOI, 2006a) would be implemented for the proposed lease sales. For the OSRA model, the chance that a large oil spill would contact a specific resource area assumes no cleanup or mitigation is in place. A large spill from a well blowout is described as a very unlikely event, and we assume that no large oil spills will occur during exploration activities (Section 1.1.4).

In the following sections, we use the MMS OSRA model to estimate the percent chance that a large spill (≥1,000 bbl) could contact an environmental resource area important to marine mammals, describe the effects of disturbance from postspill cleanup activities, evaluate the effects of prey reduction or contamination, describe the vulnerability of each marine mammal group, and determine the anticipated effects to marine mammals.

4.5.2.8.3.1.6.1. Oil-Spill Analysis. To put the chance of a large spill affecting marine mammals in perspective, one must consider several variables. First, for a large oil spill to occur, production would have to occur. The most likely scenario states the optimistic probability of a successful commercial find in the Chukchi Sea sale area is 10%, indicating that production is unlikely (USDOI, MMS 2007d). Second, the location of the oil or gas find and subsequent development platform could influence the chance that a spill would occur as well as that it would reach environmental resource areas important to marine mammals, if and when the they are present or, in the case of a winter spill, when migrating marine mammals return. Finally, the number, sex/age, of the marine mammal population and the duration and type of exposure to marine mammals would influence the anticipated effects.

The potential for large spills to contact marine mammal habitat in the Chukchi Sea was analyzed in the Chukchi Sea Sale 193 EIS (USDOI, MMS 2007d) and Seismic Survey PEA (USDOI, MMS 2006a). We have updated the assessment for the proposed Chukchi Sea lease sales below. The results of this analysis are similar to past analyses.

The following oil spill effects analysis presents conditional and combined probabilities expressed as percent chance. Conditional probabilities assume that a large spill has occurred and estimate the chance of a large spill contacting a particular environmental resource area (see Appendix A). Combined probabilities estimate the chance of one or more large spills occurring and contacting a particular environmental resource area. The probabilities in the following discussions, unless otherwise noted, are conditional probabilities estimated by the OSRA model of a large spill contacting the environmental resource areas and land segments or Grouped Land Segments (GLSs). Environmental resource area locations are found in Appendix A, Maps A.1-2a through 2e and land segments in Maps A.1-3a through 3d. The OSRA model assumes that a spill starts at a specific launch area or pipeline segment. The launch areas and pipeline segments for the Chukchi Sea area are found in Appendix A, Map A.1-5. An environmental resource area can represent an area important to one or more species or species groups during a discrete amount of time.

4.5.2.8.3.1.6.1.1. Conditional Probabilities. This section discusses the chance that a large oil spill from the Chukchi Sea lease-sale area would contact specific environmental resource areas that are important to nonendangered and nonthreatened marine mammals. Conditional probabilities assume that a large spill has occurred.

The estimated chance that one or more large platform and pipeline spills will occur as a result of production from Lease Sales 212 or 221 is 40% over the 25-year life of the project. This estimated chance of a large spill remains constant, regardless of the selection of any combination of deferrals. This model assumes that one field is developed and that the life of the production field is 25 years (Table A.1-28). For development and production phases, the fate and behavior of a 1,500-bbl oil spill from a platform and a 4,600-bbl oil spill from a pipeline were evaluated using the SINTEF Oil Weathering Model (Appendix A).

A 1,500-bbl platform spill occurring during the summer season (between June 1 and October 31) would cover approximately 29 km^2 after 3 days and 577 km^2 of discontinuous area after 30 days, and could oil an estimated 25 km of coastline (Table A.1-11). A meltout spill of the same size from a platform would cover 10 km^2 after 3 days and 188 km^2 of discontinuous area after 30 days, and would oil an estimated 30 km of coastline (Table A.1-11). These examples highlight the critical importance of an immediate response from onsite oil-spill-response personnel and equipment, although winter cleanup would have limited effectiveness, particularly in broken-ice conditions.

A 1,500 or a 4,600-bbl spill in the Chukchi Sea could contact environmental resource areas where marine mammals may be present (Table A.1-16 and 17). Approximately 44% of a 4,600-bbl pipeline spill during the summer open-water period would remain after 30 days, covering a discontinuous area of 1,008 km^2. A spill during broken ice in fall or under ice in winter would melt out in the following summer, potentially causing major impacts to walruses and minor or negligible impacts to other marine mammal species. Approximately 55% of a 4,600-bbl pipeline spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 332 km^2 (Table A.1-12).

The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting identified marine mammal habitats (environmental resource areas). Conditional probabilities are based on the assumption that a large spill occurred and do not assume any cleanup activities (for further explanation, see Appendix A). For a map of the 15 hypothetical launch areas and the 11 hypothetical pipeline routes used in the oil-spill-trajectory analysis, see Appendix A, Map A.1-5. The following discussion summarizes the results for LAs 1-15 and PLs 1-11. In the Chukchi Sea, a summer spill is defined as a spill that occurred between June 1 and October 31; a winter spill is defined as a spill that occurred between November 1 and May 31.

Ringed, Spotted, Ribbon, and Bearded Seals. Sea-ice habitats can be categorized as shorefast, persistent flaw zones or leads, polynyas, divergence zones, and the ice edge or front. Ringed seals occur in all of these ice zones. Bearded seals are found in all but shorefast ice. Ribbon and spotted seals are found along the ice edge in winter only (roughly February through April). In summer, ribbon seals remain in open waters, while spotted seals use a variety of shoreline and sandbar haul outs (Burns, Shapiro and Fay, 1980). It is difficult to identify particular areas for oil-spill analysis, because the primary habitat—sea ice—is a constantly changing environment. Areas that remain consistent among years and that were identified for this analysis includes the spring lead systems in the Beaufort (ERAs 24-28) and Chukchi Sea (ERA19) and the polynya areas near Point Lay (ERA39) and Wainwright (ERA 40) in the Chukchi Sea. Spotted seal haulouts are located at Kasegaluk Lagoon (ERA1) and Cape Espenberg (LS48) in the Chukchi Sea, Smith Bay (ERA65) and Harrison Bay (ERAs 68-69) in the Beaufort Sea. The following discussion summarizes the results for LAs 1-25 and PLs 1-17.

For summer spills occurring in the Chukchi Sea, the OSRA model estimates the percent chance of a large oil spill contacting the Beaufort Sea spring lead system within 30 days is ≤1% for all launch areas and pipeline segments. Over 360 days, the percent chance that a summer spill occurring in the Chukchi sea would contact the Beaufort Sea spring lead system varies from <0.5-4% for all launch areas and pipeline segments . The OSRA model estimates the percent chance of a large oil spill contacting the Chukchi Sea spring lead system within 30 days is <0.5-14% for all launch areas and pipeline segments . Over 360 days, the percent chance that a summer spill would contact the Chukchi Sea spring lead system varies from <0.5-14% for either launch areas or pipeline segments. The percent chance of a large oil spill contacting the Point Lay polynya area is <0.5-41% for all launch areas and pipeline segments 30 days after a spill and <0.5-44% 360 days after a spill. The percent chance of a large oil spill contacting the Wainwright polynya area is <0.5-51% for all launch areas and pipeline segments 30 days after a spill, and from <0.5-57% for all launch areas and pipeline segments 360 days after a spill. The percent chance of a large oil spill contacting Kasegaluk Lagoon is <0.5-31% for all launch areas and pipeline segments 30 days after a spill and <0.5-34% 360 days after a spill. The percent chance of a large oil spill contacting Cape Espenberg is <0.5% for all launch areas and pipeline segments 30-360 days after a spill. The percent chance of a large oil spill contacting Smith or Harrison Bay is <0.5% for all launch areas and pipeline segments 30 days after a spill, and from <0.5-2% for all launch areas and pipeline segments 360 days after a spill.

For winter spills in the Chukchi Sea, the OSRA model estimates the percent chance of a large oil spill contacting the Beaufort Sea spring lead system within 30 days as varying from <0.5-1% for all launch areas and pipeline segments . Over 360 days, the percent chance that a winter spill would contact the Beaufort Sea spring lead system varies from <0.5-3% for launch areas or pipeline segments. The OSRA model estimates the percent chance of a large oil spill contacting the Chukchi Sea spring lead system within 30 days as varying from <0.5-23% for all launch areas and pipeline segments. Over 360 days, the percent chance that a winter spill would contact the Chukchi Sea spring lead system varies from <0.5-35% for all launch areas and pipeline segments . The percent chance of a large oil spill contacting the Point Lay polynya area is <0.5-32% for all launch areas and pipeline segments 30 days after a spill and <0.5-39% 360 days after a spill in the Chukchi Sea. The percent chance of a large oil spill contacting the Wainwright polynya area is <0.5-38% for all launch areas and pipeline segments 30 days after a spill, and from <0.5-52% for all launch areas and pipeline segments 360 days after a spill. The percent chance of a large oil spill contacting Kasegaluk Lagoon is <0.5-5% for all launch areas and pipeline segments 30days after a spill, and <0.5-13% 360 days after a spill. The percent chance of a large oil spill contacting Cape Espenberg is <0.5% for all launch areas and pipeline segments 30-360 days after a spill. The percent chance of a large oil spill contacting Smith or Harrison Bays is <0.5% for all launch areas and pipeline segments 30-360 days after a spill. For more information, see Appendix A, Tables A.2-57 and 60, A.2-63 and 66.

Pacific Walrus. A large oil spill that occurred in summer or winter and persisted into summer could impact walruses coming ashore due to sea-ice retreat, or in the spring lead system and along the ice edge. Although walruses depend largely on sea ice as a platform in the Chukchi Sea, this may be changing as pack ice diminishes. In summer 2007, walruses were found hauling out near Barrow, and a large terrestrial haulout formed in late summer near Cape Lisburne (Garlich-Miller, 2006, pers. commun.). It is difficult to predict where walrus might be found, because their distribution is heavily dependent on sea ice. In recent years, large terrestrial haulouts also have been forming along both the Russian and U.S. coastlines of the Chukchi Sea as the sea ice retreats north of the continental shelf. For this analysis, we focused on the Beaufort Sea spring lead system (ERA 24-28) and Chukchi Sea spring lead system (ERA19), the Point Lay polynya area, which includes Icy Cape (ERA39), the Wainwright polynya area (ERA40), the offshore polynya area (ERA58), an area near Hanna Shoal (ERA56) and the Cape Lisburne area (ERA15) on the U.S. side of the Chukchi Sea.

We also analyzed the chance of contact to large traditional walrus haulout areas on the Russian side of the Chukchi Sea. These included Wrangell Island and a 12 nmi buffer around the island (ERA11), Ostrov Kolyuchin (ERA59), Herald Island (ERA66), Mys Vankarem (LS 28), Mys Onmyn (LS 29), Ostrov Ididlya (GLS 129), Mys Serditse Kamen (GLS 130), Mys Unikin (LS 38), and Mys Dezhnev (LS 39).

Summer Spills. For summer spills, the OSRA model estimates the percent chance of a large oil spill occurring in the Chukchi Sea and contacting the Beaufort Sea spring lead system within 30 days is <0.5-1% for all launch areas and pipeline segments. Over 360 days, the percent chance that a spill would contact the Beaufort Sea spring lead system varies from <0.5-4% for all launch areas and pipeline segments. The percent chance of any portion of a large oil spill contacting the Chukchi sea spring lead system within 30 days varies from <0.5-9% for all launch areas and <0.5-14% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Chukchi sea spring lead system varies from <0.5-10% for launch areas and from <0.5-14% for pipeline segments. The percent chance of a large oil spill contacting the Point Lay polynya area within 30 days varies from <0.5-16% for all launch areas and <0.5-41% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Point Lay polynya area varies from <0.5-19% for launch areas and from <0.5-44% for pipeline segments. The percent chance of a large oil spill contacting the Wainwright polynya area within 30 days varies from <0.5-19% for all launch areas and <0.5-51% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Wainwright polynya area varies from <0.5-26% for launch areas and from <0.5-57% for pipeline segments. The percent chance of a large oil spill contacting the offshore polynya area between Point Lay and Wainwright within 30 days varies from <0.5-84% for all launch areas and <0.5-82% for all pipeline segments. Over 360 days, the percent chance that a summer spill would contact the offshore polynya area varies from <0.5-85% for launch areas and from <0.5-82% for pipeline segments. The percent chance of a large oil spill contacting the Hanna Shoal area within 30 days varies from <0.5-51% for all launch areas and <0.5-56% for all pipeline segments. Over 360 days, the percent chance that a summer spill would contact the Hanna Shoal area varies from <0.5-59% for launch areas and from <0.5-65% for pipeline segments. The percent chance of a large oil spill contacting the Cape Lisburne area within 30 days varies from <0.5-25% for all launch area and <0.5-45% for all pipeline segments. Over 360 days, the percent chance that a summer spill would contact the Cape Lisburne area varies from <0.5-28% for launch areas and from <0.5-46% for pipeline segments. Careful selection of pipeline locations could appreciably lower the chance of contact for many areas. For more information see Appendix A, Tables A.3-33, A.3-36.

Winter Spills. For winter spills, the OSRA model estimates the percent chance of a large oil spill occurring in the Chukchi Sea and contacting the Beaufort sea spring lead system within 30 days is <0.5-1% for all launch areas and pipeline segments. Over 360 days, the percent chance that a spill would contact the Beaufort Sea spring lead system varies from <0.5-3% for all launch areas and pipeline segments. The percent chance of any portion of a large oil spill contacting the Chukchi sea spring lead system within 30 days varies from <0.5-16% for all launch areas and <0.5-23% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Chukchi sea spring lead system varies from <0.5-26% for launch areas and from <0.5-35% for pipeline segments. The percent chance of a large oil spill contacting the Point Lay polynya area within 30 days varies from <0.5-16% for all launch areas and <0.5-32% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Point Lay polynya area varies from <0.5-25% for launch areas and from <0.5-39% for pipeline segments. The percent chance of a large oil spill contacting the Wainwright polynya area within 30 days varies from <0.5-8% for all launch areas and <0.5-38% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Wainwright polynya area varies from <0.5-18% for launch areas and from <0.5-52% for pipeline segments. The percent chance of a large oil spill contacting the offshore polynya area between Point Lay and Wainwright within 30 days varies from <0.5-18% for all launch areas and <0.5-19% for all pipeline segments. Over 360 days, the percent chance that a winter spill would contact the offshore polynya area varies from <0.5-33% for launch areas and from <0.5-37% for pipeline segments. The percent chance of a large oil spill contacting the Hanna Shoal area within 30 days is <0.5% for all launch areas and all pipeline segments. Over 360 days, the percent chance that a winter spill would contact the Hanna Shoal area varies from <0.5-11% for launch areas and pipeline segments. The percent chance of a large oil spill contacting the Cape Lisburne area within 30 days varies from <0.5-4% for all launch areas and <0.5-6% for all pipeline segments. Over 360 days, the percent chance that a winter spill would contact the Cape Lisburne area varies from <0.5-7% for launch areas and from <0.5-10% for pipeline segments. For more information see Appendix A, Tables A.3-57, A.3-60.

For resource areas on the Russian side of the Chukchi Sea, we chose to use annual conditional probabilities rather than to analyze both summer and winter conditional probabilities. There was virtually no difference between summer and winter, so we felt that this better consolidated our analysis. Annual conditional probabilities reflect the percent chance that a spill occurring at any time of year will contact a particular resource. The percent chance that a large spill occurring at any time of the year and originating from any one of the launch areas or pipeline segments in the lease-sale area would reach within 12 nmi of Wrangell Island is from <0.5%-1% for 30 or 360 days after a spill. The percent chance that a spill occurring at any time of the year and originating from any one of the launch areas or pipeline segments in the lease sale area would reach Ostrov Kolyuchin, Herald Island, Mys Van Karem, or Mys Onmyn is from <0.5%-1% for 30 or 360 days after a spill. The percent chance that a spill occurring at any time of the year and originating from any one of the launch areas in the lease sale area would reach Mys Unikin or Mys Dezhnev is from <0.5%-1% for 30 or 360 days after a spill, and from any one of the pipeline segments from <0.5%-2% for 30 or 360 days after a spill. The percent chance that a spill occurring at any time of the year and originating from any one of the launch areas or pipeline segments in the lease sale area would reach Ostrov Ididlya is from <0.5%-2% for 30 or 360 days after a spill. The percent chance that a spill occurring at any time of the year and originating from any one of the launch areas in the lease sale area would reach Mys Serditse Kamen is from <0.5%-3%, for pipeline segment; it varies from <0.5%-4% for 30 or 360 days after a spill. See Tables A.3-3, A.3-6, A.3-9, A.3-12, A.3-31 and A.3-24 for more information.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. This section discusses the percent chance that a large oil spill from the Chukchi Sea lease-sale area would contact specific areas that are important to non-ESA listed whales occurring in the Chukchi Sea. Narwhals occur in the U.S. waters of the Chukchi Sea very rarely; specific areas have not been identified as important habitat for narwhals, and they are not discussed further in this section. Similarly, resident and transient populations of killer whales, minke whales, and harbor porpoises are known to occur in the Chukchi Sea, but specific habitats have not been identified as being consistently used by any of these species in the Chukchi Sea. We are unable to analyze the percent chance of a large spill contacting these species or oiling their habitats without further information. Therefore, they are not discussed further in this section of the analysis.

The OSRA model estimates conditional probabilities (expressed as a percent chance) of a large spill contacting identified whale habitats (environmental resource areas). Both beluga and gray whales are present in the Chukchi Sea in the summer ice-free months. Gray whales have been seen more frequently and in higher numbers in recent years, possibly in response to changes in food availability. In winter, belugas are associated with the pack ice in offshore waters and are thought to move southward into the Bering Sea. In spring and summer, belugas move into warmer bays and coastal areas to molt and to give birth (Angliss and Outlaw, 2005). For this analysis, we focused on estuaries and bays where belugas regularly occur in spring and summer. The following environmental resource areas were identified for belugas: Kasegaluk Bay (ERA1), Kotzebue Sound (ERA13), King and Shingle Points in the Canadian Beaufort (ERA60) and the Mackenzie River Delta in the Canadian Beaufort (ERA62). King and Shingle Points and the Mackenzie River Delta have a <0.5% chance of being contacted by oil from a spill in the Chukchi Sea and are not analyzed further. We also included polynya areas, and the spring lead systems and the nearshore waters in the Beaufort and Chukchi seas near Barrow. The Beaufort Sea spring lead system is represented by ERAs 24, 25, 26, 27, and 28. The Chukchi Sea spring lead system is represented by ERA19. The Barrow area is represented by ERA41 on the Chukchi Sea side and ERA42 on the Beaufort Sea side. The Point Hope area is ERA38. The Point Lay polynya area is ERA39. The Wainwright area is ERA40. The Kaktovik area is ERA44. The Kaktovik area has a <0.5% chance of being contacted by oil from a spill in the Chukchi Sea and is not analyzed further.

Most of the Eastern North Pacific gray whales spend the summer feeding in the Bering and Chukchi Seas. In late fall, they migrate southward down the coast to Baja California. The following environmental resource areas were identified for gray whales: sections of nearshore waters along the Russian Chukotka Peninsula, these included areas near Kolyuchin Bay, and between Kolyuchin Bay and the Bering Strait (ERAs 3, 4, and 16), the offshore polynya area between Barrow and Wainwright (ERA35), the Herald Shoal polynya (ERA46), and the Hanna Shoal area (ERA48). For more information on the location of specific ERAs, see Maps A.1-2A, A.1-2B and A.1-2C.

Summer Spills. For summer spills, the OSRA model estimates the percent chance of a large oil spill in the Chukchi Sea contacting the Beaufort Sea spring lead system within 30 days as <0.5-1% for all launch areas and <0.5% for all pipeline segments. Over 360 days, the percent chance that a summer spill would contact the spring lead system varies from <0.5-4% for either launch areas or pipeline segments. The OSRA model estimates the percent chance of a large oil spill contacting the Barrow area within 30 days as varying from <0.5-8% for all launch areas and <0.5-3% for all pipeline segments. Over 360 days, the percent chance that a summer spill would contact the Barrow area varies from <0.5-13% for launch areas and from <0.5-6% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Chukchi sea spring lead system is <0.5-9% within 30 days for all launch areas and from <0.5-14% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the

Chukchi Sea spring lead system varies from <0.5-10% for launch areas and from <0.5-14% for pipeline segments. The percent chance that a large oil spill would contact Kasegaluk Lagoon is <0.5-15% within 30 days for all launch areas and from <0.5-31% for all pipeline segments. Over 360 days, the percent chance that a spill would contact Kasegaluk Lagoon varies from <0.5-17% for launch areas and from <0.5-34% for pipeline segments. The percent chance that a large oil spill would contact Kotzebue Sound is <0.5% within 30 or 360 days for all launch areas and from <0.5-1% for all pipeline segments. The percent chance that a large oil spill would contact the Point Hope area is <0.5-8% within 30 or 360 days for all launch areas and from <0.5-20% for all pipeline segments. The percent chance that a large oil spill would contact the Point Lay polynya area is <0.5-16% within 30 days for all launch areas and from <0.5-41% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Point Lay polynya area varies from <0.5-19% for launch areas and from <0.5-44% for pipeline segments. The percent chance that a large oil spill would contact the Wainwright polynya area is <0.5-19% within 30 days for all launch areas and from <0.5-51% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Wainwright polynya area varies from <0.5-26% for launch areas and from <0.5-57% for pipeline segments.

The percent chance that a large oil spill in the Chukchi Sea would contact the offshore polynya area between Barrow and Wainwright is <0.5-53% within 30 days for all launch areas and from <0.5-60% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the offshore polynya area between Barrow and Wainwright varies from <0.5-61% for launch areas and from <0.5-67% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Herald Shoal polynya is <0.5-20% within 30 days for all launch areas and from <0.5-17% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Herald Shoal polynya varies from <0.5-21% for launch areas and from <0.5-19% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Hanna Shoal area is <0.5-41% within 30 days for all launch areas and from <0.5-37% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Hanna Shoal area varies from <0.5-45% for launch areas and from <0.5-42% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact any of the Russian coastline environmental resource areas for gray whales is <0.5-7% within 30 days for all launch areas and pipeline segments. Over 360 days, the percent chance that a spill would contact any of the Russian coastline environmental resource areas for gray whales varies from <0.5-7% for launch areas and pipeline segments. For more information see Appendix A, Tables A.3-33, and A.3-36.

Winter Spill. For winter spills, the OSRA model estimates the percent chance of a large oil spill in the Chukchi Sea contacting the Beaufort Sea spring lead system within 30 days as <0.5-1% for all launch areas and <0.5% for all pipeline segments. Over 360 days, the percent chance that a winter spill would contact the spring lead system varies from <0.5-3% for launch areas and from <0.5-2% for pipeline segments. The percent chance of a large oil spill contacting the Barrow area within 30 days varies from <0.5-2% for all launch areas and <0.5-9% for all pipeline segments. Over 360 days, the percent chance that a winter spill would contact the Barrow area varies from <0.5-4% for launch areas and from <0.5-12% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Chukchi sea spring lead system is <0.5-16% within 30 days for all launch areas and from <0.5-23% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Chukchi Sea spring lead system varies from <0.5-26% for launch areas and from <0.5-35% for pipeline segments. The percent chance that a large oil spill would contact Kasegaluk Lagoon is <0.5-3% within 30 days for all launch areas and from <0.5-5% for all pipeline segments. Over 360 days, the percent chance that a spill would contact Kasegaluk Lagoon varies from <0.5-10% for launch areas and from <0.5-13% for pipeline segments. The percent chance that a large oil spill would contact Kotzebue Sound is <0.5% within 30 or 360 days for all launch areas and for all pipeline segments. The percent chance that a large oil spill would contact the Point. Hope area is <0.5-2% within 30 days for all launch areas and from <0.5-9% for all pipeline segments. The percent chance that a large oil spill would contact the Point Hope area is <0.5-3%

within 360 days for all launch areas and from <0.5-11% for all pipeline segments. The percent chance that a large oil spill would contact the Point Lay polynya area is <0.5-16% within 30 days for all launch areas and from <0.5-32% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Point Lay polynya area varies from <0.5-25% for launch areas and from <0.5-39% for pipeline segments. The percent chance that a large oil spill would contact the Wainwright polynya area is <0.5-8% within 30 days for all launch areas and from <0.5-38% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Wainwright polynya area varies from <0.5-18% for launch areas and from <0.5-52% for pipeline segments.

The percent chance that a large oil spill in the Chukchi Sea would contact the offshore polynya area between Barrow and Wainwright is <0.5% within 30 days for all launch areas and pipeline segments. Over 360 days, the percent chance that a spill would contact the offshore polynya area between Barrow and Wainwright varies from <0.5-7% for launch areas and from <0.5-8% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Herald Shoal polynya is <0.5-9% within 30 days for all launch areas and pipeline segments. Over 360 days, the percent chance that a spill would contact the Herald Shoal polynya varies from <0.5-10% for launch areas and pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact the Hanna Shoal area is <0.5-9% within 30 days for all launch areas and from <0.5-10% for all pipeline segments. Over 360 days, the percent chance that a spill would contact the Hanna Shoal area varies from 2-22% for launch areas and from 1-25% for pipeline segments. The percent chance that a large oil spill in the Chukchi Sea would contact any of the Russian coastline environmental resource areas for gray whales is <0.5-5% within 30 and 360 days for all launch areas and <0.5-7% for all pipeline segments. For more information see Appendix A, Tables A.3-57 and A.3-60.

4.5.2.8.3.1.6.1.2. Combined Probabilities. Combined probabilities differ from conditional probabilities in that there is no assumption that a large spill has occurred. Instead, combined probabilities reflect the chance of one or more large spills occurring over the 25-year production life of the Proposed Action, and of any portion of that spill contacting any portion of a particular environmental resource area. Combined probabilities do not factor in any cleanup efforts. For more background, see Appendix A, Section 4.3.

Ringed, Spotted, Ribbon, and Bearded Seals. Only environmental resource areas that have a percent chance of contact higher than <0.5% are discussed below. All other environmental resource areas discussed in the conditional probabilities section above (Section 4.5.2.8.3.1.6.1.1) are not discussed further in this section. The combined probabilities of one or more large spill (≥1,000 bbl) occurring and any oil contacting the Chukchi Sea spring lead system is 2% 3 days after a spill, 3% 10 days after a spill, 5% 30 days after a spill, 6% 60 days after a spill, and 7% 180-360 days after the spill. The combined probabilities of one or more large spills occurring and contacting the Point Lay polynya area is 2% 3 days after a spill, 4% 10 days after a spill, 5% 30 days after a spill, 6% 60 days after a spill, and 7% 180-360 days after a spill. The combined probabilities of one or more large spills occurring and contacting the Wainwright polynya area is 1% 3 days after a spill, 3% 10 days after a spill, 5% 30 days after a spill, 6% 60 days after a spill, and 8% 180-360 days after a spill. The combined probabilities of one or more large spills occurring and contacting Kasegaluk Lagoon is <0.5% 3 days after a spill, 1% 10 days after a spill, 3% 30-60 days after a spill, and 4% 180-360 days after the spill. For more information see Appendix A, Tables A.3-79.

Considering their dispersed distribution, and the chances of contacting an oil spill, we believe an oil spill would have a moderate level of effects on ice seals in the Beaufort Sea.

Pacific Walrus. The combined probabilities of one or more large spills (≥1,000 bbl) occurring and any portion of that spill contacting the Chukchi Sea spring lead system is 2% 3 days after a spill, 3% 10 days after a spill, 5% 30 days after a spill, 6% 60 days after a spill, and 7% 180-360 days after the spill. The combined probabilities of one or more large spills occurring and any portion of that spill contacting the Cape Lisburne area is 1-2% from 3 days after a spill until 60 days after a spill, and 3% 180-360 days after the spill. The combined probabilities of a large spill occurring and any portion of that spill contacting the Point Lay polynya and Icy Cape area is 2% 3 days after a spill, 4% 10 days after a spill, and from 5-7% from 30-360 days after a spill. The combined probabilities of one or more large spills occurring and any portion of that spill contacting the Wainwright polynya area is 1% 3 days after a spill and from 3-8% 10-360 days after the spill. The combined probabilities of one or more large spills occurring and any portion of that spill contacting the Hanna Shoal area is 1% 3 days after a spill and from 2-5% 10-360 days after the spill. The combined probabilities of one or more large spills occurring and any portion of that spill contacting the offshore polynya area is 8% 3 days after a spill and from 10-17% 10-360 days after the spill. There is a <0.5% combined probability with any of the Russian resource areas important to walrus from 3-360 days after a spill (Tables A.3-79, A.3-80, A.3-81 and A.3-82).

Walruses have a patchy, clumped distribution, which makes it difficult to evaluate the risk to walrus from a spill. During early spring and summer months, nearly the entire population of Pacific walruses can be found in the Chukchi Sea, and they could be extremely vulnerable to a large oil spill at this time. However, the OSRA model estimates the percent chance of a large oil spill occurring in the Chukchi Sea and contacting walrus habitat as <17%. Careful placement of pipeline could reduce this risk further. Efficient oil-spill cleanup efforts could reduce this risk even more. Therefore, MMS believes that with appropriate mitigation measures and OSRPs in place, the anticipated level of effect to walruses is likely to be minor.

Beluga Whales and Gray Whales. Only environmental resource areas that have a percent chance of contact higher than <0.5% are discussed below. All other environmental resource areas discussed in the conditional probabilities section above (Section 4.5.2.8.3.1.6.1.1) are not discussed further in this section.

For environmental resource areas that have been identified as important to belugas, the combined probabilities of one or more large spills (≥1,000 bbl) occurring and any oil contacting Kasegaluk Lagoon; the Chukchi sea spring lead system; the Point Hope, Wainwright and Point Lay areas (environmental resource areas that were identified as also important to ice seals) all are discussed in the ice seals section above. The combined probabilities of one or more large spills occurring and contacting the Barrow area (ERA42) is <0.5% from 3 days after a spill until 360 days after a spill, when the percent chance rises to 1%.

For environmental resource areas that have been identified as important to gray whales, the combined probabilities of one or more large spills occurring and contacting the Chukchi Sea spring lead system, the Herald Shoal polynya, and the Hanna Shoal area all are discussed above in the walrus section. The combined probabilities of one or more large spills occurring and contacting the offshore area between Barrow and Wainwright (ERA35) is 2% from 3-10 days after a spill, 3% 30 days after a spill, 4% 60 days after a spill, and 5% 180-360 days after a spill (Table A.3-79).

Considering the low probability of a large spill occurring, relatively low vulnerability of these species coupled with a variety of other factors that would need to be satisfied to result in population-level effects, MMS anticipates that it is highly improbable that these whales would experience more than a negligible level of effect to some individuals as a result of oil spills under the Proposed Action.

4.5.2.8.3.1.6.2. Chronic Low-Volume Spills. Small or low-volume spills are defined as spills <1,000 bbl. Between 1989 and 2000, there have been 1,178 spills <500 bbl on the Alaska North Slope. There have been six spills that were between 500 and 1,000 bbl. The total volume of all 95 spills combined was 306,277 gal, or 7,292 bbl (Table A.1-29). An estimated 178 small crude oil spills <500 bbl could occur during the 25-year oil production period (Appendix A, Table A.1-32), an average of more than 7 per year. The average crude oil spill size is 126 gal (3 bbl) for spills <500 bbl. The average refined oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined oil spills could occur during the 25-year oil production period (Appendix A, Table A.1-36), an average of more than 17 per year. Overall, an estimated 24 low-volume oil spills could occur during each year over the 25-year production period.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects of low-volume spills on ice seals would depend on the location and timing of each spill, as well as the speed and success rate of cleanup efforts. Due to their patchy distribution and reliance on sea ice, it is difficult to predict where ice seals might encounter spilled oil. A low-volume oil spill is expected to have a negligible level of effect on ice seals in the Beaufort Sea.

Pacific Walrus. The effects of low-volume spills on walrus would depend on the location and timing of each spill as well as the speed and success rate of cleanup efforts. Due to their patchy distribution and reliance on sea ice, it is difficult to predict where walruses might encounter spilled oil. Over time, chronic small spills could have minor or moderate impacts to walrus if they were to occur regularly in frequently used foraging or resting habitat. Conversely, chronic small spills that occurred in deep water and dispersed quickly would be unlikely to impact walrus.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. Small, chronic petroleum (fuel and oil) spills rapidly dissipate volatile toxic compounds within hours to a few days through evaporation, and residual components rapidly disperse in open waters. Individual whales potentially could be exposed to small fuel oil spills, and this exposure could have short-term, nonlethal effects on health. A negligible level of effect from low-volume spills is expected.

Considering the low probability of a large spill occurring, a negligible level of effect to whales as a result of oil spills is anticipated.

4.5.2.8.3.1.6.3. Oil-Spill-Response Activities. Conditional and combined probabilities do not factor in the effectiveness of oil-spill-response activities to large or small spills. Oil-spill response (cleanup efforts) varies from highly effective in calm, open-water conditions to largely ineffective during unfavorable or broken-ice conditions. The MMS requires that each operator have an approved OSRP prior to the onset of production, and that equipment and trained personnel be available to respond to spills. The FWS also may review these plans as part of their LOA review process. In general, oil-spill-response activities include containing the release and spread of oil, recovering oil as quickly as is safely possible, and keeping oil away from areas identified as important habitat using boom or other resources.

Depending on the location of the spill, oil-spill response could take some time to begin. Oil-spill-response equipment is cached in Barrow and in Deadhorse, about 150 mi east of Barrow. Oil-spill-response personnel would be expected to work with FWS on walrus and polar bear management activities in the event of a spill, and to work with NMFS on the management of other marine mammals present in the area.

Oil-spill-response plans and oil-spill management must be flexible. For example, to adequately protect walruses and their habitat from the threat of a large oil spill or chronic small spills, mitigation measures currently in place must be adaptable to continued changes in walrus distribution and habitat use—for example, the increasing use of the coastline for terrestrial haulouts in late summer and fall. Equipment and trained crews need to be able to respond rapidly to a spill as soon as it is discovered. The effectiveness of oil-spill-response measures will depend largely on the location of the spill, the distances involved, the season, and the weather along the Chukchi Sea coast.

4.5.2.8.3.1.6.4. Prey Reduction or Contamination.

Ringed, Spotted, Ribbon, and Bearded Seals. The diet habits of northern ice seals are covered in Section 3.3.6. The effects of oil spills on benthos are discussed in Section 4.5.2.3.1.3. Section 4.5.2.4.1.1.1 provides details regarding the effects of oil spills on fish in the Chukchi Sea. While ice seals bioaccumulate hydrocarbon byproducts over time and sequester many of these byproducts in their layer of fat, they also have the ability to excrete polar metabolites through their renal systems. Very little information exists in the form of trend analyses or incremental analyses that show what the long-term effects of hydrocarbon exposure are, or what effects ensue from varying sublethal levels of hydrocarbon exposure.

Pacific Walrus. Walruses prey primarily on benthic invertebrates. Some walruses also may prey on seals. The effects of oil spills on benthos is discussed in Section 4.5.2.3.1.3. Walruses may accumulate hydrocarbon byproducts over time and may sequester many of these byproducts in their layer of fat. Very little information exists in the form of trend analyses or incremental analyses that show what the long-term effects of hydrocarbon exposure are, or what effects ensue from varying sublethal levels of hydrocarbon exposure.

Beluga Whale, Killer Whale, Harbor Porpoise, Minke Whale, and Gray Whale. Section 4.5.2.6.1.3.9 describes the probabilities associated with prey reduction or contamination for whales in the Chukchi Sea. Reduction or contamination of food sources would be localized relative to the available prey in the Chukchi Sea. Exposure to contaminated prey multiple times over the long lifetime of these whales could increase contamination of whale tissues through accumulation. This generally likely would not affect large numbers of whales, because they would be exposed to contaminated prey in localized areas. Because the percent chance of large spills occurring is unlikely, infrequent consumption of contaminated prey is unlikely to accumulate to toxic levels that would cause population-level effects. A negligible level of effect is anticipated.

4.5.2.8.3.1.6.5. Vulnerability or Mortality of Marine Mammals to Petroleum Spills.

Ringed, Spotted, Ribbon, and Bearded Seals. The likelihood that an ice seal would become exposed to petroleum in the unlikely event of a spill is greatly influenced by their habitat preferences. Ringed and bearded seals may be found near the sea ice throughout the Proposed Action area. Spotted seals in the Chukchi Sea often occur in the nearshore areas along the sea coast in Kasegaluk Lagoon in the thousands. Ribbon seals occur on the edges of the sea ice during winter, spending their summer months hunting in the open ocean.

Ice seals typically rely on a thick layer of blubber for insulation rather than fur. Consequently oiling of the pelt is not likely to result in any decreases in a seal’s ability to thermoregulate in the Chukchi Sea. The two primary venues where oil seems to pose the greatest risk to ice seals are through ingestion of oiled foods or through absorption of oil through openings in the seal’s body. Smith and Geraci (1975) determined from field experiments that ringed seals exposed to crude oil showed evidence of kidney lesions, liver changes, and eye damage. In a related lab experiment, three ringed seals placed in a tank with an oiled surface layer died within 71 minutes of immersion. Since these studies only lasted for a short while, they reflect what would likely happen if an oil spill were to occur during the ice-free season.

Summarily, oil spills are most likely to affect northern ice seals if they ingested oiled food items, absorbed oil through body openings, inhaled oil, or possibly absorption through the skin. However no long-term studies relating to the issue of oiling of northern ice seals have been conducted.

Pacific Walrus. Spills in the marine environment have the greatest potential to affect walruses in the Chukchi Sea. The effects of exposure to oil on walruses are reviewed in Section 4.5.1.8.1.6. This analysis assumes that walruses contacted by oil may not survive, and that walrus could be impacted by ingesting prey that had either been directly oiled or had absorbed oil through their own feeding processes. Many benthic invertebrates are filter feeders, which tend to concentrate hydrocarbons through bioaccumulation. Walruses may continue to be affected by contaminants ingested long after oil has ceased to be apparent on the surface of the water. Walruses could come into contact with oil in the open-lead system, in pack ice, or along the coastline. Walruses that were oiled could suffer effects to vision; inhale toxic fumes, which could result in respiratory illnesses; or suffer skin lesions, among other potential effects.

Walruses inhabit the Chukchi Sea from early spring through late fall. Most female walruses and calves, and some males, move north from the Bering Sea with the ice edge as it recedes north in spring. Some males move south and spend the summer on terrestrial haulouts in Bristol Bay. In years when the ice edge retreats north of the continental shelf into areas too deep for walruses to forage successfully, walruses may come ashore and form large terrestrial haulouts on both sides of the Chukchi Sea and along Wrangell Island. As the ice edge extends southward in fall, walruses move southward with the ice into the Bering Sea, where they breed in late winter and then calve in early spring. Walrus are vulnerable to spills that occur in summer or that occur at any time of the year, with oil remaining in the lead systems or in terrestrial haulout areas in summer. Little is known about the level of toxicity to walrus after the aromatic hydrocarbons have dissipated. After an oil spill occurs, the highly toxic aromatic hydrocarbons typically evaporate relatively quickly, sometimes within weeks, if the oil is exposed to optimum environmental conditions. If the oil remains trapped in ice, frozen within sea ice for example, the oil can retain aromatic hydrocarbons for months until the oil eventually melts out of the ice and is exposed to wind and wave action. Walruses may inhale aromatic hydrocarbons when using breathing holes in the ice, in lead systems, or while hauled out onshore. Oil toxicity decreases over time with weathering. However, walruses may continue to ingest oil through their prey species long after a spill, and little is known about the long-term effects of bioaccumulation in pinniped species.

As sea ice breaks up in spring, walruses follow the receding ice edge and may come ashore in late summer and fall, where they remain until the sea ice re-forms in early winter. Large aggregations of walruses typically form along the Russian Chukchi Sea coastline. In recent years, large aggregations also have formed along the U.S. Chukchi Sea coastline, particularly near Icy Cape and Cape Lisburne. It is unknown whether walruses would avoid oil in lead systems or onshore. It is unknown whether walrus would avoid their usual prey items due to oiling. Ingesting oiled prey could be a secondary source of contamination after a spill and potentially could cause short-term health impacts or chronic health impacts, depending on the level and rate of exposure.

Female walrus exhibit extremely strong bonds to their calves and will not leave them, even when being actively pursued by hunters. Therefore, we presume that it is unlikely that walruses would abandon their calves if threatened by oil pollution. Walruses scratch and rub themselves with their hind and fore flippers. They also will rub their faces and vibrissae with their fore flippers but are unlikely to ingest oil while grooming.

Walruses are long-lived mammals that mature slowly. Females generally produce a single calf every 2-3 years, beginning at roughly age 7. Walruses are demographically the most vulnerable of all pinniped species to population catastrophes such as oil spills (McLaren, as cited in Geraci and St. Aubin, 1990).

Beluga Whale, Killer Whale, and Harbor Porpoise. Current oil-spill rates are expected to remain the same under this alternative. No large spills are anticipated to occur during exploration activities in the Alaska Chukchi Sea. This alternative is anticipated to result in negligible impacts to beluga whales, because petroleum spills are considered infrequent, illegal, or accidental events.

Minke and Gray Whales. No large spills are anticipated to occur during exploration activities in the Alaska Chukchi Sea relative to existing or new leases. The OSRA modeling runs predict the probability of such a spill scenario to be very low. The most likely number of spills $\geq$1,000 bbl is zero (USDOI, MMS, 2003a). The MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. Development/production projects and associated infrastructure for product transport may occur on existing and new leases in the Beaufort Sea OCS and would be analyzed at the time of proposal. Some individual whales could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, localized reduction in prey sources, consumption of petroleum and/or petroleum-contaminated food items, perhaps temporary displacement from feeding/resting areas, and temporary interruption of migration timing and route. Spilled oil, if chemical dispersants are used to break up surface oil and cause it to sink to the bottom, could negatively affect gray whales by contaminating benthic prey, particularly in primary feeding areas (Wursig, 1990; Moore and Clarke, 2002). Bottom muds could be contaminated, and oil deposited on the bottom could be ingested by feeding gray whales. Most whales exposed to spilled oil likely would experience a minor level of effect.

Small, chronic petroleum (fuel and oil) spills rapidly dissipate volatile toxic compounds within hours to a few days through evaporation and residual components rapidly disperse in open waters. Any OCS activities as result of leasing may increase the region within the Chukchi Planning Area where small spills could occur due to expanded areas of exploration and vessel traffic. Individual whales potentially could be exposed to small fuel oil spills, and this exposure could have a negligible level of effect on health.

Summary of Spill Effects.

Ringed, Spotted, Ribbon, and Bearded Seals. Ice seals are assumed to be widely distributed throughout the proposed lease area. Species such as the bearded, spotted, and ribbon seals prefer to occupy the ice front, leads, or polynyas, while the ringed seal prefers to occupy leads and iced-over areas. In the unlikely event of an oil spill, ice seal habitat would be impacted. No one can accurately say how many individuals and what species would be affected. However, it is not unreasonable to assume mortality could occur to at least a small number of individuals. Consequently we must anticipate that an oil spill would result in a moderate level of effect to ringed seals in the Chukchi Sea, because mortalities might reasonably be expected to occur.

Pacific Walrus. The biological potential for walrus to recover from moderate or major impacts to their population is low due to their low reproductive rate and long maternal investment in a single calf. Additionally, walruses already may be a population at risk due to ongoing changes in their sea-ice habitat. There is not enough information at this time to fully assess ongoing impacts to walruses due to climate change or other factors. An oil spill in the Chukchi Sea could have negligible impacts or major impacts to walruses, depending on the location, timing, and size of the spill and the effectiveness of cleanup efforts. The combined probability of an oil spill impacting walrus habitat varies from <0.5%-17%. Careful assessment of OSRPs, locating pipelines away from critical foraging and resting habitats, and a timely oil-spill-cleanup response could reduce this risk further.

Beluga Whale, Killer Whale, and Harbor Porpoise. Current oil-spill rates are expected to remain the same under this alternative. No large spills are anticipated to occur during exploration activities in the

Alaska Chukchi Sea relative to existing leases. This alternative is anticipated to result in negligible impacts to beluga whales, because petroleum spills are considered infrequent, illegal, or accidental events.

Minke and Gray Whales. Refer to Section 4.5.2.6.1.3.9 for a summary of oil-spill effects on baleen whales in the Chukchi Sea. No large spills are anticipated to occur during exploration activities in the Alaska Chukchi Sea relative to existing leases. The OSRA modeling runs predict the probability of such a spill scenario to be very low. The most likely number of spills ≥1,000 bbl is zero (USDOI, MMS, 2003a). The MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. Development/production projects and associated infrastructure for product transport may occur on existing leases in the Beaufort Sea OCS in addition to the Northstar and ongoing Liberty projects or adjacent State of Alaska oil and gas leases. It is anticipated that in the unlikely event of a large oil spill, some individual gray whales may experience injury or mortality as a result of prolonged exposure to freshly spilled oil; however, the number affected likely would be small. Some individual whales could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, localized reduction in prey sources, consumption of petroleum and/or petroleum-contaminated food items, perhaps temporary displacement from feeding/resting areas, and temporary interruption of migration timing and route. Spilled oil, if chemical dispersants are used to break up surface oil and cause it to sink to the bottom, could negatively affect gray whales by contaminating benthic prey, particularly in primary feeding areas (Wursig, 1990; Moore and Clarke, 2002). Bottom muds could be contaminated and oil deposited on the bottom could be ingested by feeding gray whales. Any perturbation, such as an oil spill, which caused extensive mortality within a high-latitude amphipod population with low fecundity and long generation times, would result in a marked decrease in secondary production (Highsmith and Coyle, 1992). Effects of exposure of whales to spilled oil may, but are not anticipated to, result in lethal effects to a few individuals, and most individuals exposed to spilled oil likely would experience a minor level of effect.

Small, chronic petroleum (fuel and oil) spills rapidly dissipate volatile toxic compounds within hours to a few days through evaporation and residual components rapidly disperse in open waters. Individual whales potentially could be exposed to small fuel oil spills, and this exposure could have a negligible level of effect on health.

4.5.2.8.3.1.7. Anticipated Level of Effects from Changes in the Physical Environment. Changes in the physical environment as a result of ongoing trends in climate change are having profound effects on many marine mammal species. The effects of these long-term trends on marine mammals are discussed in detail in Section 4.4.1.8.3.2.7. This alternative is not anticipated to have a direct effect on greenhouse gas emissions.

4.5.2.8.3.2. Cumulative Effects Under Alternative 2. This analysis describes the anticipated effects that are anticipated to occur in the Chukchi Sea under Alternative 2. The cumulative effects under this alternative are the combination of the direct and indirect effects under the Proposed Action and the cumulative effects under Alternative 1. Mitigation applied by MMS on and adjacent to existing and new leases to exploration, development and production activities avoid or minimize adverse effect to whales in the Chukchi Sea Planning Area. The MMS actions presumably would result in incremental increases in intensity, duration, distribution, and magnitude of activities; however, the total additive effect is not substantially greater than the effects under Alternative 1, and cumulative effects under this alternative are minor (the same as under Alternative 1).

Ringed, Spotted, Ribbon, and Bearded Seals. The greatest impacts to ice seals would come from climate changes and the reduction of sea-ice. Impacts from local community travel and subsistence activities are expected to continue at current levels. Disturbances to northern ice seals from increasing vessel, aircraft, and subsistence activities are expected to continue at current levels. These levels of disturbance should result in only minor impacts to ice seal populations in the Chukchi Sea analysis area. The greatest source of large, noncrude oil spills would continue to arise from bulk fuel deliveries to coastal villages. The expected increase in traffic from tourism, research, and shipping, as well as the potential for OCS exploratory traffic, increases the potential for marine accidents, disturbances, and oil/gas spills. The spill could result in major adverse impacts on pinniped species in the Proposed Action area; however it is likely that climate change will continue to be the main source for major impacts on ice seals.

We believe oil and gas exploration associated with this lease sale will have a minor level of effect on northern pinniped species in the Chukchi Sea. Close cooperation between NMFS, MMS, and OCS operators will help ensure the level of effect does not increase.

Overall, a minor level of effects to ice seals should result under Alternative 2 in the Chukchi Sea. While this alternative does occur in habitat used by ringed, bearded, spotted, and ribbon seals, proper mitigation should greatly reduce the impacts associated with offshore oil and gas exploration. The existing level of effect as explained under Alternative 1 indicates that the main source for adverse population-level effects on northern ice seals likely would be climate change and the coinciding changes to sea-ice quality and quantity in the Arctic. These climatic changes are expected to result in a major level of effect to ice seals in the Chukchi Sea. Consequently, we derived our cumulative level of effects by combining the overall direct and indirect effects under this alternative, which is a minor level of effects, with the existing condition under Alternative 1, which is a major level of effect. Hence, the cumulative effects under Alternative 2 would constitute a major level of effect on ice seals in the Chukchi Sea.

Pacific Walrus. Pacific walruses currently are experiencing tremendous changes in their habitat due to ongoing trends in climate change. Temporal and spatial changes in sea-ice distribution may alter walrus distribution, cause preferred habitats to become unavailable, and impact breeding and foraging success. These factors may have major population-level effects. The Proposed Action area in the Chukchi Sea encompasses habitat commonly used by walrus from spring through late fall. Continued monitoring of walrus distribution and monitoring of physical parameters such as fecundity, contaminant loads, parasite loads, and other measures of health, would allow managers to identify problems as they arise and would supply the information needed for effective adaptive management plans. The level of impact on walruses of the proposed lease-sale area would depend on the location and amount of concurrent exploration activity. Careful mitigation and avoidance of aggregations of walruses could lower impact levels to negligible to minor.

Beluga Whale, Killer Whale, and Harbor Porpoise. There may be small increases in vessel and aircraft activity associated with new leases from the proposed sales over existing levels within the Chukchi Sea lease-sale area. Close cooperation between MMS, NMFS, and OCS operators will help ensure that no more than a negligible level of effect occurs. Any exploration drilling activities also would be conducted in a manner consistent with the MMPA. Overall, the oil and gas exploration activities are anticipated to have a negligible level of effect on beluga whales in the Chukchi Sea lease-sale area.

An expected increase in traffic from tourism, research, and shipping would increase the noise in the marine environment and the potential for marine accidents and oil spills. The greatest potential effect to beluga whales would be the unlikely event of a large oil spill occurring within the Chukchi Sea spring lead system at a time and place when large numbers of migrating beluga whales could contact fresh oil and inhale aromatic hydrocarbons for a prolonged period. The impacts to beluga whale subsistence activities from non-OCS-related vessel traffic are expected to continue at current levels. The greatest potential for a major level of effect on beluga whales in the Chukchi Sea could result from changes in the physical environment associated with arctic warming/climate change.

Minke and Gray Whales. Effects from oil and gas operations in the Beaufort and Chukchi OCS to these whales have been assessed in a number of documents, including a BE of the *Effects of Oil and Gas Leasing and Exploration in the Alaska OCS Beaufort Sea and Chukchi Sea Planning Areas on endangered Bowhead Whales (Balaena mysticetus), Fin whales (Balaeanoptera physalus) and Humpback Whales* (*Megaptera novaeangliae*) (USDOI, MMS 2006c, 2008c); the Five Year Programmatic EIS (USDOI, MMS, 2007c); an ESA *Biological Opinion for Oil and Gas Leasing and Exploration Activities in the U. S. Beaufort and Chukchi Seas Alaska* (USDOC, NOAA, 2006a); and *Authorization of Small Takes under the Marine Mammal Protection Act* (USDOC, NOAA, 2006b); the Beaufort Sea multiple sale EIS (USDOI, MMS, 2003a); and environmental assessments updates thereto for Lease Sales 195 and 202 (USDOI, MMS 2004, 2006b).

If the proposed lease sales are held, past and existing environmental changes and conditions that may be sources of adverse effects to non-ESA listed whales are similar to those discussed in Section 4.4.1.6.1.4.1 for bowhead, fin, and humpback whales. These are expected to persist, and effects under the Proposed Action would be additive to them. Many of these activities and effects are beyond the authority of MMS to control, and some whales and whale populations could be adversely affected over the next 25 years. Past and existing OCS activities and previous assessments not associated with Lease Sales 212 and 221 include mitigation measures to avoid or minimize effects to nonendangered whales and other marine mammals. Activities beyond MMS authority may or may not be subject to mitigation measures for the protection of nonendangered beluga and gray whales. Commercial and private aircraft or climate change may be subject to limited or no direct regulatory or mitigation measures regarding these whale species. We are unable to determine the level of cumulative effects, as determining the effects and outcomes, in part, would be speculative at this time.

The cumulative interaction of ongoing or existing activities and climate change processes may or may not adversely affect these whales depending on the complex temporal, spatial, magnitude, rate of change, and many more variables that are unpredictable at this time. Climate change may create positive and/or negative effects to nonendangered beluga and gray whales. How such potential changes would occur singly or in combination would be highly speculative at this time, and continued intensive monitoring effort would be necessary to document changes and effects and to develop responsive management, as appropriate. Increased human activities could deflect and possibly alter nearshore and offshore spring and fall bowhead whale migration corridors that, in turn, may or may not adversely affect whales, their habitat, and human use of the whale resource. Such traffic could prevent effective duration of use of or prevent other nonendangered whale access to high-quality prey concentrations. Frequent encounters and exposure to noise disturbance could reach levels of chronic and cumulative stress to some animals so as to impact health, social bonds, and productivity of individuals and, potentially, populations.

4.5.2.9. Terrestrial Mammals. In the following analysis, we determined that there likely would be few direct or indirect effects if the lease sales were conducted: there would be negligible effects from vessel presence and noise, aircraft presence and noise, seismic airgun noise, petroleum spills, vehicular traffic, subsistence hunting, habitat loss, and gravel mining. While the greatest potential for major effects is associated with continuing physical changes in the arctic environment, the lease sales will not result in a direct effect to this impact category. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1, and the resultant levels of effect are the same as under Alternative 1. Mitigation measures imposed by MMS on future exploration and development activities on existing or new leases and surrounding waters avoid or minimize adverse effects to terrestrial mammals in the Chukchi Sea. While MMS actions likely would result in an incremental increase in or longer duration of some activities, the total effect would be miniscule when compared to other unrestricted activities in the area.

This analysis identifies the anticipated effects under this alternative to terrestrial mammals. The anticipate effects under this alternative are separated into direct and indirect effects (Section 4.5.2.9.4) and cumulative effects (Section 4.5.2.9.5).

4.5.2.9.1. Potential Effects to Terrestrial Mammals. The potential effects to terrestrial mammals along the Chukchi Sea were described in Section 4.5.1.9.1.

4.5.2.9.2. Mitigation Measures. Mitigation measures are the same as those described in Section 4.5.1.9.2 and any applicable mitigation described in Section 2.2.

4.5.2.9.3. Anticipated Effects Under Alternative 2.

Terms used to define a level of effect. We used the terms negligible, minor, moderate, and major to describe the relative degree or anticipated level of effect of an action to terrestrial mammals. Following each term below are the general characteristics we used to determine the anticipated level of effect. For all terms, best professional judgment was used to estimate population size when current or precise numbers were not known.

Negligible: Localized short-term disturbance or habitat effect experienced during one season that is not anticipated to accumulate across 1 year. No mortality is anticipated. Mitigation measures implemented fully and effectively or not necessary.

Minor: Widespread annual or chronic disturbances or habitat effects not anticipated to accumulate across 1 year or localized effects that are anticipated to persist for more than 1 year. Anticipated or potential mortality is estimated or measured in terms of individuals or <1% of the local postbreeding population. Mitigation measures are implemented on some, but not all, impacting activities, indicating that some adverse effects are avoidable. Unmitigatable or unavoidable adverse effects are short term and localized.

Moderate: Widespread annual or chronic disturbances or habitat effects anticipated to persist for more than 1 year, but less than a decade. Anticipated or potential mortality is estimated or measured in terms of tens or low hundreds of individuals or <5% of the local postbreeding population, which may produce a short-term population-level effect. Mitigation measures are implemented for a small proportion of similar impacting activities, but more widespread implementation for similar activities would likely be effective in reducing the level of avoidable adverse effects. Unmitigatable or unavoidable adverse effects are short term but more widespread.

Major: Widespread annual or chronic disturbance or habitat effect experienced during one season that would be anticipated to persist for a decade or longer. Anticipated or potential mortality is estimated or measured in terms of hundreds or thousands of individuals or <10% of the local postbreeding population, which could produce a long-term population-level effect. Mitigation measures are implemented for limited activities, but more widespread implementation for similar activities would be effective in reducing the level of avoidable adverse effects. Unmitigatable or unavoidable adverse effects are widespread and long-lasting.

4.5.2.9.3.1. Direct and Indirect Effects Under Alternative 2. Oil spills may result in the ingestion, inhalation, or exposure of terrestrial mammals to crude oil. What information we have suggests physiological stress or damage may occur as an effect of contacting or ingesting crude oil. Ingesting contaminated food items has been linked to liver damage, kidney damage, and respiratory damage in some cases.

The temporary displacement of a small number of caribou, muskoxen, grizzly bears, and furbearers from preferred habitats may occur. Chronic disturbances can have moderate effects over time; however, mitigation currently in place is expected to moderate potential impacts to terrestrial mammals. Disturbances that do occur are expected to be transient, producing negligible effects on the fitness and survival of most terrestrial mammal species. Seismic activity appears to present no impacts to terrestrial mammals. Vibroseis activities are temporary and may displace the occasional terrestrial scavenger or hunter on the sea ice. Both vibroseis and seismic surveys should have no impacts on grizzly bears, caribou, or muskoxen in the Proposed Action area.

Vessel traffic in the Chukchi Sea is assumed to present a very minor level of disturbance during the ice-free season. Activity from icebreakers may pose a low threat to furbearers foraging on the sea ice by cutting off their avenues of moving to and from the sea ice. Vehicular traffic associated with offshore oil and gas exploration may include snowmachines, rollagons, snowcats, ATV's, and automobiles in some areas. Considering the stringent regulations governing vehicle use by the oil and gas industry, only transient disturbances with negligible effects are expected under Alternative 2.

Aircraft traffic has been identified as a strong source of disturbance to caribou, muskoxen, grizzly bears, etc. Studies have indicated maintaining an altitude no less than 1,500 ft should greatly mitigate any adverse effects to terrestrial mammals might otherwise occur. Moreover the ADNR (1999) requires oil and gas operators to maintain an altitude of 1,500 ft on Alaska's North Slope, including the Proposed Action area.

4.5.2.9.3.1.1. Anticipated Level of Effect from Vessel Presence and Noise. The anticipated effects from vessel presence and noise are the same as those described in Section 4.5.1.9.3.2.1.

4.5.2.9.3.1.2. Anticipated Level of Effect from Aircraft Presence and Noise. The number of aircraft using the Proposed Action area is expected to increase above the expectations outlined in Section 4.5.1.9.3.2.2. Adhering to mitigation should keep any adverse impacts to a negligible level of effect. Increased aircraft presence and noise are expected to continue to have a negligible level of effect on terrestrial mammal species, if a 1,000-ft flying altitude is maintained.

4.5.2.9.3.1.3. Anticipated Level of Effect from Vehicular Traffic. The anticipated effects from vehicular traffic are the same as those described in Section 4.5.1.9.3.2.3.

4.5.2.9.3.1.4. Anticipated Level of Effect from Subsistence. The anticipated effects from subsistence are the same as those described in Section 4.5.1.9.3.2.4.

4.5.2.9.3.1.5. Anticipated Level of Effect from Gravel Mining. The anticipated effects from gravel mining are the same as those described in Section 4.5.1.9.3.2.5.

4.5.2.9.3.1.6. Anticipated Level of Effect from Petroleum Spills. While spills can occur on land or in the marine environment, spills to the marine environment have the greatest potential to affect small numbers of terrestrial mammals because of their ability to spread and persist in the food web. Exposure of terrestrial mammals to petroleum or other hydrocarbons could result from a number of ongoing or future events. Such an event might occur when caribou wade into the coastal shallows seeking relief from swarms of biting flies and mosquitoes. Grizzly bears and furbearers are most likely to directly encounter oil spills when scavenging the carcasses of dead marine mammals. Trophic effects may occur through ingesting oil while grooming or by feeding on contaminated food items. Ingestion of oil can lead to renal failure, liver failure, reproductive failure, or a host of other physiological side effects (Oritsland et al., 1981.).

Petroleum spills may occur as a result of ongoing industry activities, barge and other vessel traffic, accidents at sea, accidents onshore, equipment malfunctions, spills during bulk-fuel transfers, local village activities, or research activities. Most spills are expected to be refined materials (diesel fuel, gasoline, antifreeze, etc.) and to be very small (Section 4.2.1.1.1.3).

Freshly spilled oil contains high levels of toxic aromatic compounds that can cause serious health effects or death if inhaled. Oil that moves some distance from a site still may have high levels of toxic aromatic compounds, depending on temperature and whether the oil becomes frozen into ice. Oil and other petroleum products are highly toxic when ingested. Petroleum products also can foul fur, leading to hypothermia.

Oil spills have a great potential for affecting terrestrial mammals in part due to the difficulties involved in cleaning up spills in remote areas, given the wide variety of possible ice and weather conditions. Indirect effects to furbearers due to a spill include the possibility of local reductions in food items (seal pups, winter carrion on sea ice). The National Research Council has determined that a major spill in the Chukchi Sea would have major effects on polar bears and ringed seals (NRC, 2003b).

A large spill event associated with OCS oil and gas activities likely would occur only during the production phase, when volumes of oil or gas product is being moved to production facilities in the existing facilities at Kuparuk or Prudhoe Bay. Section 4.4.1.6.2.3.2 describes the basis for concluding that oil or gas production resulting from the proposed lease sales is considered speculative, and production effects are not considered reasonably foreseeable. Such a commercial discovery warranting production has not been identified or proposed for development and is considered speculative at this time. In other words, while MMS acknowledges that a large spill could have major impacts on terrestrial mammals, a spill from production activities is not considered a reasonably foreseeable future event.

The MMS 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 have the highest chance of contact from a specific geographic location. In the following sections we evaluate the vulnerability of caribou, grizzly bears, and furbearers, as a group, to large oil spills (oil-spill analysis), then we describe the effect of disturbance from oil-cleanup activities, the effects of prey reduction or contamination, and the anticipated effects of that mortality on these terrestrial mammal populations.

4.5.2.9.3.1.6.1. Vulnerability of Terrestrial Mammals to Oil Spills.

Caribou. The Teshekpuk Lake (TCH) Central Arctic (CAH), and Western Arctic (WAH) caribou herds calve in areas near the Chukchi Sea coastline (Figure 4.4.2.9-1). These sites near the coast occur in the relatively flat coastal plain, which is riddled with shallow lakes, ponds, streams, and puddles, all of which create ideal breeding habitat for mosquitoes. These hordes of biting insects have been known to force caribou onto barrier islands or into the surf in an effort to gain relief from their torment. After physically encountering oil, an individual animal's coat will become slicked with oil, resulting in a loss of thermal protection and subsequent hypothermia. Mammals typically respond to a filthy coat by licking it clean, a behavior that will result in the ingestion of oil by the individual caribou. Consequently caribou could go into renal failure, liver failure, neuromuscular degeneracy, and a quick death. Any mortality associated with a large 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 (e.g., wintering individuals vs. calving individuals vs. migrating individuals).

Grizzly Bears. Barren ground grizzlies are known to occupy various portions of this area. While >80% of their diet consists of vegetative matter, these are an opportunistic species that will prey on other animals and actively scavenge as the opportunity presents itself. The primary risk to the grizzly bear would occur in the event of a large oil spill that kills off large numbers of marine mammals and fishes. There exists the very possibility that grizzly bears from a large area would smell the rotting carrion and rapidly make their way to the carcasses. After feeding on the contaminated carcasses, there is a chance that the bears will physically encounter a portion of the spill, contaminating their fur. Consumption of the contaminated carcasses and grooming would result in oil ingestion by the bear, which may easily lead to hypothermia, renal failure, liver failure, reproductive failure, other physiological problems, and eventual death. A large oil spill that occurs during winter most likely would not have any immediate effects on the grizzly population, providing adequate cleanup is completed before the bears wake from hibernation. Any mortality associated with a large oil spill is likely to reflect local population size and vulnerability determined by seasonal habitat use, sex, and stage of lifecycle at the time of contact (e.g., males vs. female with cubs, migrating caribou vs. runs of salmon).

Furbearers. Wolves, wolverines, and arctic and red foxes are addressed here, because they all exhibit some similarities in their scavenging and hunting behaviors. The effects of a furbearer ingesting or becoming physically exposed to a large oil spill are the same as for the grizzly bear. There would be a much greater chance of arctic or red foxes coming in contact with a large oil spill or contaminated food, because they tend to occur and higher population densities than bears, wolves, or wolverines. Furthermore, arctic foxes are well known for denning under facilities and near developments in the Arctic. Consequently, any large spill that occurs near onshore facilities and that results in a marine mammal, bird, or fish die off will draw in foxes and other scavengers. The physiological effects of ingesting or coming into direct contact with oil would be the same as for bears. Unlike grizzly bears, the furbearers remain active throughout the winter, often roaming well out onto the sea ice to scavenge kills or to hunt seal pups. This could place them into relatively close proximity to offshore developments in the landfast ice and food items that ingested oil in quantities that were too small to result in death. There exists a strong possibility of the bioaccumulation of oil-derived contaminants in furbearers scavenging and hunting on the winter sea ice, and no information is available relating to their ability to cope with sublethal amounts of these toxins. However, the potential for the winter scenario will disappear with the projected disappearance of the winter sea ice sometime during the next 40 years, although oiled carcasses may was ashore as a result of a spill event.

4.5.2.9.3.1.6.2. Oil Spill Analysis. The potential for large spills to contact terrestrial mammal species in the Chukchi Sea was described in the Chukchi Sea Sale 193 final EIS (USDOI, MMS, 2007d). Due to small adjustments in the environmental resource areas, lease-sale area, and other model refinements, we have updated the assessment for the proposed Chukchi Sea lease sales below. The results of this analysis are much the same as those for the previous multiple lease sales in the Chukchi Sea.

Conditional Probabilities-Large Oil Spill. The following discussion summarizes LAs 1-25 and PLs 1-17 during summer or winter unless otherwise specified.

Summer Spill. The OSRA model estimates that the chance of a large spill originating from launch areas or pipeline segments contacting land segments important to terrestrial mammals. Some caribou of the CAH, TCH, and WAH herds frequent coastal habitats from Wales (LS40) north to Point Barrow (LS85). The OSRA model estimates the chance of a large spill from launch areas contacting individual LSs 40-85 within 30 days ranges is <0.5-35% (Table A.3-45) and <0.5-43% for 180 days (Table A.3-47).

Winter Spill. The OSRA model estimates the chances of a large spill (≥1,000 bbl) originating from launch areas and contacting land segments important to terrestrial mammal habitat. Some caribou of the CAH, TCH, and WAH frequent coastal habitats from Ikpek Lagoon (LS40) North to Point Barrow (LS85). The OSRA model estimates the chance of a large spill from launch areas contacting individual

LSs 40-85 within 30 days ranges from <0.5-48% (Table A.3-57) and from <0.5-52% over 180 days (Table A.3-59).

Combined Probabilities-Large Oil Spill. The chance of one or more large spills occurring and contacting important terrestrial mammal habitat (LSs 40-85) is 8% within 30 days and 13% within 180 days (Table A.3-79).

Chronic Small Spills. Low-volume spills are defined as being <1,000 bbl. The average crude oil spill size is 126 gal (3 bbl) for spills <500 bbl. An estimated 178 small crude oil spills would occur during the 20-year oil-production period (Appendix A, Table A.1-32), an average of more than 7 per year. The average refined-oil spill size is 29 gal (0.7 bbl), and an estimated 440 refined-oil spills would occur during the 25-year oil-production period (Appendix A, Table A.1-36), an average of 17.6 per year.

It is unknown how many low-volume spills or what total volume would affect areas used by caribou or muskoxen, or how much contaminated carrion would be available for grizzly bears or furbearers.

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 production.

Activities such as hazing and other human activities (vessel and aircraft traffic) could impact caribou, muskoxen, grizzly bears, and furbearers. During the ice-free months, hazing likely may prevent the death of some terrestrial mammals in the contaminated area. Although hazing would have an immediate detrimental effect on an individual animal, the long-term benefit (preventing an oil-related mortality) could partially compensate for the effects of the disturbance.

The presence of large numbers of cleanup workers, boats, and additional aircraft is likely to displace caribou, muskoxen, wolves, and wolverines around affected coastal habitats during open-water periods for one to several seasons. The same does not hold true for arctic and red foxes, which easily habituate to human activity. However little direct mortality from cleanup activity is likely. Disturbance during the initial season, possibly lasting 6 months, could be expected in some areas.

Oil-spill response could originate from as far away as Deadhorse, about 150 mi east of Barrow. 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 MMS, landowners, and State officials on wildlife-management activities in the event of a spill. In an actual spill, the three aforementioned groups may have a presence at the Incident Command Post to review and approve proposed hazing activities and monitor their impact on terrestrial mammals.

The OSRPs 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 knowledge of scare tactics in addition to an inventory of equipment (air cannons, guns, pyrotechnics, vessels, and visual devices) to deter terrestrial mammals from entering the spill area or approaching carcasses, and it would be assumed they would cycle their use to ensure that the animals do not habituate to their effect.

For purposes of evaluating the potential impact of a large spill on terrestrial mammal species, oil-spill response in the Chukchi Sea is assumed to be ineffective due to the unpredictability of response time and certain environmental conditions (e.g., broken ice, weather).

Prey Reduction or Contamination. Local reduction or contamination of food sources could reduce survival or reproductive success of the grizzly bear and furbearer populations occupying the local area. However, the contamination of some local habitat areas is not likely to affect a large proportion of the grizzly bear, wolf, or wolverine population, because they are highly territorial with large home ranges and have access to similar resources away from the spill site.

Impacts to arctic and red fox populations could be more severe, considering their higher population densities, particularly in and around onshore oil field developments. Furthermore, they are notorious for caching surplus foods for late-season and winter use. Moreover, the smaller size of the foxes could make them more prone to dying after ingesting smaller quantities of oil.

Furbearers scavenging or hunting seal pups on the sea ice may see a decrease in the quantity of seal pups or available marine mammal carcasses. This would place undue stresses on these furbearers at a very crucial season, when they already are nutritionally stressed to their limits. With the anticipated retreat of winter sea ice away from the Chukchi Sea coast, this winter scavenging issue eventually might lose relevance, because routes to and from the sea ice may disappear earlier in the spring and develop later in the fall.

Anticipated Mortality from an Oil Spill. The chance of oil exposure to caribou would occur if a large oil spill eventually drifted to the coastline while caribou were resting in the surf. While unlikely, such an event is conceivable and must be addressed. If oil cleanup and/or hazing could be initiated quickly, the losses from such a spill would be greatly minimized for all terrestrial mammals. Furthermore, the monitoring for and removal of contaminated carrion would have to be incorporated into the response action. By collecting dead carcasses at sea and on the shoreline, the attractants for furbearers and bears will be removed, providing no reasonable likelihood of grizzly bear or furbearer exposure to the spill.

Anticipated mortality associated with these modeled events would represent a very small number of North Slope caribou, muskoxen, grizzly bears, or furbearers. The MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. This situation has not changed. Similarly, smaller spills would have even less likelihood of reaching these areas. Oil-spill modeling indicates that the percent chance of a spill of a magnitude that could jeopardize the continued existence of a significant number of terrestrial mammals on the North Slope is extremely low. Considering the low probability of a large spill coupled with a variety of other factors that would need to be satisfied to result in mortality, MMS anticipates that it is highly improbable that a significant amount of terrestrial mammal mortality would result from oil spills associated with the Proposed Action, and negligible effects are expected. Any oil spills that occur under Alternative 2 are expected to produce a negligible level of effect on terrestrial mammals in the Proposed Action area.

4.5.2.9.4. Cumulative Effects Under Alternative 2. In addition to the nonproject-related impacts of global warming as outlined in Section 4.5.1.9.1.9, an increase in the levels of icebreaker/aircraft/vehicular traffic, gravel mining, and oil spills are likely to occur. Icebreaker activity could create leads, which may fragment the areas of sea ice available for hunting and scavenging by furbearers, however these impacts probably would affect an extremely small number of terrestrial mammals and are not expected to result in any mortalities. Gravel mining could alter river habitat; however, it is unlikely to disturb a large number of grizzly bears or other terrestrial mammals considering the localized scale of the activity and the fact that existing mitigation is mandated by the State of Alaska (ADNR, 1999). Recommendations for aircraft to operate at or above an altitude of 1,500 ft would greatly mitigate disturbances that otherwise could elicit injurious reactions in wildlife. Any additional oil- and gas-related vehicle use onshore would create brief and transient impacts with a short duration and negligible level of effect as long as it continues to be limited by regulation and mitigation.

Anticipated mortality associated with the modeled oil-spill events could affect muskoxen, caribou, grizzly bears, or furbearers. However the MMS requires companies to have and implement OSRPs to help prevent oil from reaching critical areas and to remove oil from the environment. This situation has not changed. Similarly, smaller spills would have even less likelihood of reaching these areas. Oil-spill modeling indicates that the percent chance of a spill of a magnitude that could jeopardize the continued existence of a significant number of terrestrial mammals on the North Slope is extremely low. Considering the very low probability of a large spill occurring coupled with sea ice conditions, and existing OSRP's, the MMS believes that it is highly unlikely that terrestrial mammal mortality would result from oil spills associated with the Proposed Action, and negligible effects are anticipated.

The preponderance of evidence and study data indicates climate change will continue to pose the greatest challenge for terrestrial mammals living near the Chukchi Sea coast and the Proposed Action area. Under Alternative 2, we expect exploration activities to occur in the foreseeable future. Most terrestrial mammals maintain enough flexibility to adapt to transient perturbations in their environment over time. Adequate mitigation efforts also will go a long way towards lessening the impacts of oil and gas activities in the analysis area. Consequently, Alternative 2 is expected to have an added negligible level of effect on terrestrial mammals in the Chukchi Sea Proposed Action area in addition to the expected major level of impacts that are expected to occur as a result of climate change, subsistence harvesting, and unregulated vehicle traffic. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.2.10 Vegetation and Wetlands.

Summary. Vegetation and wetlands might be affected by additional construction and possible spills as a result of the proposed lease sales. The adverse effects to tundra vegetation and palustrine wetlands from routine exploration activities are expected to be negligible, and production is not anticipated until the first commercially viable discovery is made in the Chukchi Sea OCS. If a spill occurs during the spring tides or during storm tides, oil might be deposited in vegetation above the level of normal wave activity. In such a case, stranded oil is expected to affect only a small amount of the emergent vegetation but persist for long periods due to low rates of dispersion and degradation.

4.5.2.10.1. Potential Effects to Vegetation and Wetlands. Vegetation and wetlands in the Beaufort and Chukchi seas are subject to the same potential effects described Section 4.4.1.10, and are not repeated here.

4.5.2.10.2. Mitigation Measures. The potential effects can be moderated by the mitigation measures listed in Section 4.4.1.10.2.

4.5.2.10.3. Anticipated Effects Under Alternative 2. Anticipated effects associated with holding Lease Sales 212 and 221 are assumed to be the same as described in Section 4.4.2.10.3, with the exception of geographic location. These anticipated effects consider mitigation measures described in Section 4.4.1.10.2. Vegetation and wetlands might be affected by additional construction and possible spills as a result of the proposed lease sales.

4.5.2.10.4. Direct and Indirect Effects Under Alternative 2. The adverse effects to tundra vegetation and palustrine wetlands from routine exploration activities are expected to be negligible.

Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until the first commercially viable discovery is made in the Chukchi Sea OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects on tundra vegetation and wetlands, if such a discovery is made and proposed for development in the more distant future. Such production-related activities include effects to tundra vegetation and palustrine wetlands due to construction of development/production facilities and the potential for oil spills.

4.5.2.10.5. Cumulative Effects Under Alternative 2. By definition, Lease Sales 212 and 221 likely would result in an increase in the number of leases in the Chukchi Sea OCS. Some of the existing leases would not be explored and would not be evaluated further by the time the lease lapses. While there may be an initial increase in the number of active leases following a sale, there would be a gradual decline in active leases over time. Exploration activities could continue at existing levels due to a limited number of specialized/suitable vessels for conducting these activities. This level of activity would represent a continuation of the same level of effect as described for anticipated Federal oil and gas activities under the reasonably foreseeable future events, except that these activities likely would extend further into the future as new leases are granted. While Federal actions likely would result in an incremental increase in some sources of potential impacts, required mitigation measures would limit these sources to proportionately fewer impacts compared to other unrestricted sources of impact in this area.

Impact to tundra vegetation and palustrine wetlands are likely to continue from community growth and are largely unrelated to OCS leasing activities. The greatest threat of oil-spill impacts on wetlands would continue to arise from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels dramatically could increase the potential for marine accidents and large fuel spills, which could result in major adverse effects to coastal wetlands adjacent to the Chukchi Sea.

Summary. The adverse effects to tundra vegetation and palustrine wetlands from routine exploration activities are expected to be negligible, and production is not anticipated until the first commercially viable discovery is made in the Chukchi Sea OCS. If a spill occurs during the spring tides or during storm tides, oil might be deposited above the level of normal wave activity. In such a case, stranded oil is expected to affect only a small amount of the emergent vegetation but persist for long periods due to low rates of dispersion and degradation.

4.5.2.11 Economy.

Summary. The typical Chukchi sale would generate increases in NSB property taxes that would average about <4% above the level of NSB revenues without the sales in the peak years. In the early years of production, the sale would generate increases in revenues to the State of Alaska of <0.02% above the same level without the sale. The peak years of production would generate increases in revenues to the Federal Government of <0.02% above the level without the sale. For the NSB, State of Alaska, and the Federal Government, the increases would taper off to even smaller percentages in the later years of production. The change in total employment and personal income would be <0.9% over the baseline for the NSB and the rest of Alaska for each of the three major phases of OCS activity. Assumed large oil spills of 1,500 bbl or 4,600 bbl would generate 60 or 90 jobs respectively for 6 months the first year, declining to zero by the third year following the spill. A typical Chukchi sale would contribute to extending the lifespan of the Trans-Alaska Pipeline.

The Impact Descriptor for economics is: Economic effects that would cause important and sweeping changes in the economic well-being of the residents or the area or region. Local employment is increased or decreased by 10% or more for at least 2 years. Economic well-being of residents is the ability of individuals and families to meet basic needs which include food, clothing, housing, heat, and subsistence.

Introduction. We assume all of the alternatives for the Chukchi Sea, except Alternative 1, the no-action alternative, have the same amount of oil and/or gas and similar levels of activity among the alternatives. Therefore, the economic effects to communities and to the State of Alaska essentially are the same. A typical Chukchi sale would generate economic activity manifested primarily in revenue to government, employment, and personal income. The economic effects would be in the NSB, Southcentral Alaska, Fairbanks, and the rest of the U.S. We use the exploration and development scenario in Appendix B for 500 MMbbl to forecast employment and personal economic effects. The reader should refer to Appendix B for a description of timing of OCS activity including infrastructure of wells, rigs, platforms, pipelines, and shore bases. The activities and construction and operation of infrastructure described in the exploration and development scenario generate the economic activity. Economic effects would not be significant.

4.5.2.11.1. Direct and Indirect Effects Under Alternative 2.

4.5.2.11.1.1. Direct Effects - Revenues. A typical Chukchi sale would generate increases in NSB property taxes of <4% without the sales in the peak years and taper off to <0.4% in the later years of production. We assume NSB revenues to be $270 million (see Section 3.4.1). The revenue to the NSB would be about $10 million in the peak years of production, tapering off to $1 million in the later years.

The peak years of production would generate increases in property tax revenues to the State of Alaska of <0.02% above the level without the sale. The increases would taper off to an even smaller percentage in the latter years of production. The revenue to the State would be about $1 million in the peak years of production, tapering off to smaller amounts in the later years. The peak years of production would generate increases in revenues to the Federal Government of <0.02% above the level without the sale. The increases would taper off to an even smaller percentage in the later years of production. The revenue to the Federal Government would be about $400 million in the peak years of production, tapering off to $40 million in the later years.

In this paragraph we explain the methods we used to calculate revenue effects. The property tax mill rate in the NSB is 18.5. The State collects 20 mills and returns 18.5 mills to the NSB. We assume a new onshore facility near Wainwright cost at $1.5 billion and an overland pipeline. This pipeline would traverse from the landfall at Wainwright to the TAPS or nearer gathering point, for example in the NPR-A, would be to 300 mi long, and would cost $4 billion (Craig, 2008, pers. commun.). We multiply the mill rate times $5.5 billion with the result of approximately $10 million. The NSB total revenue in the 2006/2007 budget is $270 million. $10 million is <4% of $270 million. The State of Alaska has authority to tax oil- and gas-transportation pipelines (AS 43.52.060; Greely, 2006, pers. commun.). Multiplying the State of Alaska mill rate of 1.5 by $5.5 billion results in approximately $1 million. The State budget for 2008 is approximately $8 billion. $1 million divided by $8 billion is <2%. The peak year of oil production is 54 MMbbl. We assume $46/bbl. The royalty rate is 16⅔%. Multiplication of those three variables results in $400 million. $400 divided by the 2008 Federal budget of $2.5 trillion results in <0.02%.

4.5.2.11.1.2. Indirect Effects - Employment and Personal Income (not related to oil spills). The forecast increase of total employment and personal income is shown in Table 3.4.1-3. The change is

<0.9% over the baseline for the NSB and the rest of Alaska for each of the three major phases of OCS activity. We use the IMPAK Model (Jack Faucett Associates, Inc., 2000) to forecast the employment and personal income in Table 3.4.1-3. We describe baselines in Chapter 3. We use the variables from the Exploration and Development Scenario in Appendix B and related variables as inputs to IMPAK. Outputs are direct employment and personal income and indirect and induced employment and personal income.

The typical Chukchi sale would generate employment and personal income in three major phases: exploration, development, and production. In general, employment and associated personal income would be at a relatively low level in exploration, peaking during development, and dropping to a plateau in production. This pattern of economic effect reflects the exploration and development scenario described in Appendix B. We assume all direct OCS workers work in enclaves on oil platforms on the OCS or onshore on the North Slope during their work time and commute to residences elsewhere in their time off. Their place of residence during the time they are not in an OCS worker enclave would be in villages of the NSB or in Southcentral Alaska or Fairbanks, as indicated in Table 3.4.1-2. Additional workers on the North Slope commute to residences outside the State. Approximately 30% of current North Slope workers in the classification of oil and gas workers commute to locations outside Alaska in 2001 and 2006 (Hadland, 2002, pers. commun.; Hadland and Landry, 2002; Hadland and Laurent, 2008).

However, the workers commuting to residences outside the State would not generate economic effects of indirect and induced employment or expenditure of income in the State, and they would have a negligible effect on the economy of the rest of the U.S. All of the commuting workers would be present at new OCS enclaves offshore or in associated enclave-support facilities onshore along the Chukchi Sea or in the Prudhoe Bay area approximately half of the days in any year. Abandonment of production facilities technically is an activity separate from production. However, for the sake of simplicity of presenting data in Table 3.4.1-3, production includes abandonment. Employment and personal income generated by abandonment would be small compared to production and would last only 2 years. Abandonment also is known as decommissioning. The exploration and development scenario for a typical Chukchi sale indicates exploration activity would take place in 2010-2019, development activity in 2019-2028, and production in 2022-2040.

Typical Chukchi postsale activity has some overlap of the three main activities of exploration, development, and production. To simplify analysis but define the primary distinctions, we present data for employment and personal income as annual averages for the three main OCS activity categories. "Direct employment" includes those workers with jobs directly in oil and gas exploration, development, and production. "Indirect employment" includes those workers in industries that support the direct exploration, development, and production activities. These include jobs in transportation, such as shuttling workers by air between Anchorage and the North Slope. Direct and indirect workers spend a part of their earnings for expenses such as food, housing, clothing, etc. The aggregate of workers associated with providing those goods and services is termed "induced employment." Each of the direct, indirect, and induced workers has compensation derived from their work termed "personal income" in Table 3.4.1-3.

Employment Related to Large Oil Spills. In the event a 1,500-bbl oil spill occurred, we estimate employment to be 60 cleanup workers for 6 months in the first year, declining to zero by the third year following the spill. In the event a 4,600-bbl oil spill occurred, we estimate employment to be 190 cleanup workers for 6 months in the first year, declining to zero by the third year following the spill. The 60-190 workers make up about 0.6-1.9% of the workers who cleaned up the EVOS. For assumptions of spill sizes, see Section 4.3.2.

Our estimate of employment to clean up spills is based on the most relevant historical experience of a spill in Alaskan waters, the EVOS of 1989. That spill was 240,000 bbl. It generated enormous employment that rose to the level of 10,000 workers directly doing cleanup work in relatively remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year following 1989 until 1992.

Numerous local residents quit their jobs to work on the cleanup at often significantly higher wages. This generated a sudden and significant inflation in the local economy (Cohen, 1993). Similar effects to the NSB would be mitigated due to the likelihood that cleanup activities, including administrative personnel and spill-cleanup workers, would be located in existing enclave-support facilities. In the event of a 1,500- or 4,600-bbl oil spill, the number of workers actually employed to clean it up would depend on a number of factors. These include the procedures called for in the OSRP, how well prepared with equipment and training the entities responsible for cleanup were, how efficiently the cleanup was executed, and how well coordination of the cleanup was executed among numerous responsible entities. Also in the case of a typical Chukchi sale, these spills could reach the shores of the Chukotka Peninsula of the Russian Federation. If this were to occur, cleanup would be more complicated and require more labor and expense because of the international effort required. How much more effort would be related to this factor is difficult to estimate.

4.5.2.11.2. Cumulative Effects Under Alternative 2.

Trans-Alaska Pipeline. The typical Chukchi sale would produce 500 MMbbl of oil over 18 years of production. This oil would contribute to extending the useful life of the Trans-Alaska Pipeline.

Local Natural Gas. Producers could provide natural gas supplies from the Chukchi to communities along a North Slope pipeline route, such as Wainwright, Barrow and Nuiqsut. This could reduce the costs of electrical power generation for these communities.

Stipulations and Information to Lessees. The stipulations and ITL clauses would not change the effects analyzed.

Subsistence as a Part of the North Slope Borough Economy. The predominately Iñupiat residents of the NSB traditionally have relied on subsistence activities. Although not fully part of the cash economy, subsistence hunting is important to the Borough's whole economy, and even more important to culture. For the analyses of effects on these activities, see Sections 4.5.2.12 Subsistence-Harvest Pattern, and 4.5.2.13 Sociocultural Systems.

4.5.2.12. Subsistence-Harvest Patterns and Resources.

Summary. The communities of Barrow, Wainwright, Point Lay, Point Hope, and Kivalina and Chukchi coastal communities in the Russian Arctic potentially would be most affected, with Wainwright potentially being the most affected community because of potential impacts from shore base-facility construction. Disturbance and noise could affect subsistence species that include bowhead and beluga whales, walruses, seals, polar bears, caribou, fish, and birds. For the communities of Barrow, Wainwright, Point Lay, and Point Hope, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt.

Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects to subsistence resources and subsistence-harvest patterns, producing major effects.

4.5.2.12.1. Anticipated Effects Under Alternative 2. Subsistence-harvest patterns in the Chukchi Sea Planning Area are subject to the same potential effects previously described in Sections 4.4.1.12.1.1-9 and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.12.4.1-11. This section describes the impacts to subsistence-harvest patterns resulting from the incremental impact of this action, the Proposed Action, and adding it to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such actions. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures are described in Section 4.4.1.12.2.

4.5.2.12.1.1. Anticipated Effects from Vessel Disturbance. Anticipated effects from vessel disturbance were described in Section 4.4.2.12.1.1 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

Vessel traffic from exploration activities would include up to two seismic surveys per year, each survey employing one seismic vessel and a number of support vessels. For development and production, one to three vessel trips per/week per/platform (1 platform anticipated for both Sales 212 and 221, collectively) are anticipated.

Oil and gas exploration and development in the Chukchi Sea Planning Area could result in disturbance to marine mammal resources and harvests. Mitigation measures on future exploration and development activities would be expected to minimize adverse effects to these resources. Vessel activities under the Proposed Action are anticipated to have a minor effect on marine mammal resources and subsistence harvests in the Chukchi Sea Planning Area.

4.5.2.12.1.2. Anticipated Effects from Aircraft Disturbance. Anticipated effects from aircraft disturbance were described in Section 4.4.2.12.1.2 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

The increase in aircraft traffic resulting from exploration activity from Lease Sales 212 and 221 likely would come mostly during summer months in support of exploration activity associated with the lease sales. Industry uses helicopters to support routine activities, such as seismic surveys, crew changes at offshore sites, and to resupply remote camps and facilities. Lease Sale 193 was held in February 2008. As a result of Lease Sale 193, MMS expects aircraft traffic would increase by a minimum of one to three flights per day from Barrow. The increase in aircraft traffic would result from exploration activity associated with Lease Sale 193. For Sales 212 and 221, one helicopter flight per week per seismic operation (up to 2 per year anticipated) and one to three helicopter flights per/day per platform would be anticipated. Aircraft traffic associated with existing oil and gas activity onshore and in State waters also would contribute to increases in aircraft traffic. The MMS assumes that existing trends in aircraft traffic will continue in the absence of additional lease sales.

Mitigation measures imposed on future exploration activities would be expected to minimize adverse effects to marine mammals and subsistence hunts in the Chukchi Sea Planning Area. Aircraft activities associated with the proposed action are anticipated to have a minor effect on marine mammal resources and harvests Chukchi Sea Planning Area.

4.5.2.12.1.3. Anticipated Effects from Discharges. Anticipated effects from discharges were described in Section 4.4.2.12.1.3 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

4.5.2.12.1.4. Anticipated Effects from Large Oil Spills. Anticipated effects from large oil spills were described in Section 4.4.2.12.1.4 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221. Large oil spills probably are the most significant potential source of adverse effects under the Proposed Action.

A pipeline or platform spill could affect subsistence activities, and such effects would reduce the availability and/or accessibility of subsistence resources, potentially for periods longer than a single harvest season. Marine mammals are the most important subsistence resource, both conceptually as well as in terms of food, for the region. The bowhead whale hunt could be disrupted, as could the hunts for beluga whales, bearded seals, and walruses, and other marine mammals generally. Animals could be directly oiled, or oil could become part of the icefloes they use on their northern migration. Such animals may be considered undesirable and more difficult to hunt because of the physical conditions. Animals are also likely to be “spooked” or wary, either because of the spill itself or from the “hazing” of marine mammals, which is a standard spill-response technique to encourage them to leave the area affected by a spill. There has been little experience with under-ice or broken-ice oil spills, and local residents have little confidence in industry’s current capability to successfully clean them up. While the concern most typically is phrased in terms of the potential effects of oil spills on whales and whaling, it can be generalized to a concern for marine mammals and ocean resources in general. Marine mammals and fishes typically comprise 60% of a coastal community’s diet, and the ocean frequently is referred to in public testimony as “the Iñupiat garden.” Pipeline and platform spills also could affect migrating anadromous fishes in the river deltas, as well as species that use oiled coastal and nearshore habitat, such as breeding caribou and nesting birds (USDOI, MMS, 1987c, 1990b, 1998a, 2001b, 2003a, 2004, 2006a,b,d).

While spills can occur on land or in the marine environment, spills to the marine environment have the greatest potential to affect marine mammals important for the subsistence harvest and harvest practices. Exposure of important subsistence resources and harvest areas to oil spills is discussed in Sections 4.4.1.12.1.4.2.1 and 4.4.2.12.1.4. The same mitigation measures described in Section 4.4.1.12.2 would be implemented for the proposed Chukchi Sea lease sales. A large spill from a well blowout is described as a very unlikely event, and no large oil spills are assumed to occur during exploration (see Appendix A, Section 1.1.4).

The MMS models spills to quantify the percent chance that a spill of a certain size could contact important resources and then analyzes the potential effects from oil spills to determine which areas would be high risk. In the following sections, we evaluate the vulnerability of certain land segments and environmental resources areas identified because of their traditional importance as harvest areas.

Most subsistence resources are similar for Chukchi Sea coastal communities, although the walrus is much more important in the region. Practices have particular differences, as Point Hope and Wainwright have spring bowhead whaling seasons and Point Lay traditionally hunts beluga whales and not bowheads, although they recently have been assigned a bowhead whale quota by the IWC. Resources migrating and congregating in the spring lead system and coastal lagoons are definitive characteristics of the Chukchi Sea subsistence round.

4.5.2.12.1.4.1. Oil Spill Analysis. The potential for large spills to contact subsistence resources and harvest areas in the Chukchi Sea was described in the Chukchi Sea Lease Sale 193 EIS (USDOI, MMS 2007c). Due to small adjustments in the environmental resource area (size/shape), lease-sale area, and other model refinements, we have updated the assessment for the proposed Chukchi Sea lease sales below.

The following discussion presents conditional and combined probabilities (expressed as a percent chance) estimated by the OSRA model of a spill occurring and contacting best known harvest areas important to subsistence resources and practices. Conditional probabilities are based on the assumption that a large spill has occurred (see Appendix A). Combined probabilities, on the other hand, factor in the chance of one or more large spills occurring.

Conditional Probabilities. This section describes the conditional probabilities estimated by the OSRA model of a large oil spill in the Chukchi Sea contacting important subsistence environmental resource areas and land segments that are important to subsistence resources and the subsistence harvest. No large oil spills are assumed to occur during exploration activities. The OSRA model estimates conditional probabilities (expressed as a percent chance) of a spill contacting subsistence environmental resource areas or land segments. Unless otherwise noted, the conditional probabilities are summarized for LAs 1-15 or PLs 1-11 during summer or winter within 30 and 360 days. The corresponding tables in Appendix A are A.3-33, A.3-36, A.3-39, A.3-42, A.3-51, A.3-54, A.3-57, A.3-60, A.3-63, A.3-75, and A.3-78). The winter and summer discussed below are the time periods when a large spill could start.

Conditional probabilities are based on the assumption that a large spill has occurred. Contact from a large spill in winter could affect polar bear hunting and sealing. During the open-water season, a large spill could affect whaling for bowhead and beluga whales and the hunt for walruses, seals, and birds, and fishing.

Summer-Barrow. The OSRA model estimates a <0.5% chance of a large spill starting at all launch areas and pipeline segments contacting important Barrow subsistence ERA41 (Subsistence Chukchi Sea Whaling Area 1) within 30 and 360 days. For ERA42 (Barrow Beaufort Sea Whaling Area 2), there is <0.5-8% chance within 30 days and a <0.5-13% chance within 360 days from all launch areas; there is a <0.5-3% chance of contact within 30 days and a <0.5-6% chance within 360 days from all pipeline segments.

The LSs 81 (Peard Bay/Point Franklin), 82 (Skull Cliff), 83 (Nulavik), 84 (Walakpa River), 85 (Barrow/Elson Lagoon), 86 (Dease Inlet), 87 (Kurgorak Bay), and 88 (Cape Simpson) have a <0.5-8% and a <0.5-13% chance of contact within 30 and 360 days, respectively, from all launch areas. The LSs 89 (Smith Bay), 90 (Drew Point/Kolovik), 91 (Lonely/Pitt Point), and 92 (Cape Halkett) have a <0.5% and <0.5-1% within 30 and 360 days, respectively, from all launch areas. For all individual land segments, for a large spill originating at all pipeline segments, there is a <0.5-10% chance of contact within 30 days and a <0.5-11% chance of contact within 360 days.

Winter-Barrow. The chances of winter contact generally are lower. The OSRA model estimates a <0.5-2% chance of a large spill starting at all launch areas contacting important Barrow subsistence ERA41 (Subsistence Chukchi Sea Whaling Area 1) for 30 days and a <0.5%-3% chance for 360 days; there is a <0.5-9% and a <0.5-12% chance from all pipeline segments within 30 and 360 days, respectively. For ERA42 (Barrow Beaufort Sea Whaling Area 2), there is <0.5% chance and a <0.5-4% chance of contact within 30 and 360 days, respectively, from all launch areas; there is a <0.5-5% and a <0.5-6% chance of contact from all pipeline segments within 30 days and 360 days.

The LSs 81-85 have a <0.5-2% and a <0.5-6%chance of contact within 30 and 360 days, respectively, from launch areas. There is a <0.5-3% and a <0.5-6% chance of contact within 30 and 360 days, respectively, from pipeline segments. The LSs 86-92 have a <0.5% chance of contact from all launch areas and pipeline segments within 30 days and a 0.5-2% chance within 360 days.

Summer-Wainwright. For all launch areas, the OSRA model estimates a <0.5-19% chance of contacting important Wainwright subsistence ERA40 within 30 days and a <0.5-57% within 360 days. For all pipeline segments, there is a <0.5-51% chance within 30 days, and a 1-57% chance within 360 days. The LSs 72 (Kokolik River/Point Lay), 73 (Akunik Pass), 74 (Kasegaluk Lagoon/ Utukok River), 75 (Icy Cape), 76 (Avak Inlet/Tunalik River), 77 (Mitliktavik/ Nokotlek Point), 78 (Point Collie/Kuk River), 79 (Point Belcher/Wainwright), 80 (Kugrua Bay), and 81 (Peard Bay/Point Franklin) have a <0.5-4% chance of contact from all launch areas within 30 days and <0.5-6% chance of contact within 360 days. From all pipeline segments, there is a <0.5-10% chance of contact within 30 days and a <0.5-11% chance of contact within 360 days.

Winter-Wainwright. In winter, the OSRA model estimates a <0.5-8% of contact from all launch areas within 30 days to important Wainwright subsistence ERA40, and <0.5-18% over a 360-day period. There is a <0.5-38% chance of contact from all pipeline segments within 30 days, and a 1-52% chance of contact within 360 days. The LSs 72-81 have a <0.5-3% chance of contact from all launch areas within 30 days and <0.5-5% chance of contact within 360 days. From a spill originating from all pipeline segments, there is a <0.5-6% chance of contact within 30 days and a <0.5-9% chance of contact within 360 days.

Summer-Point Lay. The OSRA model estimates a <0.5-16% chance from all launch areas contacting important Point Lay subsistence ERA39 within 30 days and a <0.5-19% chance of contact within 360 days. There is a <0.5-41% chance of contact from all pipeline segments within 30 days and a <0.5-44% chance of contact within 360 days. The LSs 69 (Cape Beaufort/Omalik Lagoon), 70 (Kuchaurak/Kuchiak Creek), 71 (Kukpowruk River/Sitkok Point), 72 (Point Lay/Siksrikpak Point), 73 (Akunik Pass/Tungak Creek), 74 (Kasegaluk Lagoon/Utukok River), 75 (Icy Cape), and 76 (Avak Inlet/Tunalik River) have a <0.5-3% chance from all launch areas within 30 days and <0.5-4% chance within 360 days. For all pipeline segments, there is a <0.5-9% chance of contact within both 30 and 360 days.

Winter-Point Lay. In winter, the chance of contact within 30 days ranges from <0.5-16% from all launch areas for Point Lay subsistence ERA39 and <0.5-25% within 360 days. From all pipeline segments, there is a <0.5-32% chance of contact within 30 days and a <0.5-39% within 360 days. The LSs 69-76 have a <0.5-3% chance of contact within 30 days and a <0.5-5% chance of contact within 360 days from all launch areas; there is a <0.5-6% chance of contact within 30 days and a <0.5-9% chance of contact within 360 days from all pipeline segments.

Summer-Point Hope. The OSRA model estimates a <0.5-8% chance of a large oil spill starting at all launch areas contacting important Point Hope subsistence ERA38 within 30 and 360 days. There is a <0.5-20% chance of contact from all pipeline segments within 30 and 360 days. The LSs 62 (Atosik Lagoon/Kuropak Creek), 63 (Cape Thompson), 64 (Ipiutak Lagoon/Point Hope), 65 (Cape Dyer/Cape Lisburne), and 66 (Ayugatak Lagoon) have a <0.5-3% chance of contact from all launch areas within 30 and 360 days. For all pipeline segments, there is a <0.5-8% chance of contact within both 30 and 360 days.

Winter-Point Hope. In winter, there is a <0.5-2% and <0.5-3% chance of contact from all launch areas within 30 and 360 days, respectively. For 30 days, there is a <0.5-9% chance of contact from PL1-PL11 (all pipeline segments), and a <0.5-11% chance of contact within 360 days. Point Hope LSs 62-66 all have a <0.5-1% chance of contact for 30 and 360 days from a spill originating from all launch areas. For these same land segments, there is a <0.5% chance of contact for 30 days and a <0.5-3% for 360 days from a spill originating from PL1-PL11 (all pipeline segments).

Summer-Kivalina. The OSRA model estimates a <0.5% chance of a large oil spill starting at all launch areas and pipeline segments contacting important Kivalina subsistence ERA13 within 30 and 360 days during summer except from PL1, where there is a 1% chance. The LSs 57 (Aukulak Lagoon/Sheshalik Spit), 58 (Cape Krusenstern/ Krusenstern Lagoon), 59 (Ipiavik Lagoon/Omikviorok River), 60 (Kivalina/Wulik River), 61 (Cape Seppings/Pusaluk Lagoon), and 62 (Atosik Lagoon/Kuropak Creek) have a <0.5% chance of contact from all launch areas and pipeline segments within both 30 and 360 days.

Winter-Kivalina. In winter, the chances of contact within both 30 and 360 days are <0.5% for Kivalina subsistence ERA13 and LSs 57-62 from all launch areas and pipeline segments.

Summer-Kotzebue and Vicinity. The OSRA model estimates a <0.5% chance of a large oil spill starting at all launch areas and pipeline segments except PL1 contacting Kotzebue and vicinity subsistence ERAs 13 (Kivalina) and 5 (Shishmaref) within both 30 and 360 days. the PL1 has a 1% chance of contact within both 30 and 360 days. The LSs 47 (Kitluk River/West Fork Espenberg River), 48 (Cape Espenberg/Espenberg River), 49 (Kungealoruk Creek/Pish River), 50 (Clifford Point/Goodhope Bay), 51 (Deering/Kugruk River), 52 (Motherwood Point/Willow Bay), 53 (Kiwalik/Mud Creek), 54 (Baldwin Peninsula/Lewis Rich Channel), 55 (Cape Blossom/Pipe Spit), 56 (Kotzebue/Noatak River), 57 (Aukulak Lagoon/Sheshalik Spit), and 58 (Cape Krusenstern/Krusenstern Lagoon) all have a <0.5% chance of contact from a large spill originating from all launch areas and pipeline segments within both 30 and 360 days.

Winter-Kotzebue and Vicinity. In winter, the OSRA model estimates the chance of contact within both the 30 and 360 days is <0.5% for subsistence ERAs 13 (Kivalina) and 5 (Shishmaref) and LSs 47-58 from all launch areas and pipeline segments.

Summer-Shishmaref. The OSRA model estimates a <0.5% chance of a large oil spill starting at all launch areas and pipeline segments contacting important Shishmaref subsistence ERA5 within 30 and 360 days. The LSs 40 (Ah-Gude-Le-Rock/Lopp Lagoon), 41 (Ikpek Lagoon/Pinguk River), 42 (Kugrupaga Inlet/Nuluk River), 43 (Sarichef Island/Shishmaref Airport), 44 (Shishmaref), 45 (Shishmaref Inlet), 46 (Cowpack Inlet/Singeakpuk River), 47 (Kitluk River/West Fork Espenberg River), 48 (Cape Espenberg/Espenberg River) have a <0.5% chance of contact from all launch areas and pipeline segments within both 30 and 360 days.

Winter-Shishmaref. In winter, contact percentages for both the 30-day and 360-day periods are <0.5% for Shishmaref subsistence ERA5 and LSs 40-48 from a large spill originating at all launch areas and pipeline segments.

Summer/Winter-Wales. The OSRA model estimates a <0.5% chance of a large oil spill starting at all launch areas and pipeline segments contacting important Wales subsistence ERA5 within 30 and 360 days during summer or winter. The LSs 40 (Ah-Gude-Le-Rock/Lopp Lagoon), 41 (Ikpek Lagoon/Pinguk River), and 42 (Kugrupaga Inlet/Nuluk River) have a <0.5% chance of contact from all launch areas and pipeline segments within both 30 and 360 days. During summer or winter, there is a 1% chance of contact to Boundary Segment (BS) 2 (Eastern Bering Strait) from a large spill originating at LA9 for 30 and 360 days; all other launch areas and pipeline segments have a <0.5% chance.

Summer–Southern Russian Arctic Chukchi Sea Coastal Communities. In general the OSRA model estimates launch areas along the western portion of the sale area (LAs 4, 9 and 10 as well as PLs 1, 2, 3, and 6 have a chance of contacting the Russian Chukchi Sea coastal communities. The OSRA model estimates a <0.5-7% chance from all launch areas and pipeline segments within both 30 and 360 days contacting the Enermino/Neshkan/Alyatki Marine Mammal Harvest ERA3. There is a <0.5-3% chance of a spill starting at LAs 1-15 for both 30 and 360 days during the summer contacting the Naukan/Uelen/Inchoun/Chegitun Marine Mammal Harvest ERA4. For ERA3, there is a <0.5-7% chance of contact from all pipeline segments within both 30 and 360 days; for ERA4, there is a <0.5-3% chance of contact from all pipeline segments both 30 and 360 days.

Winter–Southern Russian Arctic Chukchi Sea Coastal Communities. The OSRA model estimates a <0.5% chance of a large oil spill starting at all launch areas and pipeline segments within both 30 and 360 days during winter and contacting the Enermino/Neshkan/Alyatki Marine Mammal Harvest ERA3. There is a <0.5-5% chance from all launch areas within both 30 and 360 days during the winter contacting the Naukan/Uelen/Inchoun/Chegitun Marine Mammal Harvest ERA4. For ERA4, there is a <0.5-7% chance of contact from all pipeline segments within both 30 and 360 days.

Northern Russian Chukchi Sea Coastal Land Segments and Wrangel Island. Moving north and west along the Russian Chukchi Sea Coast, LSs 37 (Chegitun/Mys Volnistyy), 38 (Inchoun), and 39 (Cape Dezhnev/Uelen) are potential harvest areas for the communities of Inchoun (pop. 362), Uelen (pop. 678), and Naukan (pop. 359). In general, the OSRA model estimates contacts to the Russian coastline are from LAs 4, 9, and 10 along the western sale area. The LSs 37-39 have a <0.5-2% chance of contact during summer and a <0.5-5% during winter form all launch areas and pipeline segments within both 30 and 360 days.

The LSs 36 (Mys Serdtse Kamen), 37 (Chegitun/Mys Volnistyy), and 38 (Inchoun) are potential harvest areas for the community of Chegitun (seasonal camp?). The LSs 36-38 have a <0.5-2% chance of contact from spills originating from all launch areas and pipeline segments within both 30 and 360 days during summer and a <0.5-6% during winter.

The LSs 34 (Emelin/Tepken), 35 (Enurmino/Mys Neten), and 36 (Mys Chechan/Mys Serditse Kamen) are potential harvest areas for the community of Enurmino (pop. 304). In summer, LSs 34-36 have a <0.5-3% chance of contact during summer and a <0.5-6% chance of contact during winter from all launch areas and pipeline segments within 30 and 360 days.

The LSs 30 (Nutepel'men), 31 (Alyatki/Kolyuchin Bay), 32 (Mys Dzhenretlen/Lit'khekay-Polar Station), and 33 (Neskan/Mys Neskan) are potential harvest areas for the communities of Alyatki (possible seasonal hunting camp) and Neshkan (pop. 628). In summer, LSs 30-33 for both the 30-day and 360-day periods have a <0.5-2% chance of a large oil spill contacting from all launch areas and pipeline segments. In winter, contact percentages for LSs 30-33 are <0.5-3% for both the 30- and 360-day periods.

The LSs 29 (Akanatkhyrgyn/Vel'may), 30 (Laguna Kunergin/Laguna Pyngopil'khin), and 31 (Alyatki/Kolyuchin Bay) are potential harvest areas for the community of Nutpel'men (pop. 155). In summer, LSs 29-31 for both 30 and 360 days from all launch areas have a <0.5-1% chance, and <0.5-2% chance for spills from all pipeline segments. In winter, LSs 29-31 have a <0.5-3% chance of contact from all launch areas and a <0.5-2% chance of contact from all pipeline segments within both 30 and 360 days.

The LSs 26 (Ekugvaam/Pil'khin), 27 (Laguna Nut/Rigol'), 28 (Kamynga/Laguna Vankarem), and 29 (Akanatkhyrgyn/Vel'may) are potential harvest areas for the communities of Rigol' (pop. unknown) and Vankarem (pop. 186). In summer, contact percentages for LSs 26-29 for both the 30- and 360-day periods are <0.5-1% for spills starting at LA1-LA15 (all launch areas), and <0.5% for 30 days and <0.5-1% for 360 days for spills starting at PL1-PL11 (all pipeline segments). In winter, LSs 26-29 have a <0.5-1% chance of contact from all launch areas within 30 days and a <0.5-2% chance of contact for 360 days. The LSs 26-29 have a <0.5-1% chance of contact from all pipeline segments for both 30 and 360 days.

The LSs 21 (Laguna Kinmanyakicha/Val'korkey), 22 (Ekiatan'/Rypkarpi), and 23 (Emuem/Tenkergin) are potential harvest areas for the communities of Rypkarpi (pop. 915) and Cape Shmidt (pop. 717). In summer, contact percentages for both the 30-day and 360-day periods are <0.5% for these land segments for spills originating from all launch areas and pipeline segments. In winter, LSs 21-23 have a <0.5-1% chance of contact from all launch areas and pipeline segments within both 30 and 360 days.

The LSs 18 (Mys Enmykay/Laguna Rypil'khin), 19 (Laguna Kuepil'khin/Leningradskii), 20 (Polyarny/Pil'gyn/Tynupytku), and 21 (Laguna Kinmanyakicha/Val'korkey) are potential harvest areas for the communities of Leningradskii (pop. 835), Pil'gyn (pop. unknown), and Polyarny (pop. unknown). In summer and winter, contact percentages for the 30- and 360-day periods are <0.5% for these land segments for spills originating from all launch areas and pipeline segments.

The LSs 14 (Innukay/Mys Veuman), 15 (Laguna Adtaynung/Laguna Uvargina), and 16 (Mys Emmatagen/Uvargin) are potential harvest areas for the community of Billings (pop. 272). In summer, contact percentages for these land segments from spills originating from all launch areas within the 30-day period are <0.5% and <0.5-1% for the 360-day period. For spills originating from all pipeline segments, contact percentages for the 30- and 360-day periods are <0.5%. In winter, LSs 14-16 have a <0.5% chance of contact from all launch areas and pipeline segments for both 30 and 360 days.

The LSs 7 (Kosa Bruch), 8 (Klark/Mys Uering), and 9 (Nasha/Bukhta Rodzhers) are potential harvest areas for the community of Ushakovskoe on Wrangel Island (pop. estimated 8). the LSs 7, 8, and 9 have a <0.5% chance of contact from summer spills originating at all launch areas and pipeline segments within 30 days and <0.5-1% chance of contact from all launch areas and pipeline segments for 360 days. In winter, there is a <0.5-1% chance of contact to LSs 7-9 from spills originating at all launch areas and pipeline segments within both 30 and 360 days.

Combined Probabilities. Combined probabilities express the percent chance of one or more large oil spills occurring and contacting certain environmental resource areas or land segments over the 25-year production life of Chukchi Sea Sales 212 and 221. For combined probabilities, the OSRA model estimates a <0.5% chance that one or more large oil spills would occur and contact subsistence-specific ERAs 3 (Russian Coastal Communities Subsistence), 4 (Russian Coastal Communities Subsistence), 5 (Shishmaref), 13 (Kivalina), 41 (Barrow Subsistence Whaling Area 1), 43 (Nuiqsut), 97 (Tigvariak Island), and 44 (Kaktovik) for both 30 and 360 days. The OSRA model estimates the chance that one or more large oil spills would occur and contact subsistence-specific ERAs 38 (Point Hope) is 1%, 39 (Point Lay) is 5%, 40 (Wainwright) is 5%, and 42 (Barrow Subsistence Whaling Area 2) is <0.5% for 30 days. For 360 days, the chance that one or more large oil spills would occur and contact subsistence-specific ERAs 38 (Point Hope) is 1%, 39 (Point Lay) is 7%, 40 (Wainwright) is 8%, and 42 (Barrow Subsistence Whaling Area 2) is 1%.

Over the production life of the Proposed Action, the OSRA model estimates a <0.5-1% chance of one or more large oil spills occurring and contacting Point Lay subsistence LSs 71-75 within 30 days and a 1% chance of one or more large oil spills occurring and contacting these land segments within 360 days. The OSRA model estimates a <0.5% chance of one or more large oil spills occurring and contacting Wainwright subsistence LSs 78-80 within 30 days, and a 1% chance of one or more large oil spills occurring and contacting these land segments within 360 days.

The potential for bowhead whales and other marine mammals to be contacted directly from an oil spill under Alternative 2 is relatively small except in areas off Point Lay and Wainwright, but the potential chance of contact to whale habitat, whale-migration corridors, and subsistence-whaling areas in the Chukchi Sea (both Russian and American waters) is considerably greater. Onshore areas and terrestrial subsistence resources, in general, would to have a lower potential for oil-spill occurrence and contact.

4.5.2.12.1.4.2. General and Specific Effects from Oil Spills. Specific anticipated effects from oil spills on subsistence resources and practices are discussed in Section 4.4.2.12.1.4.1. Chukchi Sea-specific impacts are reiterated below.

General Effects to Subsistence Resources and Practices from Oil Spills. General effects from oil exploration and development could be expected from potential oil spills and tainting and the cleanup disturbance that could occur after such a spill event. An oil spill affecting any part of the migration route of the bowhead whale could taint a resource that is culturally pivotal to the subsistence lifestyle. Even if whales were available for the spring and fall hunts, tainting concerns could leave bowheads less desirable and alter or stop the subsistence hunt. Communities unaffected by a potential spill would share bowhead whale products with impacted villages, and the harvesting, sharing, and processing of other resources should continue. While the concern is most typically phrased in terms of the potential effects of oil spills on whales and whaling, it can be generalized to a concern for marine mammals and ocean resources in general. Marine mammals and fish typically comprise 60% of a coastal community's diet, and the ocean is frequently referred to in public testimony as "the Iñupiat garden," and concerns about tainting also would apply to walruses, seals, polar bears, and caribou. In the event of a large oil spill, it could cause potential short-term but serious adverse effects to some bird populations. A potential loss of a small number of polar bears would reduce their local availability to subsistence users. Oil-spill-cleanup activities could produce additional effects on subsistence activities, potentially causing displacement of subsistence resources and subsistence hunters.

Although a spill could originate within the Chukchi Sea Planning Area, its indirect impacts might be felt by communities remote from the sale area and far removed from the spill. Essentially, concerns about subsistence harvests and subsistence food consumption would be shared by all Iñupiat and Yup'ik Eskimo communities in the Beaufort and Bering seas adjacent to the migratory corridor used by whales and other migrating species. Tainting concerns in these communities about resources initially and secondarily oiled could seriously curtail traditional practices for harvesting, sharing, and processing important subsistence species, because all communities would share concerns over the safety of subsistence foods in general and whale food products and the health of the whale stock, in particular.

All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling, because even if bowhead whales were not contaminated, Iñupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered major.

Russian Arctic Chukchi Sea Coastal Communities. Potentially, important coastal lagoons and nearshore subsistence-harvest areas for beluga, gray and bowhead whales; walruses; seals; fish; and birds could be contacted in the event of a large oil spill. Intensive industrialization, massive inmigration, forced acculturation, and the collapse of Soviet economic and employment supports have taken a huge toll on the indigenous peoples of the region. These conditions, ironically and out of necessity, have brought coastal Native peoples closer to nature and turned them again toward their traditional reliance on hunting and fishing of marine resources, and their traditional diet of marine mammals, fish, marine invertebrates, and other locally harvested resources such as small game. In some cases, population and industrial declines have lead to lower anthropogenic pressures on ecosystems, but more often these conditions have increased poaching levels due to increased unemployment and the lack of adequate food supplies. Effects from a large oil spill could exacerbate existing stresses on local resource populations and the local hunt, causing major impacts to indigenous coastal communities (Newell, 2004; Nuttall, 2005 Schweitzer, 2005, pers. commun.).

Transboundary Effects and Mitigation. Because of the OSRA model's potential spill contact to the Russian Arctic Chukchi Sea coastline, the following discussion on transboundary impacts is included in this analysis.

In July 1997, the Council on Environmental Quality (CEQ), after discussion with various Federal Agencies, issued a memorandum concerning the applicability of the National Environmental Policy Act (NEPA) to Federal actions that had the potential to produce effects that extended beyond U.S. boundaries and affected another country's environment. The guidance was written to pertain to all Federal Agency actions, normally subject to NEPA, whether covered by an international agreement or not, and to be consistent with long-standing principles of international law.

Courts that have addressed impacts across the United States' borders have assumed that the same rule of law applies in a transboundary context. In *Wilderness Society v. Morton* (463 F.2d 1261 (D.C. Cir. 1972)), the court granted intervener status to Canadian environmental organizations that were challenging the adequacy of the Trans-Alaska Pipeline EIS. The court granted intervener status, because it found that there was a reasonable possibility that oil-spill damage could significantly affect Canadian resources and that Canadian interests were not adequately represented by other parties in the case.

The CEQ has determined that agencies must include analysis of reasonably foreseeable transboundary effects of proposed actions in their analysis of proposed actions in the United States. Federal Agencies should use the scoping process to identify those actions that may have transboundary environmental effects and determine at that point their information needs (40 CFR 1501.7). Agencies should be particularly alert to actions that may affect migratory species, air quality, watersheds, and other components of the natural ecosystem that cross borders, as well as to interrelated social and economic effects. Should such potential impacts be identified, agencies may rely on available professional sources of information and should contact agencies in the affected country with relevant expertise. Agencies have expressed concern about the availability of information that would be adequate to comply with NEPA standards that have been developed through the CEQ regulations and through judicial decisions. Agencies do have a responsibility to undertake a reasonable search for relevant, current information associated with an identified potential effect. In the context of international agreements, parties may set forth a specific process for obtaining information from the affected country that could then be relied on in most circumstances to satisfy agencies' responsibility to undertake a reasonable search for information.

It has been customary law since the 1905 Trail Smelter Arbitration that no nation may undertake acts on its territory that will harm the territory of another state (*Trail Smelter Arbitration*, *U.S. v. Canada*, 3 UN Rep. Int'l Arbit. Awards 1911 (1941)). This rule of customary law has been recognized as binding in Principle 21 of the Stockholm Declaration on the Human Environment and Principle 2 of the 1992 Rio Declaration on Environment and Development. This concept, along with the duty to give notice to others to avoid or avert such harm, is incorporated into numerous treaty obligations undertaken by the U.S. Analysis of transboundary impacts of Federal Agency actions that occur in the U.S. is an appropriate step towards implementing those principles.

The NEPA requires agencies to include analysis of reasonably foreseeable transboundary effects of proposed actions in their analysis of proposed actions in the U.S. Such effects are best identified during the scoping stage, and should be analyzed to the best of the agency's ability using reasonably available information. Such analysis should be included in the EA or EIS prepared for the proposed action (http://ceq.eh.doe.gov/nepa/regs/transguide.html).

Because the EIS is the comprehensive environmental analysis document, it also is the correct vehicle to lay out the full spectrum of appropriate mitigation. The NEPA and CEQ specify the identification of all relevant, reasonable mitigation measures that could improve the project, even if they are outside the jurisdiction of the lead agency or the cooperating agencies. Also, to ensure that the environmental impacts of a proposed action are fairly assessed, the probability of the mitigation measures being implemented also must be discussed. Because the Chukchi Sea Sale 193 is a lease sale EIS, the level of mitigation identified in the discussion above would broadly apply to potential subsistence resource and harvest impacts to communities on the Russian Arctic Chukchi Sea coast.

The probability of identified mitigation being implemented outside of MMS and U.S. jurisdiction is unclear at the level of detail required in a lease sale EIS. At the development and production stages, when more specific actions are proposed, the details of mitigation implementation would be developed and would be expected to follow the rule of customary law—that no nation may undertake acts on its territory that will harm the territory of another state—recognized as binding in Principle 21 of the Stockholm Declaration on the Human Environment and Principle 2 of the 1992 Rio Declaration on Environment and Development http://ceq.eh.doe.gov/nepa/regs/transguide.html; (CEQ, 1997).

Specific Effects to Subsistence Resources and Practices from Oil Spills.

Whales, Seals, and Other Marine Mammals. For bowhead and beluga whales, there is uncertainty about effects to them from a large spill. In some years and in some locations, there are relatively large aggregations of feeding and molting whales within the planning area. If a large amount of fresh oil contacted a significant portion of such an aggregation, effects could be greater than typically assumed; and population-level effects cannot be ruled out if a large number of females and newborn or very young calves were contacted by a large amount of fresh crude oil. Available information indicates it is unlikely that whales would be likely to suffer significant population-level adverse effects from a large spill originating in the Chukchi Sea. However, individuals or small groups could be injured or potentially even killed in a large spill, and oil-spill-response activities (including active attempts to move whales away from oiled areas) could cause short-term changes in local distribution and abundance. For walruses, an oil spill impacting haulout areas could have a significant impact on the Pacific walrus population, although the chance of contact to haulout areas is small. Little information is known about oil-spill effects on seals, although any large oil spill in nearshore marine or coastal riverine environments could cause injury or death to these sea mammals, potentially causing them to move off of their normal course and make them unavailable for subsistence harvest.

The potential for bowhead whales to be contacted directly from an oil spill from the Beaufort Sea multiple sales is relatively small, but the potential chance of contact to whale habitat, whale-migration corridors, and subsistence-whaling areas is considerably greater. Onshore areas and terrestrial subsistence resources, in general, seem to have a lower potential for oil-spill contact.

Polar Bears. For polar bears, if an offshore oil spill occurred, a major impact to polar bears could result, particularly if areas in and around polar bear aggregations were oiled. This is because the biological potential for polar bears to recover from any perturbation is low due to their low reproductive rate.

Caribou and Terrestrial Mammals. If an oil spill contaminates beaches and tidal flats along the Chukchi Sea coast, some grizzly bears and arctic foxes are likely to ingest contaminated food, such as oiled birds, seals, and other carrion. Such ingestion could result in the loss of at least a few bears and a few foxes through kidney failure and other complications. An oil spill in a coastal river would have greater impacts to local grizzly bear populations, particularly if it occurred during an active salmon run.

Onshore, the greatest potential impact from a large spill would result if the spill occurred in spring, just before breakup, and resulted in a release of crude oil into a river or stream below the ice, which in turn was released during breakup into the nearshore coastal waters of the Chukchi Sea. If oil were spilled in a waterway in large volumes, waterfowl, fish, and marine mammals could be fouled, contaminated, or killed. A large spill would be toxic immediately to fish and could contaminate them for years, even in apparently cleaned habitats. Waterfowl and marine mammal populations could be affected by the death of animals from hypothermia caused by oiling, reactions to toxic components of spilled oil, and gastric distress resulting from attempts to clean themselves. In addition, scavengers, such as foxes, feeding on their remains also could be harmed.

If a platform or pipeline oil spill occurred during the open-water season or during winter and melted out of the ice during spring, some caribou frequenting coastal habitats could be directly contaminated by the spill along the beaches and in shallow waters during periods of insect-pest-escape activities. However, even in a severe situation, a comparatively small number of animals—perhaps a few hundred—are likely to be directly exposed to the oil spill and die as a result of toxic hydrocarbon inhalation and absorption. This loss probably would be small to the overall population of a particular caribou herd.

Birds. The greatest potential for substantial adverse impacts on marine and coastal birds typically would come from large volume oil spills in important coastal bird habitats. These areas are Kasegaluk Lagoon, Peard Bay, barrier islands, the spring open-water lead system, and the seabird-nesting colonies at Cape Lisburne and Cape Thompson. Oil spills have the greatest potential for affecting large numbers of birds in part due to toxicity to individuals and their prey and the difficulties involved in cleaning up spills in remote areas, given the wide variety of possible ice conditions. A large spill could impact large number of murres, puffins, and kittiwakes at the Cape Lisburne and Cape Thompson colonies. The magnitude of potential mortality could result in significant adverse impacts to the colonies. Similarly, large-scale mortality could occur to pelagic distributions of auklets and shearwaters during the open-water period and male and juvenile murres in the late summer. Kasegaluk Lagoon, Peard Bay, colonies at Cape Thompson and Cape Lisburne, the open-water Spring-Lead System, 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. Up to 45% of the estimated Pacific Flyway population of Pacific brant could be affected if an oil spill reached Kasegaluk Lagoon. Effects could range from direct mortality of approximately 60,000 brant to sublethal effects on an equal or smaller number of brant. The loss of up to 45% of the Pacific Flyway population would have conspicuous population-level effects. The situation with brant is similar to a wide variety of waterfowl and shorebirds that use similar areas of the Chukchi Sea.

Fish. A large oil spill impacting intertidal or estuarine spawning and rearing habitats used by capelin or other fishes potentially could result in significant adverse impacts to some local breeding populations. Recovery to former status by dispersal from nearby population segments would require more than three generations. Given a lack of contemporary abundance and distribution information, large oil spill effects on rare or unique species (including potential extirpation) could occur, but would likely go unnoticed or undetected. Depending on the timing, extent, and persistence of a large spill, some distinct runs of pink and chum salmon could be eliminated. Recovery from this significant adverse impact would only occur as strays from other populations colonized the streams after the oiled habitats recovered. These local fish stocks would not be available for subsistence harvest for many years.

4.5.2.12.1.5. Anticipated Effects from Small Oil Spills. Anticipated effects from small oil spills were described in Section 4.4.2.12.1.5 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

Overall, accidental small oil spills periodically could affect subsistence resources. Small oil spills have the potential to impact subsistence-harvest resources and patterns indirectly, because subsistence users will reduce their harvests of a particular resource if they fear that the resource has been contaminated. An oil spill of any volume into a lagoon area, a river system or lake could have effects on subsistence fish, bird and beluga whale harvests. Subsistence users typically would allow some period of time for contaminated resources or areas to recover following exposure to oil, effectively reducing the total resource amount and the total harvest area acreage available to them for the subsistence harvest.

4.5.2.12.1.6. Anticipated Effects from Oil-Spill Response and Cleanup. Anticipated effects from oil-spill response and cleanup were described in Section 4.4.2.12.1.6 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

Specific Effects from Cleanup Activities on Subsistence Resources.

Bowhead Whales. Identified spill-cleanup strategies potentially would reduce the amount of spilled oil in the environment and tend to mitigate spill-contamination effects. In the case of a winter spill when few important subsistence resources would be present, cleanup is likely to be fairly effective in dealing with a spill before migrating whales and other species return to the area during breakup and the open-water season. There are no described observations concerning the level of disturbance on bowhead whales from cleanup activities, although the presence of offshore skimmers, workboats, barges, aircraft overflights, and in situ burning during cleanup are expected to cause whales to temporarily alter their swimming direction and cause temporarily displacement (USDOI, MMS, 2002a; 2003a).

Beluga Whales and Other Marine Mammals. In the case of a winter spill when few important subsistence marine mammal resources would be present, cleanup is likely to be fairly effective in dealing with a spill before migrating whales and other species return to the area during breakup and the open-water season. Ringed seals are common during the winter, but they are not harvested by local subsistence hunters during this period. It is possible that cleanup operations could displace some ringed seals and walruses during rearing of their young. If a large oil spill occurred, contacted, and extensively oiled coastal habitats during the open-water season, the presence of cleanup personnel, boats, and aircraft operating in the cleanup area is expected to displace beluga whales, seals, and walruses and to contribute to increased stress and reduced pup survival of ringed seals, if operations occur during spring. These effects may occur during 1 or 2 years of cleanup; however, we do not expect it to greatly affect seal, walrus, and beluga whale behavior and movement beyond the area (within about 1 mi) of the activity or after cleanup (Impact Assessment, Inc., 1998; USDOI, MMS, 2003a, USDOI, BLM, 2004a).

Polar Bears. If a large oil spill occurred, contacted, and extensively oiled coastal habitats, the presence of cleanup personnel, boats, and aircraft operating in the cleanup area is expected to displace polar bears. It is possible that cleanup operations could displace some bears from maternity dens during the winter, resulting in the loss of a few bear cubs. These effects may occur during 1 or 2 years of cleanup; however, we do not expect it to greatly affect polar bear behavior and movement beyond the area (within about 1 mi of the activity) or after cleanup. Cleanup efforts should include the removal of all oiled animal carcasses to prevent polar bears from scavenging on them. Oil-spill-contingency measures that include the aircraft hazing of wildlife away from the oil spill could reduce the chances of polar bears entering coastal waters where there is an oil slick. However, such hazing may have to be repeated to be effective in preventing polar bears from entering the oiled water (Impact Assessment, Inc., 1998; USDOI, MMS, 2003a, USDOI, BLM, 2004a).

Caribou and Other Terrestrial Mammals. If a large oil spill occurred, contacted, and extensively oiled coastal habitats containing herds or bands of caribou during the insect season, the presence of cleanup personnel, boats, and aircraft operating in the area of cleanup activities is expected to cause displacement of some caribou in the oiled areas and could seriously stress the herd, resulting in increased mortality or decreased productivity. For most spills, control and cleanup operations at the spill site would frighten animals away from the spill and prevent them from grazing on oiled vegetation. For the most part, effects are likely to occur only during cleanup operations (1-2 seasons) and are not expected to significantly affect caribou herd movements or foraging activities. Cleaning up a large oil spill also would disturb some muskoxen, grizzly bears, and arctic foxes (USDOI, BLM, 2006; USDOI, MMS, 2003a).

Birds. The presence of large numbers of workers, boats, and aircraft following a spill is expected to displace eiders foraging in affected offshore or nearshore and coastal habitats during open-water periods for one to several seasons. Disturbance during the initial season, possibly lasting 6 months, is expected to be frequent. Cleanup in coastal areas late in the breeding season may disturb broodrearing, juvenile, or staging birds. However, staging or migrating flocks of most species generally are dispersed and, thus, would not necessarily occur in the vicinity of cleanup activity; as a result, relatively few flocks are likely to be displaced from favored habitats and expend energy stores accumulated for migration. However, large flocks of long-tailed ducks molting in lagoons, and common eiders occupying barrier islands or lagoons are particularly susceptible if they are nesting, broodrearing, or flightless. Although little direct mortality from cleanup activity is expected, predators may take some eggs or young while females are displaced off their nests, if located near a site of operation. Survival and fitness of individuals may be affected to some extent, but this infrequent disturbance is not expected to result in significant population losses (USDOI, MMS, 2003a).

Fish. Because of the low density of fish in the Chukchi Sea, and the low probability that they would be harmed by cleanup equipment, oil-spill-cleanup activities in open water or in broken ice are not expected to adversely affect fish populations. Reducing the amount of oil in the marine environment is expected to have a beneficial effect by reducing the possibility of hydrocarbons contacting fish and their food resources. The extent of that benefit would depend on the actual reduction in the amount of oil contacting fish and their food resources (USDOI, MMS, 2003a).

Subsistence Resources and Practices. Spill-cleanup strategies potentially would reduce the amount of spilled oil in the environment and tend to mitigate spill-contamination effects, especially in the case of a winter spill when few important subsistence resources would be present and cleanup is likely to be fairly effective. Disturbance to bowhead and beluga whales, seals, walrus, caribou, fish, birds, and polar bears would increase from oil-spill cleanup activities for spills occurring during breakup or the open-water season. Offshore, skimmers, workboats, barges, aircraft overflights, and in situ burning during cleanup could cause whales to temporarily alter their swimming direction. Such displacement would cause some animals, including seals in ice-covered or broken-ice conditions, to avoid areas where they are normally harvested or to become more wary and difficult to harvest. Cleanup disturbance would affect polar bears within about 1 mi of the activity. People and boats offshore and people, support vehicles, and heavy equipment onshore, as well as the intentional hazing and capture of animals would disturb coastal resource habitat, displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Deflection of resources, resulting from the combination of a large oil spill and spill-response activities, would persist beyond the timeframe on a single season, perhaps lasting several years.

Subsistence hunting also would be impacted by any spill that required the local knowledge, experience, and vessels of local whaling captains. Diverting effort and equipment to oil-spill cleanup would adversely impact the subsistence whale hunt (and other harvesting activities). Far from providing mitigation, oil-spill-cleanup activities more likely should be viewed as an additional impact, potentially causing displacement of the subsistence hunt, subsistence resources, and subsistence hunters. The overall result would be a major effect on subsistence harvests and subsistence users, who would suffer impacts on their nutritional and cultural well-being. Impacts to subsistence harvests and subsistence users would be major if they persisted for more than a single harvest season (Impact Assessment, Inc., 1998; USDOI, MMS, 2003a, USDOI, BLM, 2004a).

4.5.2.12.1.7. Anticipated Effects from Seismic Surveys. Anticipated effects from seismic surveys were described in Section 4.4.2.12.1.7 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

Seismic activities are used to locate and delineate potential oil and gas resources. Exploration and delineation drilling, seismic work, and related support activities are typically conducted from vessels during the ice-free, open-water period. The MMS will impose the mitigation measures described in Section 4.4.1.3.12.2 on future exploration and development activities to avoid or minimize adverse effects on subsistence resources and practices.

Up to four open-water seismic surveys (both 2D and 3D) could be conducted seasonally in the Chukchi Sea Planning Area during the open-water season. The Chukchi Sea season would begin in July and, depending on ice conditions, extend into late October. Three additional vessels (one of which could be used for ice management in emergency situations), would serve as support vessels for the three seismic-survey vessels. Helicopters also would be used for vessel support and crew changes. No estimates have been developed for the expected number of line miles of seismic survey to be done or the number of helicopter support flights that might be needed.

The greatest potential disruption of the subsistence whale hunt would be expected in the traditional bowhead whale-hunting areas where multiple seismic-survey operations could deflect whales away from traditional hunting areas. Because the spring subsistence-whale hunt in the communities of Point Hope, Wainwright, and Barrow would be concluding by the time seismic activities begin in the Chukchi Sea region, adverse noise effects on the spring whale harvest are not anticipated. Conflict avoidance agreements (CAA) between the AEWC and oil operators conducting one or perhaps two seismic-survey operations per open-water season have tended to mitigate disruptions to the fall hunt in these communities in the past, but the magnitude of three concurrent seismic surveys and the breakdown of the CAA process would test the ability of survey operators and whalers to coordinate their efforts to prevent disruptions to the hunt.

Barrow's fall bowhead whale hunt could be particularly vulnerable. Noise effects from multiple seismic surveys to the west in the Chukchi Sea and to the east in the Beaufort Sea potentially could cause migrating whales to deflect farther out to sea, forcing whalers to travel farther, increasing the effort and danger of the hunt and increasing the likelihood of whale-meat spoilage, as the whales would have be towed from greater distances. Barrow's fall hunt is particularly important, as it is the time when the Barrow whaling effort can "make up" for any whales not taken by other Chukchi Sea and Beaufort Sea whaling communities. These communities give their remaining whale strikes to Barrow, hoping that Barrow whaling crews will successfully harvest a whale and then share the meat back with the donating community. This practice puts a greater emphasis on the Barrow fall hunt. Additionally, changing spring-lead conditions—ice becoming thinner in recent years due to arctic warming—have made the spring hunt more problematic and make the pivotal fall hunt even more vulnerable. Thus, any disruption of the Barrow bowhead whale harvest could have significant effects on regional subsistence resources and harvest practices (USDOI, MMS 1987d; Brower, 2005).

Even though the potential of up to four concurrent surveys being conducted in the open-water season in the Chukchi Sea is low, the additive and synergistic noise impacts produced by more than a single seismic survey would indicate an acoustic environment where clearly much more than a single sound event and a "low level" of activity is occurring; thus, the approach of considering seismic-survey noise as a short-term and local disturbance phenomenon to these species could be considered too simplistic.

Beluga whales, when in confined areas such as spring leads or lagoons, are potentially sensitive to noise; however, when not restricted they appear not to be particularly sensitive. If boat traffic moved north and south along the coast very near Kasegaluk Lagoon and interfered with beluga whale or spotted seals movements to and from the lagoon, such disturbance could compromise the Point Lay subsistence effort. Icebreaking activities (which would only occur if a seismic-survey vessel working the Beaufort Sea became stuck in the ice in the fall) has been demonstrated to disturb beluga whales at much greater distances than bowhead whales. In summer, if vital lagoons and bays used by beluga whales and spotted seals, and a walrus haulout site near Cape Lisburne are not avoided by seismic-survey vessels, local harvests could be compromised. Any displacement of the local movements of whales, seals, and walrus by seismic survey noise could disturb the subsistence-harvest of a particular species. If multiple surveys were done in close proximity to each other, seismic survey noise could displace fish species, making them more difficult to harvest.

Given the level of potential seismic-survey activity described in the scenario—up to four concurrent seismic surveys seasonally in the Chukchi Sea—and past assessments of species and resource effects discussed above, whales, pinnipeds, and polar bears might be displaced and their availability affected for an entire harvest season, potentially causing major impacts. Protective mitigation measures incorporated into seismic-survey permits, required industry Adaptive Management Mitigation Plans (AMMPs), and required mitigation under IHA requirements, as defined by NMFS and FWS is expected to reduce noise disturbance impacts (USDOI, MMS, 2006a), so that no unmitigable adverse effects to subsistence resources and harvest practices occur.

4.5.2.12.1.8. Anticipated Effects from Habitat Loss. Anticipated effects from habitat loss were previously described in Section 4.4.2.12.1.8 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

4.5.2.12.1.9. Anticipated Effects from Onshore Development. Anticipated effects from onshore development were described in Section 4.4.2.12.1.8 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

See Table 3.1.1-1 for North Slope oil discoveries and a "best guess" approximation for their potential production. There are no discoveries in the Chukchi Sea Planning Area that are anticipated to be developed within the next 20 years. A large-scale gas transportation system from the North Slope will not be operational for at least a decade. Excess capacity in this system will not be available for another decade after that. When there is capacity in the system, new gas developments are likely to be prioritized according to accessibility and cost. Such a pipeline is considered to be speculative at this time.

Under our proposed scenario, primary development activities would occur primarily from exploration-driven seismic surveys that would take place in the summer, open-water months between June and November. Construction of offshore production and transportation facilities could be carried out during the summer months and completed in 1-2 years. Construction of an onshore support and transportation facility could be carried out during the summer and winter months simultaneously with offshore work. Once construction is complete, production facility operations would occur year-round, over a 25-year period. The analysis in Section 4.4.1.12.1 describes and evaluates the potential effects of noise (seismic and drilling activities), habitat alterations (construction of platforms and pipelines), and discharges effects.

Overall, potential disturbance effects from production operations may be more difficult to mitigate, as such activities, by definition, will be longer term and operate year-round. The need to install one production platform, drill 80 production wells, construct 120 mi of offshore pipeline, and 250 mi of onshore pipeline, and construct one pipeline landfall and shore base in the region could increase the areas and times where subsistence resources and activities are restricted. This would increase the possibility for significant harvest disruption. This would be further exacerbated if construction and production activities were concentrated in critical subsistence-use areas (such as the anticipated shore base location in Peard Bay) rather than dispersed. Offshore pipeline effects on subsistence generally would be confined to the period of construction, and would be mitigated through lease stipulations, which will minimize industry activities during critical subsistence-use periods.

The major onshore pipeline constructed for the proposed action would connect Chukchi Sea oil and gas production with the TAPS. The potential impact of an onshore pipeline on subsistence-resource-use patterns, while unavoidable, can be at least partially mitigated and minimized with proper pipeline design and location/routing. Potential effects of a pipeline on subsistence users (perceptions of areas they wish to avoid, or which are difficult for them to access, for hunting) can be addressed with design considerations (for instance, by elevating or burying segments of the pipeline) and by including subsistence users in the consultation process. The most difficult potential onshore pipeline effects to mitigate would be those related to pipeline servicing and access. Service roads constructed for this purpose, would greatly increase impacts to caribou movement and access to subsistence resources on the western part of the North Slope. This effect would be greater if such a road were eventually opened to public access, on the model of the Dalton Highway. Roads are also reported to impose substantial maintenance costs on subsistence equipment (snow machines and sleds) and to present some safety issues (Impact Assessment, Inc., 1990a). Current practices are to minimize the construction of new roads. If pipeline servicing was conducted using aircraft, and perhaps ice roads or other ground transport in winter, such potential access effects would be minimized. Increased aircraft traffic in the summer could have a moderate effect on subsistence uses, but with coordination with subsistence users such impacts could be reduced.

Negative impacts to caribou can be minimized by mitigation measures, including: (1) construction of pipelines at least 100 m from roads; (2) elevation of the pipelines above the ground to ensure that caribou can pass underneath; (3) maintenance of traffic control in critical areas such as calving grounds, in season; (4) installation of buried or higher than normal pipelines in areas that are typically heavily traveled by caribou; and (5) adherence to minimum altitude levels for service aircraft in flight.

Onshore construction would affect local availability of key subsistence resources (caribou, waterfowl, fish, wolves, wolverine, and seals) because of displacement and would occur in seasonal- and general-use areas for key subsistence resources. Subsistence access would be affected, as subsistence users avoid construction areas because of perceived regulatory barriers and safety concerns about shooting around industrial development. Subsistence hunters consequently would travel farther and at greater cost and effort. Key resources are harvested during more than one season each year; they have been used for multiple generations, and the affected areas are used for multiple resources each year. Effects from construction would occur in key geographic areas relative to other areas of subsistence availability and would pertain to individual subsistence users, groups of users, and the overall pattern of local subsistence uses (USDOI, BLM, 2005).

Overall, remote, high-cost gas projects in the Chukchi will be less attractive than projects lower in cost and closer to future infrastructure. Also, considerable gas resources will have to be discovered in the Chukchi to justify a large overland pipeline to the Prudhoe Bay area. All of these factors led us to conclude that gas development in the Chukchi Sea OCS would be considered speculative.

4.5.2.12.1.10. Anticipated Effects from Production Activity. Anticipated effects from production activity were described in Section 4.4.2.12.1.10 and are expected to be similar for Chukchi Sea Lease Sales 212 and 221.

For purposes of analysis, we assume that development activities could occur in the reasonable foreseeable future. Reserve estimates for Northstar, Oooguruk, Nikiatchuq, and the Duck Island Unit are included in our estimates for offshore developments as well as any known discoveries in the Beaufort and Chukchi seas such as Hammerhead and Kuvlum. See the discussion of anticipated effects from onshore development in Section 4.5.2.12.1.9 above.

4.5.2.12.1.11. Anticipated Effects from Climate Change. Sections 4.4.1.12.1.9 and 4.4.2.12.11.11 described the potential and anticipated effects from climate change on subsistence resources and practices.

Continuing sea-ice melting and permafrost thawing will threaten subsistence livelihoods. Typically, Arctic peoples have settled in particular locations because of their proximity to important subsistence food resources and dependable sources of water, shelter, and fuel. Northern peoples and subsistence practices will be stressed to the extent: (1) settlements are threatened by sea-ice melt, permafrost loss, and sea level rise; (2) traditional hunting locations are altered; (3) subsistence travel and access difficulties increase; and (4) as game patterns shift and their seasonal availability changes. Large changes or displacements of resources are likely, leaving little option for subsistence communities: they must quickly adapt or move (Langdon, 1995; Callaway, 1995; *NewScientist* 2001; Parson et al., 2001; AMAP, 1997, *Anchorage Daily News*, 1997; Weller, Anderson, and Nelson, 1998; IPCC, 2001b). Great decreases or increases in precipitation could affect local village water supplies, shift the migration patterns of land mammals, alter bird breeding and molting areas, affect the distribution and abundance of anadromous and freshwater fish, and limit or alter subsistence access routes (particularly in spring and fall) (AMAP, 1997). Changes in sea ice could have dramatic effects on sea mammal migration routes, and this, in turn, would impact the harvest patterns of coastal subsistence communities and increase the danger of hunting on sea ice (Callaway et al., 1999; Bielawski, 1997). Between 1980 and 2000, three sudden ice events caused Barrow whalers to abandon their spring whaling camps on the ice leads in the Chukchi Sea (George et al., 2003; National Assessment Synthesis Team, 2000; Groat, 2001).

Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet would be expected (IPCC, 2001b; NRC, 2003b; ACAI, 2004).

Climate change and the associated effects of anticipated warming of the climate regime in the Arctic significantly could affect subsistence harvests and uses if warming trends continue (NRC, 2003b, ACIA, 2004). Every community in the Arctic is potentially affected by the anticipated climactic shift, and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of coastal communities in the Chukchi Sea, including Russian coastal communities in Chukotka. If the loss of permafrost, and conditions beneficial to the maintenance of permafrost, arise as predicted, there could be synergistic cumulative effects on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of freshwater, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their populations, shifting the populations to places with better subsistence hunting, and causing a loss or dispersal of community (NRC, 2003b; ACIA, 2004; USDOI, BLM, 2005; Parmesan and Galbraith, 2004; The Wildlife Society, 2004; United Nations Environment Programme, 2005; Callaway, 2007).

4.5.2.12.2. Direct and Indirect Effects Under Alternative 2.

Summary. The following analysis describes only the anticipated effects on subsistence resources and harvests that most likely would occur if the MMS opens the entire lease-sale area (no deferrals) in the Chukchi Sea. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and environmental factors, etc.) described in Sections 4.4.1.12.6 and 4.4.1.12.7. Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until another commercially viable discovery is made in the OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects on subsistence resources and harvests if such a discovery is made and proposed for development in the more distant future.

Direct effects include delay or deflection of resource populations' movements and mortality; indirect effects include destruction or degradation of habitat and changes in productivity. The placement of a drilling structure or production island near the bowhead whale migration corridor that operated over the life of a field (15-20 years) would represent a major effect, because of potential long-term noise disturbance to migrating whales. Potential disturbance from seismic surveys in the Chukchi Sea conducted during the open-water season likely would cause bowhead whales to experience temporary, nonlethal effects. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals although most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Similar impacts would be expected on beluga whales, walruses, seals, and polar bears.

Onshore effects under Alternative 2 oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 0.62-1.2 mi along onshore pipelines, with local effects persisting during construction activities. Brief disturbances of groups of caribou and muskoxen from a few minutes to a few days could occur along pipeline corridors during periods of high ice-road and air traffic, but these disturbances are not expected to affect the movements and distribution of caribou, muskoxen, grizzly bears, and arctic foxes.

Given the level of potential seismic-survey activity described in the scenario—up to four concurrent seismic surveys seasonally in the Chukchi Sea—and past assessments of species and resource effects discussed above, whales, pinnipeds, and polar bears might be displaced and their availability affected for an entire harvest season, potentially causing major impacts. Protective mitigation measures incorporated into seismic-survey permits, required industry AMMPs, and required mitigation under IHA requirements, as defined by NMFS and FWS is expected to reduce noise disturbance impacts (USDOI, MMS, 2006a), so that no unmitigable adverse effects to subsistence resources and harvest practices occur.

A recent breakdown in the CAA process has precipitated the need for industry to develop an annual AMMP that contains similar measures as contained in past CAAs to avoid whaling and other subsistence-harvest conflicts. Similar avoidance measures in the AMMP could be required for the subsistence hunts for beluga whales, walruses, seals, and polar bears. The AMMP is expected to follow protocols similar to those reached annually between permittees and the AEWC for the subsistence bowhead hunt and address industry seismic-vessel activities under provisions of the MMPA. With the use of an annual AMMP, it is expected that Native subsistence-whale hunters will continue to be successful in their marine mammal harvests and in reaching their annual whale “take” quotas. Without an AMMP in place, major impacts to subsistence resources and the subsistence hunts for bowhead and beluga whales, walruses, bearded seals, and polar bears would result.

A large oil spill could affect subsistence resources and communities of Barrow, Wainwright, Point Lay, and Point Hope, as well as Russian coastal communities in Chukotka. In the event of a large oil spill, many harvest areas and some subsistence resources could become unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Iñupiat culture. There also is concern that the IWC, which sets the quota for the Iñupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Iñupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walrus, fish, and birds.

Conclusion. The communities of Barrow, Wainwright, Point Lay, Point Hope, and Kivalina and Chukchi coastal communities in the Russian Arctic potentially would be most affected, with Wainwright potentially being the most affected community because of potential impacts from shore base-facility construction. Disturbance and noise could affect subsistence species that include bowhead and beluga whales, walruses, seals, polar bears, caribou, fish, and birds. For the communities of Barrow, Wainwright, Point Lay, and Point Hope, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable, and no resource population would experience an overall decrease. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt.

Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on subsistence resources and subsistence-harvest patterns, producing major effects.

4.5.2.12.3. Cumulative Effects Under Alternative 2.

Summary. Anticipated effects under the Proposed Action are combined with the anticipated effects of the no-action alternative to determine the cumulative effects under this alternative. The noise-producing exploration and construction activities are those most likely to produce disturbance effects on critical subsistence species that include bowhead and beluga whales, walruses, seals, caribou, fish, and birds.

Disturbance effects would be associated with aircraft and vessel noise, construction activities, and oil spills; specifically: (1) seismic surveys that occur prior to an oil and gas lease sale; (2) aircraft support of exploration and development activities; (3) possible vessel supply and support of exploration and development activities; (4) drilling activities during the exploration and development and production phases; and (5) onshore construction, including pipeline, road, support-base, landfall, and pump-station construction. Noise and traffic disturbance would be a factor throughout the life of the sale.

Seismic surveys and exploration drilling could continue at existing levels due to a limited number of suitable or specialized vessels for conducting these activities. No more than two drill rigs could operate in the Chukchi Sea at any one time. Similarly, no more than six seismic surveying activities could be completed during a season, an unrealistic number because six seismic surveying vessels are not available. It is more reasonable to assume that no more than three seismic surveys could be completed simultaneously in the Chukchi Sea. Further impacts to subsistence resources and harvests would come from (1) ongoing maintenance and development projects in local communities; (2) onshore oil and gas infrastructure development; (3) passenger, research, and industry-support aircraft activities; (4) local boat traffic, barge resupply to local communities, research vessel traffic, industry-support vessel activities (mostly in support of seismic surveys), an increasing U.S. Coast Guard presence, and vessel traffic from increasing Arctic ecotourism. Ongoing actions include: (1) development and production activities at Endicott, Northstar, Badami, and Alpine; (2) recent leasing from Beaufort Lease Sales 195 and 202 and Chukchi Sea Sale 193; (3) State leasing; and (4) onshore leasing activity in the NPR-A. In the Chukchi Sea region, west of the North Slope industrial complex, the major industrial developments have been and continue to be associated with Red Dog Mine and the Delong Mountain Terminal (DMT). Their addition to cumulative activities would be about 250 barge lightering trips per year needed to transfer 1.5 million tons of concentrate to bulk cargo ships anchored 6 mi offshore. About 27 cargo ships are loaded each year. These activities have the potential to affect marine mammals and marine birds that migrate just offshore of the facilities into the marine waters of the Chukchi Sea Planning Area (USDOI, MMS, 2006a).

Effects from these sources would continue to have a moderate level of effect on subsistence resources and harvest practices. The greatest source of large noncrude oil spills would occur from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and other shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in major adverse effects on subsistence resources and harvest practices in the Chukchi Sea region.

Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources, could change if oil development reduces the availability of resources or alters their distribution patterns. Cumulative effects to bowhead whales and other marine mammals is a serious concern. If increased noise affected whales and caused them to deflect from their normal migration route, they could be displaced from traditional hunting areas and the traditional bowhead whale harvest could be adversely affected. The same could be true for beluga whales, walrus, and seals (USDOI, MMS, 2003a). The disruption of bowhead whale harvests could result from any potential diversion of the whale migration farther offshore, or from other behavior changes by the animals—making them more skittish, for example—in reaction to OCS activities. The greater the degree of activity onshore and oil and gas development in Federal, State, and Canadian waters, as measured by increases in seismic noise, vessel traffic, east-to-west development, Canadian activities in the Mackenzie Delta, or some other metric, the more probable and more pronounced cumulative effects are likely to be. If the IWC considers the threat of industrialization large enough, it could reduce the Alaska bowhead whale quota to protect the stock. This quota reduction would have a serious subsistence and cultural effect on the Iñupiat communities of the North Slope as well as to Iñupiat in other communities who receive whale meat from the harvest (USDOI, MMS, 2007d, 2006b; USDOI, BLM and MMS, 1998).

Onshore development in the Beaufort Sea region has already caused increased regulation of subsistence hunting, reduced access to hunting and fishing areas, altered habitat, and intensified competition from nonsubsistence hunters for fish and wildlife (Haynes and Pedersen, 1989). Additive impacts that could affect subsistence resources include potential oil spills, seismic noise, road and air traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Diverting animals from their usual and accustomed locations, or building facilities in proximity to those locations, could compel resource harvesters to travel further to avoid development areas. Harvest of subsistence resources in areas further from the local subsistence communities would require increased effort, risk, and cost on the part of subsistence users. Increasing onshore areas open for leasing and exploration would lead to development in previously closed areas, leading to concentrating subsistence harvest efforts in the undeveloped areas, and increasing the potential for conflict over harvest areas within a community (USDOI, BLM, 2005). Based on potential cumulative, long-term displacement and/or functional loss, habitat available for caribou may be reduced or unavailable or undesirable for use. Changes in caribou population distribution due to the presence of oilfield facilities or activities may affect availability for subsistence harvests in traditional subsistence use areas. Overall, subsistence users likely would continue to travel farther to harvest resources, but hunters are unlikely to cease subsistence harvests given the pivotal value of subsistence activities and subsistence food. The communities of Barrow, Wainwright, Point Lay, and Point Hope would be most affected by onshore activities in the Chukchi Sea region. Changes in oil and gas exploration and development technology could mitigate some of the effects observed in the past (USDOI, MMS, 2003a; USDOI, BLM, 2004a, 2005).

If a large oil spill occurred and affected any part of the bowhead whale's migration route, it could taint this culturally important resource. Any actual or perceived disruption of the bowhead whale harvest from oil spills and any actual or perceived tainting anywhere during the bowhead's spring migration, summer feeding, and fall migration could disrupt the bowhead hunt for an entire season even though whales still would be available. In fact, even if whales were available for the spring and fall seasons, traditional cultural concerns of tainting could make bowheads less desirable and alter or stop the subsistence harvest in Kaktovik, Nuiqsut, Barrow, Wainwright, and Point Hope, and the beluga whale hunt in Point Lay for up to two seasons. Concerns over the safety of subsistence foods could persist for many years past any actual harvest disruption. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Such a condition would constitute a major adverse effect. Tainting concerns would also extend to walrus, seals, polar bears, fish, and birds; some or all of these resources could also suffer losses from an oil spill. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads, threatening a critical underpinning of Inupiat culture. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale and other marine mammal products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated.

Additionally, all areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered major. Overall, such effects are not expected from routine activities and operations.

If the present rates of climate change continue, changes in diversity and abundance to arctic flora and fauna could be significant. Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet could be expected. Increasing climate change impacts are likely to produce major effects on subsistence activities by causing additional losses of traditional subsistence harvest areas and making traditional subsistence resources no longer available for harvest. Subsistence users would continue to travel farther to harvest resources, but are unlikely to cease subsistence harvests given the strong cultural continuity and value of subsistence activities (Johannessen, Shalina, and Miles, 1999; IPCC, 2001c; NRC, 2003; NMFS, 2008b; USDOI, BLM, 2005). Additionally, changing spring lead conditions—ice becoming thinner due to climate change—has made the spring hunt more problematic and makes the fall hunt even more pivotal in the annual whale harvest for all communities in the region. Thus, any disruption of the Barrow bowhead whale harvest could have disruptive effects on regional subsistence resources and harvest practices (USDOI, MMS, 1987b; Brower, 2005).

Conclusion. An increasing level of seismic-survey activity in the Chukchi Sea could displace whales, walruses, seals, and polar bears and alter their availability for an entire harvest season, causing major impacts to these subsistence resources and Inupiaq harvest practices that depend on them. Adaptive management mitigation to replace the mechanism of the conflict avoidance agreement has been incorporated in this draft EIS to reduce effects to subsistence sea mammals resources below a major level. Without such proposed mitigation in place, cumulative effects on subsistence resources and harvests from noise and disturbance would be major. To a large extent existing stipulations and required mitigation have in the past mitigated such potential effects and may continue to do so. With an MMS approved industry AMMP in place, effects would be reduced to moderate. Additionally, stipulated measures for seismic-survey permits and mitigation accompanying NMFS IHA plans generally ensure that acceptable levels of whale monitoring will occur. Together, these measures should ensure that no unmitigable adverse effects to subsistence-harvest patterns, resources, or practices will occur. Cumulative impacts from a large oil spill, when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together would be considered major. If present rates of climate change continue, impacts to subsistence resources and harvests would be expected to be major.

4.5.2.13. Sociocultural Systems.

Summary. The following analysis describes only the anticipated effects on sociocultural systems that would most likely occur if MMS opens the entire lease sale area (no deferrals) in the Chukchi Sea. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and environmental factors, etc.) described in Sections 4.4.1.12.2 and 4.4.1.12.7. Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until another commercially viable discovery is made in the OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects on sociocultural systems if such a discovery is made and proposed for development in the more distant future.

Disturbance and noise affect on subsistence species could include bowhead and beluga whales, walrus, seals, polar bears, caribou, fish, and birds. For the communities of Barrow, Wainwright, Point Lay, and Point Hope, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on subsistence resources and subsistence-harvest patterns, producing major effects.

For routine activities from exploration, development and production, and decommissioning (abandonment), effects to sociocultural systems would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate level of effect.

4.5.2.13.1. Anticipated Effects Under Alternative 2. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects previously described in Sections 4.5.1.13.1 and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.5.1.13.4. This section describes the impact on sociocultural systems resulting from the incremental impact of this action, the Proposed Action, and adding it to other past, present, and reasonably foreseeable future actions regardless of what agency undertakes such actions. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures are described in Section 4.4.1.12.2. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

4.5.2.13.1.1. Anticipated Effects from Disturbance. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from vessel and aircraft disturbance previously described in Sections 4.4.1.13.1.1 and 4.5.1.13.1.1, the same anticipated effects described in Sections 4.4.1.13.4.1 and 4.5.1.13.4.1, and the same cumulative past, present and reasonably foreseeable actions previously described in Sections 4.4.1.13.7 for the Beaufort Sea no-action alternative and Section 4.5.1.13.7 for the Chukchi Sea no-action alternative. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

During the exploration phase for Chukchi Sea sales, Barrow and Wainwright would be used as air-support bases for offshore operations. Personnel and freight would be transferred at either location for the helicopter flights to offshore locations. There could be between one and three flights a day, depending on the level of offshore activity. The existing facilities at Barrow and Wainwright appear sufficient to meet these needs. Vessels used in support of exploration activities staging out of Barrow would have to anchor offshore, as Barrow has no port facilities (USDOI, MMS, 2007d).

4.5.2.13.1.2. Anticipated Effects from Discharges. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same anticipated effects from discharges described in Sections 4.4.1.13.4.2 and 4.5.1.13.4.2 and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea no-action alternative and Section 4.5.1.13.7 for the Chukchi Sea no-action alternative.

4.5.2.13.1.3. Anticipated Effects from Large Oil Spills. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from large oil spills described in Sections 4.4.1.13.1.2 and 4.5.1.13.1.2, the anticipated effects described in Sections 4.4.1.13.4.3 and 4.5.1.13.4.3, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7

for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. The potential for oil spills to contact subsistence resources and harvest areas in the Chukchi Sea Planning Area was discussed in the oil-spill analysis in Section 4.5.2.12.1.4.1. While spills can occur on land or in the marine environment, spills to the marine environment have the greatest potential to affect marine mammals important for the subsistence harvest and harvest practices. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices. The same mitigation measures described in Section 4.4.1.12.2 would be implemented for the proposed lease sales. A large spill from a well blowout is described as a very unlikely event and no large oil spills are assumed to occur during exploration (see Appendix A, Section 1.1.4).

The sociocultural impacts of oil spills are of at least two types. The first is the result of direct effects to resources that are used in some way by local residents or that may benefit them (i.e., subsistence, tourism, recreation, and elements of quality of life). The second is the impact of spill-cleanup efforts, in terms of short-term increases in population and economic opportunities, as well as increased demand on community services and increased stress to local communities. As is evident from the EVOS, such cleanup efforts can be quite disruptive economically, socially, and psychologically for an extended period of time. While the magnitude of impacts declines rapidly in the first year or two after a large spill, long-term effects continue to be evident (Palinkas et al., 1993; Picou et al., 1992; Picou and Gill, 1996). Such effects can be mitigated, and one important element in such a program is the establishment of, and local participation in, an effective spill-response effort that has been formulated into an explicit spill-response plan. Such local programs can be credited as one effect of spill events, and do have a number of benefits. They provide local employment, a sense of local empowerment, and a means for local resident/oil industry communication (USDOI, MMS, 2007c).

4.5.2.13.1.4 Anticipated Effects from Small Oil Spills. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same anticipated effects from small oil spills described in Sections 4.4.1.13.4.4 and 4.5.1.13.4.4, the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. Anticipated effects of small oil-spills on subsistence resources and harvest areas in the Beaufort Sea Planning Area were discussed in the Section 4.5.2.12.1.5 for the Subsistence-Harvest Patterns Alternative 2. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

4.5.2.13.1.5. Anticipated Effects from Oil-Spill Response and Cleanup. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from oil-spill response and cleanup described in Sections 4.4.1.13.1.3 and 4.5.1.13.1.3, the same anticipated effects described in Sections 4.4.1.13.4.5 and 4.5.1.13.4.5, and the same cumulative past, present, and reasonably foreseeable actions described in Sections4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. Anticipated effects of oil-spill response and cleanup on subsistence resources and harvest areas in the Beaufort Sea Planning Area were discussed in the Section 4.4.2.12.7 for the Subsistence-Harvest Patterns Proposed Action Alternative II. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

4.5.2.13.1.6. Anticipated Effects from Seismic Surveys. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from seismic surveys described in Sections 4.4.1.13.1.4 and 4.5.1.13.1.4, the same anticipated effects described in Sections 4.4.1.13.4.6 and 4.5.1.13.4.6, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea

Alternative 1. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

Any long-term deflection of whale migration routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated; however, seismic activity of the magnitude discussed in the scenario for the 2006 surveys and those described in the Sale 193 scenario has not been approached since the 1980s (USDOI, MMS, 2003d). Potential seismic-survey effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope might result from seismic-exploration activities (USDOI, MMS, 2006a). Because seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of personnel and equipment for seismic exploration (USDOI, MMS, 2007d).

4.5.2.13.1.7. Anticipated Effects from Habitat Loss. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from habitat loss described in Sections 4.4.1.13.1.5 and 4.5.1.13.1.6, the same anticipated effects described in Sections 4.4.1.13.1.8 and 4.5.1.13.4.1.8, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

4.5.2.13.1.8. Anticipated Effects from Onshore Development. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from onshore development described in Sections 4.4.1.13.1.8 and 4.5.1.13.1.8, the same anticipated effects previously described in Sections 4.4.1.13.4.8, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

At the local level, Wainwright could experience major effects. Noticeable disruption most likely would result during development from the placement of onshore infrastructure, with the most prominent effect being the change in land use that comes about by introduced industrialization. Wainwright would experience other effects to social organization, cultural values, and institutional organization, as well, for a period exceeding 2-5 years. Collectively, these effects would represent a chronic disruption. Given the resiliency of social systems (many aspects of social organization, cultural values, and institutional organization will not be affected or will continue unchanged) and their ability to adapt (new capacity to address the effects will emerge), the chronic disruption could be successfully accommodated. However, the social patterns that emerge could be markedly different from the patterns that preceded development, indicating that displacement would have occurred (USDOI, MMS, 2007d).

The shore base would serve as an enclave to house project-related workers, who would largely travel out of the area at shift change. Overall, development and production activities would have little effect on the demographics and workforce changes of the communities on the North Slope. However, shore base employment could have an effect on the demographics of nearby Wainwright. The city's population decline between 1998 and 2003 is attributed to the completion of several large capital improvement projects and the corresponding decline in jobs available in the community. The unemployment rate in Wainwright was estimated at approximately 19% in the 2003 Census, which is higher than the rates for the State or Nation for a similar timeframe. Wainwright's unemployment rates for Iñupiat residents were higher than for non-Iñupiat residents (URS Corporation, 2005).

Construction would create business opportunities for Native corporations. In the short term, local employment would stabilize population and density and slow the rate of decline and increase the stability of the community. The end of shore base construction could cause an exodus of workers similar to that experienced by the community with the completion of the capital improvement projects. However, it must be noted that petroleum activities generally have not translated into employment opportunities for the region's Native residents. In general, employment opportunities are viewed positively by NSB residents, and wage employment can facilitate subsistence harvest activities (URS Corporation, 2005; Martin, 2005). However, if industrial development and employment conflicts with subsistence harvest activities and related networks, these opportunities could cause disruption of sociocultural systems and be associated with declines in perception of economic and social well being and individual satisfaction with subsistence (Kruse, 1984; Martin, 2005; USDOI, MMS, 2007d).

Some local services could be affected by the proximity of operations to Wainwright. For example, until an airfield at the shore base is completed, transportation to and from the enclave would use the airports at Barrow and Wainwright. The importation of alcohol is prohibited in Wainwright. Enforcement of this prohibition by public safety officers at originating airports in Alaska (e.g., Anchorage, Fairbanks, and Barrow) and at Wainwright would increase with the frequency of flights and tax the rate at which current surveillance is currently conducted. As enclaves generally are self-sufficient, establishment of the shore base should create little demand for government services such as waste disposal, power and communication, housing, health care, and education. Air and marine operations gradually would shift to the shore base, with airports in Barrow and Wainwright providing alternatives in case of emergencies, likely allowing the shift from existing to new transportation infrastructure to occur gradually without overtaxing existing facilities (USDOI, MMS, 2007d).

Because of the use of enclaves, little inmigration or outflow of residential, non-Native workers for Wainwright is anticipated. Less than 50 total direct, indirect, and induced jobs would be created across the NSB by anticipated development and production activities. Sufficient housing units appear to be available to handle what influx might occur. A recent count of housing units in Wainwright had 179 housing units, with 148 occupied, leaving 31 vacant (URS Corporation, 2005); we anticipate little disruption from the presence of the new residents. Conflicts over subsistence resources are not expected as non-Native households of NSB communities claim to use none or very little subsistence resources (Shepro, Maas, and Callaway, 2003). Therefore, an influx of new residents from development and production related employment would be expected to have little direct and indirect consequences to sociocultural systems (USDOI, MMS, 2007d).

Wainwright became accustomed to housing even larger nonresident labor forces because of past capital improvement program employment. The proximity of the shore base to Wainwright may bring nonresident enclave workers and others into greater contact with area residents. Positive and negative effects may result from this interaction, as was noted by other NSB communities proximate to oil and gas activities (Kaktovik Impact Project, 2003; URS Corporation, 2005; Nuiqsut Community Profile, cited in USDOI, BLM, 2004a). Precise effects of such interaction are difficult to quantify. Communities in California that have OCS-related onshore infrastructure established impact monitoring and mitigation programs with industry. These programs ascertained the effects and recovered costs for services provided by local government (USDOI, MMS, 2000b). These monitoring and mitigation programs and other measures have facilitated project approval when there is uncertainty over the cause and effect of project-related impacts, and North Slope communities could benefit from a similar program (Woolley and Lima, 2003; USDOI, MMS, 2007d).

Construction and operation of the shore base, a new activity for the Chukchi Sea coast, would require planning, zoning, and permitting actions that routinely are undertaken by Borough government departments for similar oil and gas infrastructure. The Borough government makes a distinction between onshore oil development, which it generally supports, and offshore development, which it generally opposes. This opposition may have an effect on the policy-formulation process but is not expected to affect land use planning and permitting processes. Other local governments and nongovernmental organizations involved in the planning process would incur the marginal expense of that participation. These efforts may represent new and substantial challenges to the financial and administrative capacity of organizations, as petroleum-related industrialization represents a qualitatively new activity to these organizations. Past analyses have noted that stress to organizations and individuals may result from: (1) a lack of resources to mobilize for advocacy; (2) a lack of time to participate in the decision making process; (3) the repetitive nature of the decision making process; and (4) the multiplicity of processes that require participation and response (USDOI, MMS, 2006a). Because of its proximity to onshore infrastructure, these effects will be most pronounced for Wainwright (USDOI, MMS,2007d).

Potential effects on traditional-use areas and archaeological sites as a result of development and construction activities also could occur. Potential effects include disturbance of traditional use and archaeological sites, such as hunting, fishing, and whaling camps, by construction and the increased possibility for vandalism. Any effects to these resources would have a corresponding and proportional effect on cultural values (USDOI, MMS, 2007d).

Precise effects from decommissioning the shore base and pipeline are difficult to forecast, as this activity will occur at the end of the lifecycle of a long-term project. However, effects in general are expected to be caused by removal and restoration activities and be very similar to those forecast for construction phase of the project (USDOI, MMS, 2007d).

4.5.2.13.1.9. Anticipated Effects from Production Activity. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from production activity described in Sections 4.4.1.13.1.7 and 4.5.1.13.1.7, the same anticipated effects previously described in Sections 4.4.1.13.4.9 and 4.5.1.13.4.9, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.7 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.7 for the Chukchi Sea Alternative 1. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

If exploration leads to discovery, the scenario anticipates construction of a shore base in the vicinity of Wainwright to support development and production activities and the construction of a pipeline to connect the landfall of the offshore pipeline to TAPS. Potential and anticipated impacts from onshore facilities and onshore pipelines are discussed in the sections cited above (USDOI, MMS, 2007d).

4.5.2.13.1.10. Anticipated Effects from Climate Change. Sociocultural systems in the Chukchi Sea Planning Area are subject to the same potential effects from climate change described in Sections 4.4.1.13.1.8 and 4.5.1.13.1.8, the same anticipated effects described in Sections 4.4.1.13.3.10 and 4.5.1.13.3.10, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.13.4.10 for the Beaufort Sea Alternative 1 and Section 4.5.1.13.4.10 for the Chukchi Sea Alternative 1. Sections 4.4.1.12.1.9 and 4.4.1.12.4.11 Alternative 1 described the potential and anticipated effects from climate change on subsistence resources and practices. Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

Climate change and the associated effects of anticipated warming of the climate regime in the Arctic significantly could affect subsistence harvests and uses if warming trends continue (NRC, 2003b, ACIA, 2004). Every community in the Arctic is potentially affected by the anticipated climactic shift and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of coastal communities in the Beaufort Sea. If the loss of permafrost and conditions beneficial to the maintenance of permafrost arise as predicted, there could be synergistic cumulative effects on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of freshwater, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their populations, shifting the populations to places with better subsistence hunting, and causing a loss or dispersal of community (NRC, 2003b, ACIA, 2004; USDOI, BLM, 2005; Parmesan and Galbraith, 2004; The Wildlife Society, 2004; United Nations Environment Programme, 2005; Callaway, 2007).

4.5.2.13.2. Direct and Indirect Effects Under Alternative 2. The following analysis describes only the anticipated effects on sociocultural systems that would most likely occur if the MMS opens the entire lease sale area (no deferrals) in the Chukchi Sea. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and environmental factors, etc.) described in Sections 4.4.1.12.2. Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until another commercially viable discovery is made in the OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects on sociocultural systems if such a discovery is made and proposed for development in the more distant future.

Disturbance- and noise-affected subsistence species could include bowhead and beluga whales, walruses, seals, polar bears, caribou, fish, and birds. For the communities of Barrow, Wainwright, Point Lay, and Point Hope, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on subsistence resources and subsistence-harvest patterns, producing major effects.

Anticipated effects would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices. Effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from oil exploration and development activities, from changes in population and employment, and subsistence harvest patterns. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems (USDOI, BLM and MMS, 2003; USDOI, MMS, 2006b).

At the local level, Wainwright could experience major effects. Noticeable disruption most likely would result during development from the placement of onshore infrastructure, with the most prominent effect being the change in land use that comes about by introduction of industrialization. Wainwright would experience other effects to social organization, cultural values, and institutional organization, as well, for a period exceeding 2-5 years. Collectively, these effects would represent a chronic disruption. Given the resiliency of social systems (many aspects of social organization, cultural values, and institutional organization will not be affected or will continue unchanged) and their ability to adapt (new capacity to address the effects will emerge), the chronic disruption could be successfully accommodated. However, the social patterns that emerge could be markedly different from the patterns that preceded development, indicating that displacement would have occurred (USDOI, MMS, 2007d).

Potential seismic-survey effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope might result from seismic-exploration activities (USDOI, MMS, 2006a). Because the spring subsistence-whale hunt in the communities of Point Hope, Wainwright, and Barrow would be concluding by the time seismic activities began in the Chukchi Sea region, adverse noise effects on the spring whale harvest are not anticipated. Additionally, seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of personnel and equipment for seismic exploration (USDOI, MMS, 2007d).

Any long-term deflection of whale migration routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated; however, seismic activity of the magnitude discussed in the scenario for the 2006 surveys and those described in the Sale 193 scenario has not been approached since the 1980s (USDOI, MMS, 2007d).

The more predominant issue associated with potential impacts on sociocultural systems is the potential disruption of seismic-survey noise on subsistence-harvest patterns, particularly those involving the bowhead whale, which is a pivotal species to the Iñupiat culture. Such disruptions could impact sharing networks, subsistence task groups, and crew structures, as well as cause disruptions of a central Iñupiat cultural value: subsistence as a way of life. Over time, these disruptions also could cause a breakdown in family ties, the community's sense of well-being, and could damage sharing linkages with other communities. Displacement of ongoing sociocultural systems by seriously curtailing community activities and traditional practices for harvesting, sharing, and processing subsistence resources could occur (USDOI, MMS, 2007d).

Many exploration impacts are similar to those effects from seismic surveys, because most of the activities are based on largely self-supporting vessels and stresses to local village infrastructure, health care, and emergency response systems would be expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of personnel and equipment for exploration. During the exploration phase, Barrow and Wainwright would be used as air-support bases for offshore operations. Personnel and freight would be transferred at either location for the helicopter flights to offshore locations. There could be between one and three flights a day, depending on the level of offshore activity. The existing facilities at Barrow and Wainwright appear sufficient to meet these needs. Vessels used in support of exploration activities staging out of Barrow would have to anchor offshore, as Barrow has no port facilities (USDOI, MMS, 2007d).

Conclusion. Effects from anticipated 3D seismic surveys and exploration should not exceed moderate effects levels. For 3D and 2D seismic surveys and exploration, which are projected to occur for at least 4 years, effects to sociocultural systems are expected to be moderate. Effects to social well-being (social systems) could be noticeable because of concern over deflection of the bowhead whale due to seismic survey activities and the attendant effects on subsistence harvests. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If deflection actually occurred, effects could be major.

For routine activities from exploration, development and production, and decommissioning (abandonment), effects to sociocultural systems would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate level of effect.

The mitigation measures for Sale 193 have been patterned on those that have been shown to be effective for OCS activities in the Beaufort Sea. These measures developed from activities starting onshore at Prudhoe Bay which expanded from that location. These measures should work as well for OCS activities in the Chukchi Sea. However, to the extent that these activities are "new" to the area, we should expect the same process of evolution and adaptation for Chukchi Sea communities as was experienced by Beaufort Sea communities. If development and production occur, this accommodation represents a chronic disruption of existing social systems for a period of more than 2 years, with a tendency to displace existing social patterns (USDOI, MMS, 2007d).

For large oil spills, noticeable disruption in excess of 2 years could occur from the oil spill and cleanup activities. The effects of this disruption would last beyond the period of cleanup and would represent a chronic disruption of social organization, cultural values, and institutional organization. The effects would have a tendency to displace existing social patterns. Effects from a large oil spill would be expected to be major. Mitigation measures should prove effective in ameliorating many of the effects of OCS activities.

4.5.2.13.3. Cumulative Effects Under Alternative 2. Effects from OCS and other Activities effects on subsistence resources and practices were previously discussed in Sections 4.4.1.12.7, and the same activities would be expected to impact sociocultural systems to the extent they adversely impacted subsistence resources and harvest practices.

Summary. Anticipated effects under the Proposed Action are combined with the anticipated effects under the no-action alternative (see Sections 4.5.1.12.7) to determine the cumulative effects under this alternative. The noise-producing exploration and construction activities are those most likely to produce disturbance effects on critical subsistence species that include bowhead and beluga whales, caribou, fish, seals, and birds. Disturbance effects would be associated with aircraft and vessel noise, construction activities, and oil spills; specifically: (1) seismic surveys that occur prior to an oil and gas lease sale; (2) aircraft support of exploration and development activities; (3) possible vessel supply and support of exploration and development activities; (4) drilling activities during the exploration and development and production phases; and (5) onshore construction, including pipeline, road, support-base, landfall, and pump-station construction. Noise and traffic disturbance would be a factor throughout the life of the sale.

Effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from oil exploration and development activities, oil spills and oil-spill cleanup, changes in population and employment, and subsistence harvest patterns; accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources. However, such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems, but community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill (USDOI, BLM and MMS, 2003; USDOI, MMS, 2006b).

Offshore exploration in the Chukchi Sea is expected to increase, with lease sales planned for the near future by MMS in this offshore area. Effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope might result from seismic-exploration activities. Because the seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of people and equipment for seismic exploration. However, the possible long-term deflection of whale migratory routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated; however, seismic activity of the magnitude proposed has not been approached in the region since the 1980's (USDOI, MMS,2006a; USDOI, BLM, 2005).

While it is unknown exactly how much of the offshore area will be leased in these future sales, several ship-based exploratory seismic operations were conducted during the open water seasons in 2006 and 2007, resulting in conflicts with marine mammal hunters, and concerns over the fall whaling harvest. Should offshore activity lead to a considerable decrease in success in fall whaling, it would contribute to major negative effects to the North Slope Iñupiat peoples' identity and could have culture-wide effects (USDOI, BLM, 2005).

Onshore in the Beaufort Sea region, continuing oil and gas leasing and development, as well as ongoing changes in the arctic climate, will have impacts on Iñupiat sociocultural systems in the foreseeable future. Development is currently being considered for the Northeast NPR-A, the planning area for Alpine Field Satellites development, and further exploration and delineation activity is ongoing in the leased areas south of Teshekpuk Lake. If oil and gas activities were to continue in areas already leased, Nuiqsut residents would be increasingly isolated from their subsistence resources and would be encircled by development. This problem could be exacerbated if gas development caused development to extend into the foothills of the Brooks Range. Cumulative effects could include changes to social organization, and impacts to cultural values and general community welfare (e.g., health and education). Changes to social organization could potentially occur as a result of changes in population, employment, subsistence harvest patterns, social bonds, and cultural values. In addition, the increase in income in NSB communities could potentially result in an increase in social problems, such as drug and alcohol abuse and violence, as well as increasing conflicts from wealth disparities (USDOI, BLM, 2005).

Overall, cumulative impacts to the sociocultural characteristics of North Slope communities could lead to changes to community structure, cultural values and community health and welfare, changes that actually predate oil and gas development on the North Slope. However, change in community sociocultural characteristics has continued during the period of oil development. As the area impacted by oil development in the future increases, especially in proximity to local communities, cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, and Atqasuk are currently dependent on subsistence caribou harvest from the CAH and TLH, additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns (including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources), social bonds, and cultural values (USDOI, BLM, 2004a, USDOI, MMS, 2006b).

Onshore, the abandonment of oil fields and the related loss of revenue would no doubt have serious effects on the entire State of Alaska. However, the collapse of commercial enterprise is seen as inevitable and is common over the history of the Iñupiat. Commercial whaling served the same markets as petrochemicals do today, and the Iñupiat survived by returning to the land. Fur trapping collapsed and the Iñupiat people adapted. Based on this historic demonstration of their resiliency, it would appear that the Iñupiat may be at less risk from the decline of industry than they are in the face of an expanding and unchecked industry. Nevertheless, worldwide data suggest a consistent pattern of marked increases in stress, social problems, and emigration under circumstances of sudden or severe economic depression. Data from Inupiat populations has shown that economic depression correlates strongly with epidemic rates of suicide (Travis, 1985). In the event of oil field abandonment, the Iñupiat would likely be employed to assist in the removal and demobilization of the infrastructure, while at the same time continuing their subsistence pursuits (USDOI, BLM, 2005).

Additionally, areas of importance to subsistence users, including areas surrounding subsistence camps, critical habitat for subsistence species, and large concentrations of historic and prehistoric cultural resources, could be impacted by oil and gas activities and could increase anxiety in Barrow, Wainwright, Point Lay and Point Hope (USDOI, BLM, 2005).

We may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. The NSB already is experiencing problems in the social health and well-being of its communities, and additional development, including offshore oil development on the North Slope, would further disrupt them. Health and social-services' programs have tried to respond to alcohol and drug problems with treatment programs and shelters for wives and families of abusive spouses, in addition to providing greater emphasis on recreational programs and services. These programs, however, sometimes do not have enough money, and NSB city governments cannot help as much now that they get less money from the State. Based on experiences after the EVOS, Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other lower paying community jobs (USDOI, MMS, 2006b).

Not all sociocultural changes are negative. It is anticipated that there will be a doubling of the population on the North Slope by the year 2040. As long as core Iñupiat values continue to be passed from generation to generation, as they currently are, an increase in the Iñupiat population results in a strengthening of the culture as a whole. At the same time, revenues from NSB taxation on oil development produce positive impacts come from higher incomes, better health care, improved housing, and improved infrastructure and educational facilities, although these impacts may primarily benefit younger individuals who are generally more accepting of change (NRC, 2003a). Iñupiat culture as an adaptive mechanism is a powerful means of self-directed social, political, and cultural change capable of sustaining the Iñupiat through adverse circumstances, as it has for centuries guided them through resource shortages, inter- and intragroup social conflicts, and environmental changes (USDOI, BLM, 2005).

Health issues caused by persistent and short-term pollution could shorten life spans of elders, who are the key repositories of traditional and cultural knowledge in the communities. Health issues from increased injuries as a result of the need to travel further over rough terrain to support families with subsistence foods could reduce community involvement with employment, tax the community health infrastructure, encourage outmigration, and lead to increases in substance abuse and depression in those no longer able to participate in subsistence activities. Cuts in funding for services would increase the severity of the problem of delivery of health services, as well as maintaining health and hygiene infrastructure (e.g., fresh water, sewers, and washeteria) (USDOI, MMS, 2006b). See also the human health discussion in the environmental justice analysis in Section 4.4.1.15.

Any realistic analysis of cumulative effects on the North Slope needs to consider both onshore and offshore effects. Although onshore and offshore cumulative effects are difficult to separate, most cumulative effects are thought to result from onshore development. To date, no comprehensive onshore monitoring or baseline data gathering has ever been undertaken by responsible Federal and State agencies and industry; the most obvious cumulative effects have occurred and continue to occur onshore, as oil-field development expands westward from the initial Prudhoe Bay/Deadhorse area of development. Proposed and ongoing studies that will contribute to a more comprehensive understanding of cumulative and human health effects to the Native population of the North Slope are discussed in the environmental justice cumulative effects analysis Section 4.4.1.15.8 (USDOI, MMS, 2006b); for a general discussion of environmental justice, see Section 4.4.1.15.

Conclusion. Cumulative effects on the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from on-and offshore exploration, development and production activities; small changes in population and employment; and disruption of subsistence-harvest patterns from seismic noise disturbance, oil spills and oil-spill cleanup, and climate change. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems (USDOI, BLM and MMS, 2003; USDOI, MMS, 2006b). However, if a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

In this cumulative analysis, the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down. However, recent activity in the Alpine field has brought non-Natives directly into the Native village of Nuiqsut, and this has added stresses in the community. Already, these workers have made demands on the village for more electrical power and health care. This potential remains for the communities of Barrow, Atqasuk, and Kaktovik (USDOI, MMS, 2003a).

Effects from anticipated 3D seismic surveys and exploration should not exceed moderate effects levels with the application of mitigation measures, especially Stipulation 5 that provides for an Adaptive Management Mitigation Plan that reduces potential conflicts between oil industry activities and subsistence whalers. For 3D and 2D seismic surveys and exploration, which are projected to occur for at least 3 years, effects to sociocultural systems are expected to be moderate. Effects to social well-being (social systems) could be noticeable because of concern over deflection of the bowhead whale due to seismic survey activities and the attendant effects on subsistence harvests. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If deflection actually occurred, effects could be major.

At the regional level, offshore effects to sociocultural systems from routine activities from exploration, development and production, and decommissioning (abandonment), would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate effect. At the local level, effects from routine development could exceed a major level of effect. Additionally, effects from a large oil spill would exceed a major level of effect, because noticeable disruption in excess of 2 years could occur from a large spill when combined with cleanup activities. The effects of this disruption would last beyond the period of cleanup and would represent a chronic disruption of social organization, cultural values, and institutional organization. The effects would have a tendency to displace existing social patterns. State and Federal mitigation measures should prove effective in ameliorating many of the cumulative effect discussed. Social systems will successfully respond and adapt to the change brought about by the introduction of these activities. If development and production occur, the accommodation response in itself could represent a major impact to social systems.

On and offshore, as the area impacted by oil development in the future increases, especially in proximity to local communities; cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, and Atqasuk currently depend on subsistence caribou harvest from the CAH and TCH; additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns, including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources; social bonds; and cultural values. If oil and gas development occurs near the north shore of Teshekpuk Lake, and is connected by roads and pipelines to the Alpine field, an important subsistence use area used by residents of Nuiqsut, Barrow, and Atqasuk could be avoided by subsistence users. Traffic that occurred north and south of Nuiqsut could isolate the community from subsistence resource harvest areas and could prevent residents from using their homelands, subsistence cabins and camps, and unspoiled open areas for resource harvests and pursuits. This would further degrade the quality of life and connection of people with their land and environment. Similar potential effects to Wainwright could result from the construction of onshore landfall and processing facilities and a pipeline connecting this facility to TAPS (USDOI, BLM, 2004a; USDOI, BLM and MMS, 1998).

Industrialization clearly displaces subsistence users from traditional use areas even if no legal impediments to access are imposed (NSB, 2003). Essentially, potential effects include disturbance of traditional use and archaeological sites, such as hunting, fishing, and whaling camps, by construction and the increased possibility for vandalism. Any effects to these resources would have a corresponding and proportional effect on cultural value. If development occurred in areas containing concentrations of subsistence cabins, camps, and traditional use sites and subsistence resources experienced only minor impacts, subsistence users would be displaced and impacts would be expected to be far greater. Onshore, the BLM expects its subsistence stipulations to mitigate potential exploration and development conflicts with subsistence cabins, camps, and use sites (USDOI, BLM and MMS, 2003; USDOI, MMS, 2007d).

If a large spill contacted and extensively oiled coastal habitat, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Such impacts would be considered major. All subsistence whaling communities and other communities that trade for and receive whale products and other resources from the whaling communities could be affected. A large spill anywhere within the habitat of bowhead whales or other important marine mammal subsistence resources could have multiyear impacts on the harvest of these species by all communities that use them. In the event of a large oil spill, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. In addition, harvests could be affected by the IWC, which could decide to limit harvest quotas in response to a perceived threat to the bowhead whale population (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003).

Beyond the impacts of a large spill, long-term deflection of whale migratory routes or increased skittishness of whales due to increasing seismic surveys and industrialization in the Beaufort Sea would make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of have bowheads have been demonstrated although a predominant concern continues to be potential disruption associated from seismic survey noise on subsistence-harvest patterns, particularly on the bowhead whale—a pivotal species to the Inupiat culture. Such disruptions could impact sharing networks, subsistence task groups, and crew structures, as well as cause disruptions of the central Inupiat cultural value: subsistence as a way of life. These disruptions also could cause a breakdown in family ties, the community's sense of well-being, and could damage sharing linkages with other communities. Such disruptions could seriously curtail community activities and traditional practices for harvesting, sharing, and processing subsistence resources—a major impact on sociocultural systems (USDOI, MMS, 2006a).

Onshore, because Nuiqsut is relatively close to oil development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community—a major effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. This same potential exists for the communities of Kaktovik, Barrow, Atqasuk, and Wainwright as Beaufort and Chukchi Sea areawide leasing, exploration, and development proceeds on- and offshore. Impacts of this magnitude in Point Lay and Point Hope remain speculative because of the lack of ongoing or planned industrial development near these communities on the Chukchi coast. Any potential effects to subsistence resources and subsistence harvests and consequent impacts on sociocultural systems are expected to be mitigated substantially, though not eliminated (USDOI, MMS, 2003a, 2004, 2006b).

Because of impacts from climate change to long-standing traditional hunting and gathering practices that promote health and cultural identity, and, considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope peoples would experience cultural stresses, as well as impacts to population, employment, and local infrastructure. The termination of oil activity could result in the outmigration of non-Iñupiat people from the North Slope, along with some Iñupiat who may depend on higher levels of medical support or other infrastructure and services than may be available in a fiscally constrained, postoil production environment. If subsistence livelihoods are disrupted, Inupiat communities could face increased poverty, drug and alcohol abuse, and other social problems resulting from a loss of relationship to subsistence resources, the inability to support a productive family unit, and a dependence on non-subsistence foods (Langdon, 1995, Peterson and Johnson, 1995, National Assessment Synthesis Team, 2000, IPCC, 2001).

As stated by Parson et al. (2001): "It is possible that projected climate change will overwhelm the available responses." It also is realistic to expect that some general assistance could be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts. If present rates of climate change continue, impacts to subsistence resources and subsistence harvests—and consequent impacts on sociocultural systems—would be expected to be major (USDOI, MMS, 2006b, 2007d).

4.5.2.14. Archaeological Resources.

Summary. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. For onshore archaeological resources, the potential for effects increases with oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects mitigated; therefore, only negligible to minor impacts on archaeological resources are anticipated.

For a detailed assessment of effects to archaeological resources in the Chukchi Sea Planning Area, see the regional discussion in Section 4.4.2.14, Effects from Beaufort Sea Alternative2. That discussion provides an archaeological resources effects analysis for both the Beaufort and Chukchi Sea Planning Areas.

4.5.2.15. Environmental Justice. The following analysis describes only the anticipated effects on Environmental Justice (EJ) that most likely would occur if MMS opens the entire lease sale area (no deferrals) in the Chukchi Sea Planning Area. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and environmental factors, etc.) described in Sections 4.4.1.12.2 and 4.4.1.15.3. Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until another commercially viable discovery is made in the OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects on EJ if such a discovery is made and proposed for development in the more distant future.

Impacts to EJ could occur from disturbance and noise to subsistence resources and practices, sociocultural systems, and associated effects on public health in the coastal communities of Barrow, Wainwright, Point Lay, and Point Hope. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects on subsistence resources and practices, sociocultural systems, and associated effects on public health, and produce consequent major impacts on EJ.

For routine activities from exploration, development and production, and decommissioning (abandonment), effects to sociocultural systems would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level, a moderate level of effect to sociocultural systems and EJ.

4.5.2.15.1. Anticipated Effects Under Alternative 2. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects described in Sections 4.4.1.15.2.1-11 and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.5.1-11. This section describes the impacts to EJ resulting from the incremental impact of this action, the Proposed Action, and adding it to other past, present, and reasonably foreseeable future actions regardless of what agency undertakes such actions. Reasonably foreseeable future actions are described in Section 4.2. Mitigation measures are described in Sections 4.4.1.12.2 and 4.4.1.15.3. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems. All of these effects would be experienced primarily by the subsistence-dependent minority Iñupiat population.

4.5.2.15.1.1. Anticipated Effects from Disturbance. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from vessel and aircraft disturbance described in Section 4.4.1.15.2.1, the same anticipated effects described in Sections 4.4.1.15.5.1, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Public health in the Chukchi Sea Planning Area is subject to the same potential public health effects from vessel and aircraft disturbance previously described in Sections 4.4.1.15.2.1 and the same anticipated effects and cumulative past, present, and reasonably foreseeable future effects described there. This section analyzes the impact of the Proposed Action, added to other past, present, and reasonably future foreseeable future actions regardless of what agency or entity undertakes such actions.

Under the Proposed Action, during the exploration phase for Chukchi Sea sales, Barrow and Wainwright would be used as air-support bases for offshore operations. Personnel and freight would be transferred at either location for the helicopter flights to offshore locations. There could be between one and three flights a day, depending on the level of offshore activity. Chukchi Lease Sale 193 predicted that for oil and gas activities on tracts leased in this sale, there could be 4 helicopter flights per day for seismic exploration, 13 per day for exploration drilling, 5 per day during shore-base construction, and 2 per day for production. The existing facilities at Barrow and Wainwright appear sufficient to meet these needs. Vessels used in support of exploration activities staging out of Barrow would have to anchor offshore, as Barrow has no port facilities (USDOI, MMS, 2007d). The development of a shore base near Wainwright also could lead to increased barge traffic in the region during the open-water season, and ice road traffic during the winter months.

As described in sections 4.4.1.15.2.1, disturbance can cause or exacerbate noise-related health problems such as developmental delay and poor school performance, high blood pressure, cardiovascular disease, annoyance and stress, and effects related primarily to impacts to the subsistence harvest. If belugas acclimated to offshore disturbance and seismic, Point Lay's beluga harvest could be substantially reduced, increasing the risk of nutritional health effects, food insecurity, and diet-related diseases such as diabetes, high blood pressure, and cardiovascular disease. The EPA has established 24-hour average noise thresholds as follows: 45 dB indoors and 55 dB outdoors are the upper limits of noise that permit normal activity (sleeping, conversing, working) without interference; 70 dB is the threshold beyond which chronic exposure may cause hearing loss (EPA, 2007). Noise levels in the village that exceeded EPA recommended levels could have adverse health effects. An adverse effect on subsistence, such as a decline in beluga harvest over more than one season, also would have impacts on psychosocial health problems and well-being. If subsistence effects impacted a resource that contributes substantially to the local diet, effects on public health would be moderate if the impact lasted one season, and major if the impact were ongoing. Existing mitigation measures and their effectiveness are discussed in Section 4.4.1.15.3, and potential new measures are discussed in Appendix J. Mitigation for public health would not eliminate the risk if subsistence impacts were ongoing.

4.5.2.15.1.2. Anticipated Effects from Discharges. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from discharges described in Section 4.4.1.15.2.2, the same anticipated effects described in Sections 4.4.1.15.5.2, and the same cumulative past, present and reasonably foreseeable actions previously described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects described in Sections 4.4.1.15.2.2 and the same cumulative past, present, and reasonably foreseeable future effects described there. Differences in discharge-related health effects relate to the notable differences in the Chukchi environment, such as ocean currents, temperatures, benthic ecology, and macrofauna biology. These characteristics could influence the reactions that drive bioavailability, the distribution, and the fate of discharges. There are relatively few baseline data on which to rely in the Chukchi environment. If discharges caused contamination of subsistence resources or widespread community concern and uncertainty regarding the safety of subsistence resources, major effects to nutritional health, chronic diseases such as diabetes and high blood pressure, and psychosocial well-being could result. Existing mitigation measures and their effectiveness are discussed in Section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.3. Anticipated Effects from Oil Spills. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from oil spills described in Section 4.4.1.15.2.3, the same anticipated effects described in Sections 4.4.1.15.5.3, and the same cumulative past, present and reasonably foreseeable actions previously described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems. The potential for oil spills to contact subsistence resources and harvest areas in the Chukchi Sea Planning Area was discussed in the oil-spill analysis for subsistence-harvest patterns in Section 4.5.2.12.1.4. While spills can occur on land or in the marine environment, spills to the marine environment have the greatest potential to affect marine mammals important for the subsistence harvest. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems. The same mitigation measures described in Section 4.4.1.12.2 would be implemented for the proposed lease sales. A large spill from a well blowout is described as a very unlikely event, and no large oil spills are assumed to occur during exploration (see Section 1.1.4).

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from large oil spills described in section 4.4.1.15.5.2.3 and the same cumulative past, present, and reasonably foreseeable future effects described there. If a spill actually occurred, the anticipated public health effects from a large spill under this alternative would be the same as the effects described in Section 4.4.1.15.5.3. This section also presents the results of the OSRA for this alternative. Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.4. Anticipated Effects from Oil-Spill Response and Cleanup. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from oil spill response and cleanup described in Section 4.4.1.15.2.4, the same anticipated effects described in Sections 4.4.1.15.5.3, and the same cumulative past, present and reasonably foreseeable actions previously described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from oil-spill response and cleanup previously described in Sections 4.4.1.15.2.4. and the same cumulative past, present, and reasonably foreseeable future effects described there. As discussed in Section 4.5.1.15.2.4, effects in the Chukchi Sea region could differ from those in the Beaufort Sea region in that the influx of personnel for response would be more likely to pass through local villages. Whether the personnel required for response to a large spill would be accommodated in an enclave such as a shore base or offshore production facility or in local villages is uncertain. Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.5. Anticipated Effects from Airborne Emissions. Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from airborne emissions described in Sections 4.4.1.15.2.5 and the same cumulative past, present, and reasonably foreseeable future effects described there. The addition of new leased areas under this alternative might increase the likelihood of active exploration in the Chukchi Sea region (and associated emissions), and might increase the chance of a large oil discovery and ensuing development and production. Also, under the Proposed Action (although this also could occur through activity on existing Chukchi Sea leases), a shore base would be an additional source of emissions. The impact from air quality on the health of local residents—particularly in Wainwright—would depend on the type and amount of pollutants emitted, prevailing winds, climate and weather, location of major emissions sources relative to communities and relative to important subsistence use areas, and the baseline health status of residents in the community (sensitive populations include the very young, elderly, and people with chronic illnesses). Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.6. Anticipated Effects from Seismic Surveys. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from seismic surveys described in Section 4.4.1.15.2.6, the same anticipated effects described in Sections 4.4.1.15.5.6, and the same cumulative past, present and reasonably foreseeable actions previously described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from seismic surveys described in Sections 4.4.1.15.5.6 and the same cumulative past, present, and reasonably foreseeable future effects described there. Impacts to public health from seismic surveys would relate mainly to subsistence impacts, as described in Section 4.4.1.15.5.6. Up to four seismic surveys (both 2D and 3D) could be conducted seasonally in the Chukchi Sea Planning Area during the open-water season. Conflict avoidance agreements (CAAs) between the AEWC and oil operators conducting one or perhaps two seismic-survey operations per open-water season have tended to mitigate disruptions to the fall hunt in these communities in the past, but the magnitude of three concurrent seismic surveys and the changing protocols of the CAA process would test the ability of survey operators and whalers to coordinate their efforts to prevent disruptions to the hunt. Barrow's fall bowhead whale hunt could be particularly vulnerable. Noise effects from multiple seismic surveys to the west in the Chukchi Sea and to the east in the Beaufort Sea potentially could cause migrating whales to deflect farther out to sea, forcing whalers to travel farther—increasing the effort and danger of the hunt—and increasing the likelihood of whale-meat spoilage, as the whales would have be towed from greater distances. If seismic activity resulted in reduced harvest success, or deflected whales farther offshore, there could be a number of health effects, including: (1) increased risk of injury for whaling crews having to travel father offshore to locate and successfully strike whales; (2) impacts to the nutritional system, which could increase food insecurity and nutritional deficiencies, particularly if the subsistence impacts took place over more than one season; (3) decreases in harvest amounts of key subsistence species if they were chronic, could incrementally increase the risk of diabetes and other chronic diseases This effect would be particularly serious if more than one village were affected, because sharing networks would be less likely to be able to compensate for the loss. Effects would be major if serious injuries resulted, or if chronic disruption of subsistence led to dietary change. Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.7. Anticipated Effects from Habitat Loss. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from habitat loss described in Section 4.4.1.15.2.7, the same anticipated effects described in Sections 4.4.1.15.5.7, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from habitat loss described in Sections 4.4.1.15 and the same cumulative past, present, and reasonably foreseeable future effects described there. Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.8. Anticipated Effects from Onshore Development. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from onshore development described in Section 4.4.1.15.2.8, the same anticipated effects described in Sections 4.4.1.15.5.8, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.8. Onshore development in the region is considered speculative. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

4.5.2.15.1.9. Anticipated Effects from Economic, Employment, and Demographic Change. Public health in the Chukchi Sea Planning Area would be subject to the same potential effects from economic, employment, and demographic change described in Sections 4.4.1.15.2.9 and the same anticipated effects described in there, which will be reviewed and summarized here. Wainwright could experience major effects. Noticeable disruption most likely would result during development from the placement of onshore infrastructure (a shore base), with the most prominent effect being the change in land use that comes about by introduced industrialization. Wainwright could experience other effects to social organization, cultural values, and institutional organization, as well, for a period exceeding 2-5 years. Economic and employment effects could involve some increases in direct and indirect employment; income from employment; opportunities for local business and Native corporation revenues; and the potential for inflation. Influx of nonresidents to and through communities could also lead to cultural strain, and place a stress on local infrastructure and services. The importation, possession, and sale of alcohol are prohibited in Wainwright. Enforcement of this prohibition by public safety officers at originating airports in Alaska (e.g., Anchorage, Fairbanks, and Barrow) and at Wainwright would need to increase with the frequency of flights: this could place a stress on the finances of the NSB, and could increase the risk of illicit drug and alcohol importation. New roads or ice roads linking the community with the shore base or the Alaska road system could compound this risk. Communities in California that have OCS-related onshore infrastructure established impact monitoring and mitigation programs with industry. These programs ascertained the effects and recovered costs for services provided by local government (USDOI, MMS, 2000b). These monitoring and mitigation programs and other measures have facilitated project approval when there is uncertainty over the cause and effect of project-related impacts, and North Slope communities could benefit from a similar program (Woolley and Lima, 2003; USDOI, MMS, 2007d). Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures are discussed in Appendix J.

4.5.2.15.1.10. Anticipated Effects from Production Activity. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from production activity described in Section 4.4.1.15.2.10, the same anticipated effects described in Sections 4.4.1.15.5.10, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.8. It should be noted that production activity in the Chukchi Sea region is still considered speculative. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

4.5.2.15.1.11. Anticipated Effects from Climate Change. Environmental justice in the Chukchi Sea Planning Area is subject to the same potential effects from climate change described in Section 4.4.1.15.2.11, the same anticipated effects described in Sections 4.4.1.15.5.11, and the same cumulative past, present and reasonably foreseeable actions described in Sections 4.4.1.15.8. Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Because potential climate change impacts on marine and terrestrial ecosystems in the Arctic would cause significant impacts on subsistence resources, traditional culture, and community infrastructure, subsistence-based indigenous communities in the Arctic and on Alaska's North Slope would be expected to experience disproportionate, high adverse environmental and health effects. See Section 4.4.1.12.4.11 for a discussion of cumulative global climate change impacts on subsistence-harvest patterns.

Public health in the Chukchi Sea Planning Area would be subject to the same potential and anticipated effects from climate change described in Sections 4.4.1.15.2.11 and the same cumulative past, present, and reasonably foreseeable future effects described there. In the Chukchi region, changes in the biological and physical environment that could profoundly shape the health of the region are already apparent, and are likely to accelerate in coming decades (ACIA, 2005; IPCC, 2007). Shore erosion in Shishmaref, Kivalina, Wainwright, and Barrow has become increasingly severe in recent years, as sea-ice formation occurs later, allowing wave action from storms to cause greater damage to the shoreline. The NSB, Dept. of Wildlife Management notes more frequent reports of species not commonly seen in the Chukchi Sea region, such as humpback, fin, and minke whales and narwhals in recent years, which may indicate that new species are entering the region from the Bering or Beaufort seas and could relate to climate change (Rosa, 2008, pers. commun.) The biological significance of these reports as far as the stability of the ecosystem, and how these changes might interact with oil and gas activities, is not known.

4.5.2.15.2. Direct and Indirect Effects Under Alternative 2. The following analysis describes only the anticipated effects on EJ that would most likely occur if the MMS opens the entire lease sale area (no deferrals) in the Chukchi Sea Planning Area. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and environmental factors, etc.) described in Sections 4.4.1.12.2 and 4.4.1.15.3. Development and production activities could result from leases offered under the proposed lease sales. Production, however, is not anticipated until another commercially viable discovery is made in the OCS. Production is not reasonably foreseeable, but those activities associated with a speculative production project were analyzed to determine the anticipated effects to EJ if such a discovery is made and proposed for development in the more distant future.

Impacts to environmental justice could occur from disturbance and noise effects to subsistence resources and practices and sociocultural systems in the coastal communities of Barrow, Wainwright, Point Lay, and Point Hope. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Major effects on subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects to subsistence resources and practices and sociocultural systems and produce consequent major impacts to EJ.

Effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from oil exploration and development activities, from changes in population and employment, and subsistence harvest patterns. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems (USDOI, BLM and MMS, 2003; USDOI, MMS, 2006b). Anticipated effects would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices and sociocultural systems.

Anticipated direct and indirect effects to public health most likely would affect the communities of Barrow, Wainwright, Point Lay, Point Hope, and Kivalina and Chukchi coastal communities in the Russian Arctic; Wainwright potentially being the most affected community because of activities and facilities associated with construction and operation of a shore base facility. The anticipated effects consider mitigation measures and other important factors (timing, residence time and productivity, spatial extent, and also environmental factors).

Direct effects to public health could occur from exposure to contaminants through discharges, emissions, or oil spills during exploration, development, or production. A large oil spill contacting subsistence resources is possible in this scenario (see Section 4.5.2.1.2.5 for the OSRA discussion). Noise associated with disturbance from increased air traffic could disrupt community well-being. An influx of nonresident workers (detailed in Section 4.5.2.11 and subsections and Section 4.5.2.13) could lead to decreased community cohesion. Projects in the planning area would operate under NPDES and NAAQS standards, which are promulgated to protect health. Furthermore, most major emissions sources under this alternative would be located far from communities, either offshore or using existing industrial infrastructure onshore. Nevertheless, vulnerable groups (elders, young children, and people with chronic illnesses) may suffer adverse outcomes at levels of pollution substantially below these standards. The most likely scenario would be intermittent exposure from hunting activities, and possibly lower-level exposure under specific climate conditions, which could produce moderate adverse health effects.

The entire planning area would be open to leasing without deferrals under this alternative, raising the chance that subsistence resources, harvests, or practices could be disrupted; disturbance from aircraft and vessels would be a factor throughout the life of the sale; up to four concurrent seismic operations would be permitted seasonally in the Chukchi Sea under this alternative; production platforms and activity, and onshore operations to support OCS development and production, if it occurred, could also displace subsistence resources. Subsistence impacts are associated with the following potential health effects: (1) Undermine the protective aspects of the culture and social structure provided by subsistence, incrementally contributing to already elevated rates of social and psychological health problems. (2) Food security could increase even with a major exploration proposal or with actual subsistence impacts. (3) If harvest of one or more resources were restricted for more than one season, nutritional deficiencies could result. (4) Increased accidents and injuries if subsistence hunters had to travel longer distances to contact resources, or if whales exhibited less predictable or more agitated behavior because of disturbances from activities under this alternative.

An influx of nonresident workers under this alternative (shown in Tables 4.4.2.11-1 and 4.4.2.11-2) could intensify cultural conflict and could undermine community cohesion, increasing the risk of psychosocial problems. An influx of nonresidents to and through communities also could place a stress on local infrastructure and services. The importation, possession, and sale of alcohol are prohibited in Wainwright. Enforcement of this prohibition by public safety officers at originating airports in Alaska (e.g., Anchorage, Fairbanks, and Barrow) and at Wainwright would need to increase with the frequency of flights: this could place a stress on the finances of the NSB, and could increase the risk of illicit drug and alcohol importation. New roads or ice roads linking the community with the shore base or the Alaska road system could compound this risk. An influx of nonresident workers from outside the region also poses the risk of infectious disease transmission between low and high prevalence groups.

The modest economic and employment effects predicted in Section 4.5.2.11 would contribute to stabilizing the NSB economy but may not offset gradual declines in revenues and employment from onshore oil and gas activity. Economy and employment are generally associated with improved overall health and less psychosocial strain. Economic inputs also would help prevent deterioration of water and sanitation infrastructure, and could stabilize health and other services provided by the NSB.

The AAMPs and IHAs could reduce the risk of deflecting subsistence resources, but their efficacy has not been tested under conditions of multiple, concurrent activities in the region. Existing mitigation measures and their effectiveness are discussed in section 4.4.1.15.3, and potential new measures proposed by NSB are presented in Appendix J.

Conclusion. Effects from anticipated 3D seismic surveys and exploration should not exceed moderate effects levels. For 3D and 2D seismic surveys and exploration, which are projected to occur for at least 3 years, effects to sociocultural systems and consequent impacts to EJ are expected to be moderate. Effects to social well-being (social systems) could be noticeable because of concern over deflection of the bowhead whale due to seismic-survey activities and the attendant effects on subsistence harvests. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If deflection actually occurred, effects could be major.

For routine activities from exploration, development and production, and decommissioning (abandonment), effects to sociocultural systems would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate level of effect on sociocultural systems and EJ.

For large oil spills, noticeable disruption in excess of 2 years could occur from a spill and from cleanup activities. The effects of this disruption would last beyond the period of cleanup and would represent a chronic disruption of social organization, cultural values, institutional organization, and produce associated effects on public health. Such major sociocultural impacts would have a tendency to displace existing social patterns and would represent disproportionate high adverse EJ impacts on subsistence-based Alaska Native coastal communities in the region. Mitigation measures should prove effective in ameliorating many of these effects.

Major effects to subsistence resources and harvests, particularly from routine concurrent seismic surveys, would be anticipated, but mitigation measures described in Section 4.4.1.12.2 would be expected to avoid and minimize these effects to a moderate level. Potential long-term impacts from climate change would be expected to exacerbate overall potential effects to subsistence resources and practices, sociocultural systems, and associated effects on public health, and produce consequent major impacts to EJ.

4.5.2.15.3. Cumulative Effects Under Alternative 2. Effects to subsistence resources and practices were discussed in Sections 4.4.1.12. and 4.5.1.12; effects to sociocultural systems were discussed in Sections 4.4.1.13 and 4.5.1.13; the same activities would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices, sociocultural systems, and associated effects on public health.

Summary. Anticipated effects under the Proposed Action are combined with the anticipated effects under the no-action alternative to determine the cumulative effects under this alternative. The noise-producing exploration and construction activities are those most likely to produce disturbance effects to critical subsistence species that include bowhead and beluga whales, caribou, fish, seals, and birds. Disturbance effects would be associated with aircraft and vessel noise, construction activities, and oil spills; specifically: (1) seismic surveys that occur prior to an oil and gas lease sale; (2) aircraft support of exploration and development activities; (3) possible vessel supply and support of exploration and development activities; (4) drilling activities during the exploration and development and production phases; and (5) onshore construction, including pipeline, road, support-base, landfall, and pump-station construction. Noise and traffic disturbance would be a factor throughout the life of the sale.

Effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from oil exploration and development activities, oil spills and oil-spill cleanup, changes in population and employment, and subsistence harvest patterns; accompanying changes to subsistence-harvest patterns, social bonds, cultural values, and associated effects on public health would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources. However, such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems but community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill (USDOI, BLM and MMS, 2003, USDOI, MMS, 2006b).

Offshore exploration in the Chukchi Sea region is expected to increase, with lease sales planned for the near future by MMS in this offshore area; development in the region is still considered speculative. Effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope might result from seismic-exploration activities. Because the seismic-survey activities are vessel based, stresses to local village infrastructure, health care, and emergency response systems are expected to be minimal; therefore, social systems in these communities would experience little direct disturbance from the staging of people and equipment for seismic exploration. However, the possible long-term deflection of whale migratory routes or increased skittishness of whales due to seismic-survey activities in the Chukchi Sea might make subsistence harvests more difficult, dangerous, and expensive and lead to associated effects on public health. To date, no long-term deflections of bowheads have been demonstrated; however, seismic activity of the magnitude proposed has not been approached in the region since the 1980s (USDOI, MMS, 2006a; USDOI, BLM, 2005).

While it is unknown exactly how much of the offshore area would be leased in these future sales, several ship-based exploratory seismic operations were conducted during the open-water seasons in 2006 and 2007, resulting in conflicts with marine mammal hunters, and concerns over the fall whaling harvest. Should offshore activity lead to a considerable decrease in success in fall whaling, it would contribute to major negative effects to the North Slope Iñupiat peoples' identity and could have culturewide and associated public health effects, effects that would lead to disproportionate high adverse EJ impacts (USDOI, BLM and MMS, 1998; USDOI, BLM, 2005).

Onshore, oil and gas leasing and development in the Chukchi Sea region is still considered speculative, and Chukchi Sea coastal communities have experienced few cumulative impacts when compared to coastal communities in the Beaufort Sea region.

Conclusion. Cumulative effects to the sociocultural systems of the communities of Barrow, Wainwright, Point Lay, and Point Hope could come from disturbance from on-and offshore exploration, development and production activities; small changes in population and employment; and disruption of subsistence-harvest patterns from seismic noise disturbance, oil spills and oil-spill cleanup, and climate change. Accompanying changes to subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but such changes would not be expected to displace sociocultural institutions (family, polity, economics, education, and religion), social organization, or sociocultural systems (USDOI, BLM and MMS, 2003; USDOI, MMS, 2006b). However, if a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003). Cumulative effects discussed above would be expected to impact EJ to the extent they adversely impacted subsistence resources and harvest practices, sociocultural systems, and produced associated effects to public health.

In this cumulative analysis, the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down (USDOI, MMS, 2003a).

Effects from anticipated 3D seismic surveys and exploration should not exceed moderate effects levels with the application of mitigation measures, especially Stipulation 5 that provides for an AMMP that reduces potential conflicts between oil industry activities and subsistence whalers. For 3D and 2D seismic surveys and exploration, which are projected to occur for at least 3 years, effects to sociocultural systems are expected to be moderate. Effects to social well-being (social systems) could be noticeable because of concern over deflection of the bowhead whale due to seismic-survey activities and the attendant effects to subsistence harvests. These concerns may translate into greater activity as various institutions seek to influence the decision making process (institutional organization). However, the combination of effects would not be sufficient to displace existing social patterns. If deflection actually occurred, effects could be major.

At the regional level, offshore effects to sociocultural systems from routine activities from exploration, development and production, and decommissioning (abandonment), would cause noticeable disruption to sociocultural systems during development, a period that would last more than 5 years. However, the combination of effects would not be sufficient to displace existing social patterns at the regional level—a moderate effect. At the local level, effects from routine development could exceed a major level of effect. Additionally, effects from a large oil spill would exceed a major level of effect, because noticeable disruption in excess of 2 years could occur from a large spill when combined with cleanup activities. The effects of this disruption would last beyond the period of cleanup and would represent a chronic disruption of social organization, cultural values, and institutional organization. The effects would have a tendency to displace existing social patterns. State and Federal mitigation measures should prove effective in ameliorating many of the cumulative effects discussed. Social systems will successfully respond and adapt to the change brought about by the introduction of these activities. If development and production occur, the accommodation response in itself could represent a major impact to social systems (see Table 4.4.1.13-1). Disproportionate high adverse environmental and health effects on subsistence-based Alaska Native coastal communities in the Chukchi Sea region—major environmental justice effects—are expected to occur only in the event of a large oil spill.

On and offshore, as the area impacted by oil development in the future increases, especially in proximity to local communities; cumulative impacts are likely to increase. For example, Barrow, Wainwright, Point Lay, and Point Hope currently depend on the subsistence caribou harvest from the WAH; additional future development may have additive impacts to the subsistence harvest from this herd leading to synergistic impacts on subsistence-harvest patterns, including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources; social bonds; and cultural values. If oil and gas development occurs in the region and is connected by roads and pipelines to TAPS, an important subsistence-use areas could be avoided by subsistence users, a process that leads to associated effects to public health, as described above. Overall, impacts to subsistence harvests and uses would arise from impacts to the availability of subsistence species in traditional use areas or a decrease in subsistence-hunting success. The reduction in subsistence-hunting success, in turn, reduces the availability of Native foods to the community. Because the Native community is the only community that depends to a significant degree on Native foods, this impact, to the extent that it occurs, falls disproportionately on the Native population. Onshore, this level of subsistence and social disruption would represent disproportionate high adverse EJ effects.

If a large spill contacted and extensively oiled coastal habitat, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Such impacts would be considered major. All subsistence whaling communities and other communities that trade for and receive whale products and other resources from the whaling communities could be affected. A large spill anywhere within the habitat of bowhead whales or other important marine mammal subsistence resources could have multiyear impacts on the harvest of these species by all communities that use them. In the event of a large oil spill, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. In addition, harvests could be affected by the IWC which could decide to limit harvest quotas in response to a perceived threat to the bowhead whale population (USDOI, MMS, 2003a, 2006b; USDOI, BLM and MMS, 2003). Such major sociocultural impacts would have a tendency to displace existing social patterns and would represent disproportionate high adverse EJ impacts on subsistence-based Alaska Native coastal communities in the region.

Beyond the impacts of a large spill, long-term deflection of whale migratory routes or increased skittishness of whales due to increasing seismic surveys and potential industrialization in the Chukchi Sea would make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of bowheads have been demonstrated although a predominant concern continues to be potential disruption associated with seismic-survey noise on subsistence-harvest patterns, particularly on the bowhead whale—a pivotal species to the Inupiat culture. Such disruptions would impact sharing networks, subsistence task groups, and crew structures, as well as cause disruptions of the central Iñupiat cultural value: subsistence as a way of life. These disruptions also could cause a breakdown in family ties, the community's sense of well-being, and could damage sharing linkages with other communities, as well as leading to associated effects on public health as described above. Such disruptions could seriously curtail community activities and traditional practices for harvesting, sharing, and processing subsistence resources—a major impact to sociocultural systems. Such sociocultural impacts would represent major EJ impacts (USDOI, MMS, 2006a).

Because of impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and, considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope and Northwest Arctic peoples would experience cultural stresses, as well as impacts to population, employment, local infrastructure, and public health. The termination of oil activity could result in the outmigration of non-Iñupiat people from the North Slope, along with some Iñupiat who may depend on higher levels of medical support or other infrastructure and services than may be available in a fiscally constrained, post-oil production environment. If subsistence livelihoods are disrupted, Iñupiat communities could face increased poverty, drug and alcohol abuse, and other health and psychosocial problems resulting from a loss of relationship to subsistence resources, the inability to support a productive family unit, and a dependence on non-subsistence foods (Langdon, 1995, Peterson and Johnson, 1995, National Assessment Synthesis Team, 2000, IPCC, 2001).

As stated by Parson et al. (2001): "It is possible that projected climate change will overwhelm the available responses." It also is realistic to expect that some general assistance could be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts. If present rates of climate change continue, impacts to subsistence resources and harvest practices, sociocultural systems, and associated effects on human health, and consequent impacts on EJ, would be expected to be major (USDOI, 2006b, 2007d).

Furthermore, potential long-term impacts on human health from contaminants in subsistence foods and ongoing and increasing social pathologies due to increasing development activities both on- and offshore would be expected to exacerbate overall potential effects on low-income, minority populations (USDOI, 2006b, 2007d).

4.5.3. Alternative 3, Chukchi Sea Coastal Deferral.

This alternative was developed by MMS as the Corridor II deferral alternative in response to scoping comments received during the Lease Sale 193 scoping process and to reduce potential conflicts between subsistence users and OCS oil and gas operations. This alternative was ultimately selected as the configuration for Sale 193 held in February 2008. This deferral alternative was also identified in scoping for this EIS. This alternative would offer for lease all of the area described for Chukchi Sea Alternative 2, except for a corridor located along the landward edge of the program area. This alternative would offer for lease 6,444 whole or partial blocks comprising approximately 35,374,261 acres (about 14.3 million hectares), minus any blocks currently leased at the time of the sale. The area deferred under this alternative consists of 882 whole or partial blocks, approximately 4,818,605 acres (about 1.9 million hectares), which is approximately 12% of the Proposed Action area. This alternative would result in a reduction of 17% of the commercial resource potential from the Proposed Action.

4.5.3.1. Water Quality. Alternative 3 would not significantly reduce the estimated oil resource or the activities associated with exploration and development and production. Therefore, this alternative does not substantially lessen the effects on Chukchi Sea water quality for any of the activities discussed in Section 4.5.2.1. There would be some reduction of the local impacts within any deferred area from construction and permitted discharges, but the risk of effects from oil spills to the deferred area would be unaffected.

Conclusion. The effects under Alternative 3 are expected to be minor to local water quality and negligible to regional water quality, the same as for the Proposed Action.

4.5.3.2. Air Quality. Effects to air quality under Alternative 3 would be essentially the same as those under Alternative 2.

4.5.3.3. Lower Trophic-Level Organisms. Part of the Coastal Deferral, Alternative 3, is located along the coast near Barrow. As explained in Section 3.3.1, planktonic habitats that are productive are located in coastal water. However, deferral of the coastal tracts would have only a small influence on the likelihood that spills would contact the coast, as documented below.

If a large spill occurs during summer near the center of the proposed lease area, the OSRA estimates a <20% chance that the spill would drift within 30 days to the U.S. Chukchi coast. The model estimates a <22% chance a large spill would drift into Russian water within 10 days, where U.S. responses might be difficult. The same chances decrease to <7 and 3% within 10 days, indicating a reduction in impacts for lower trophic-level organisms of the requirements for rapid-response capabilities (Section 4.3.1.5.5). Specifically, the OSRA model estimates up to a 7% chance that a large spill from nearshore launch areas would contact the U.S. Chukchi coastline within 10 days during summer (Appendix A, Table A.3-32). The likelihood is up to 6% without LAs 11, 12, and 13 in the deferral area. Therefore, the level of effects to lower trophic-level organisms would be slightly lower under this alternative.

If a large spill did contact the Alaska coastline, the hydrocarbons would likely affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for more than a decade. Some lower trophic-level organisms would experience a larger effect than others.

Conclusion. Three aspects of the lease sales without coastal leases that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells may likely be local and minor. Any exploratory discharges during summer likely would have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL on pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the level of effect would be minor due to the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. Therefore, the cumulative level of effect, including the effect of ongoing climate change, would be major under this alternative. The extent to which this deferral reduces the cumulative effects to lower trophics compared to Alternative 2, the Proposed Action, would be negligible. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.3.4. Fish Resources.

Summary. The deferral reduces the size of the sale area, but it was not specifically designed to minimize adverse effects to fish resources. This deferral would serve to protect fish resources and fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large oil spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative would result in reduced adverse effects for certain fish resources, but an overall minor level of adverse effect is anticipated.

4.5.3.4.1. Potential Effects to Fish Resources. The potential effects to fish resources in the Chukchi Sea were described in Section 4.5.1.4.1.

4.5.3.4.2. Mitigation Measures. The potential effects can be moderated by application of the mitigation measures identified in Section 4.5.2.4.2.

4.5.3.4.3. Anticipated Effects Under Alternative 3. This deferral reduces the size of the lease-sale area, but it was not specifically designed to minimize adverse effects to fish resources. This deferral could serve to protect fish resources and fish habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large oil spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative would result in reduced adverse effects for certain fish resources, but an overall minor level of adverse effect is anticipated. The extent to which this deferral reduces the cumulative effects to fish resources compared to Alternative 2, the Proposed Action, would be negligible.

4.5.3.5. Essential Fish Habitat.

Summary. This deferral area was not specifically designed to minimize adverse effects to EFH; however, the deferral would serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. A nearshore deferral could serve to delay the time it would take for a large offshore oil spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to EFH. To the extent that salmon habitats are separated from adverse effects, this alternative would result in a somewhat reduced level of adverse effect for certain resource categories, but an overall minor level of adverse effect is anticipated.

4.5.3.5.1. Potential Effects to Essential Fish Habitat. The potential effects to EFH in the Chukchi Sea lease sale area were described in Section 4.5.1.5.1.

4.5.3.5.2. Mitigation Measures. The potential effects would be moderated by application of the mitigation measures identified in Section 4.5.2.5.2.

4.5.3.5.3. Anticipated Effects Under Alternative 3. Deferral areas are not specifically designed to minimize adverse effects to EFH; however, deferrals could serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. A nearshore deferral could serve to delay the time it would take for a large offshore oil spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to EFH. To the extent that salmon habitats are separated from adverse effects, this alternative would result in a somewhat reduced level of adverse effect for certain resource categories, but an overall minor level of adverse effect is anticipated. The extent to which this deferral reduces the cumulative effects to EFH compared to Alternative 2, the Proposed Action, would be negligible.

4.5.3.6. Threatened and Endangered Species.

4.5.3.6.1. Threatened and Endangered Whales.

Summary. Endangered Species Act-listed whales that can occur within or near the Chukchi Sea Planning Area or that could potentially be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. The direct, indirect, and cumulative adverse effects under Alternative 3 may improve slightly over those noted under Alternative 2, the Proposed Action (Section 4.5.2.6.1), but reductions in impacts are not substantial, and effects are considered to be the same (negligible to minor) as under Alternative 2. After reviewing the current status of endangered bowhead, fin, and humpback whales, the environmental baseline for the action area, the Proposed Action, and the cumulative effects, it is NMFS's biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that Alternative 3 is not likely to jeopardize the continued existence of Western Arctic bowhead whales, North Pacific fin whales, or humpback whales. No critical habitat has been designated for these species; therefore, none will be affected. The NMFS concludes at this time, there is reasonable likelihood that oil and gas development and production in the Beaufort and Chukchi seas, as described, would not violate Section7(a)(2) of the ESA (NMFS, 2008c).

The following analysis describes potential adverse effects to endangered whales from OCS activities associated with oil and gas exploration and development activities as described in Section 2.4.5, Scenario for the "Typical" Chukchi Sea lease sales (Sales 212 and 221) in Section 4.5.1.6.1.1, mitigation measures to avoid or minimize potential adverse effects to endangered whales in Section 4.5.1.6.1.2, and the anticipated effects resulting from application of mitigation to potential adverse effects in Section 4.5.1.6.1.3. Anticipated effects discussed herein consider mitigation measures applied to determine the effects under Alternative 3, the Coastal Deferral, on bowhead, fin, and humpback whales. In this section, we address the important differences between the Proposed Action (Alternative 2) and this alternative.

4.5.3.6.1.1. Potential Effects to Threatened and Endangered Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified under Alternative 3, the Coastal Deferral, that could occur if the entire Chukchi Sea Planning Area, except the Coastal Deferral area, would be open to proposed lease sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain identical for all Alternatives including the Coastal Deferral and will not be repeated here.

4.5.3.6.1.2. Mitigation Measures. The measures listed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.2 are applied, as appropriate, to OCS activities to protect ESA-listed whales and other marine mammals during Federal seismic and exploratory drilling in the Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities associated with all alternatives for Lease Sale 221 and 221, including the Coastal Deferral.

4.5.3.6.1.3. Anticipated Effects Under Alternative 3. This section describes the important differences in the anticipated effects between the Proposed Action (Alternative 2) and the Coastal Deferral (Alternative 3). Anticipated effects consider mitigation measures, specific biological and activity characteristics discussed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.2.

4.5.3.6.1.4. Conclusions.

4.5.3.6.1.4.1. Direct and Indirect Effects Under Alternative 3.

Summary. This deferral would reduce impacts to bowhead whales during the spring and fall migration periods and summer-fall feeding aggregations of bowheads and humpback whales. Potential displacement from important prey concentrations and feeding would be reduced slightly from reduction in noise and vessel traffic related to OCS lease activities on the lease blocks identified in the deferral. The deferral further would buffer the contiguous areas south of the deferral by increasing the distance (effectively decreasing exposure to high noise levels) between potential activities on OCS lease blocks farther north. The effects analysis and conclusions are slightly improved. The effects under this alternative would not result in detectable population-level effects. Some whales would maintain or slightly improve nutrient and energy intake over the life of the Proposed Action, but effects are considered to be the same as under Alternative 2.

This alternative would defer 882 full or partial lease blocks along the southern boundary of the Chukchi Sea Planning Area (Figure 2-2). The primary reduction in impacts of this deferral would be to exclude disturbance and collision impacts to endangered whales arising from exploration activities in these blocks for the remainder of the 5-Year Program period. These sources of potential adverse effects would not occur within or adjacent to the important spring lead system migration and calving corridor of bowhead whales. Feeding habitats and fall migration would be slightly less impacted by a reduction in area subject to oil and gas exploration, development, and production noise that would have been associated with leases in the deferral area. While development is considered speculative, the increased distance between potential offshore launch areas and nearshore whale habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. The OCS-related infrastructure (pipelines) to transport product still could occur on these blocks and potential for petroleum spills from these and vessel fuel spills still could occur. Anticipated direct and indirect effects under Alternative 3 are anticipated to be the same under Alternative 2, the Proposed Action.

4.5.3.6.1.4.2. Cumulative Effects Under Alternative 3.

Summary. The cumulative effects of this alternative are considered to be the same as for Alternative 2.

As explained in Section 4.4.6.3.3, Direct and Indirect Impacts under Alternative 3, the Coastal Deferral would reduce impacts to endangered whales during the bowhead migration periods and period of concentrated summer-fall feeding; however, those reductions in impacts and the effects analysis and conclusions are only slightly improved compared to those under Alternative 2 and would not allow oil- and gas-related activities during periods when endangered whales are not present or accessing petroleum resources via extended-reach technology from adjacent active lease blocks. The reduced impact level reduces slightly the total cumulative effect. Impacts to endangered whales and habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue to have an adverse, moderate level of effect on whales. The greatest source of large, noncrude oil spills would continue to come from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could increase the potential for vessel-whale collision, marine accidents, and large fuel spills, which could result in major adverse effects on endangered whales in the Chukchi Sea. Climate change is likely to continue and, although speculative and unpredictable at this time, effects may be positive and/or adverse to endangered whales or their habitat in the Chukchi Sea. Anticipated cumulative impacts would be the same under Alternative 3 as those under Alternative 2, the Proposed Action.

4.5.3.6.2. Threatened and Endangered Birds.

Summary. In the following analysis, we determined that this deferral would reduce the size of the lease-sale area, and there could a reduced level of direct or indirect effects compared to Alternative 2; there would be a negligible level of effect from vessel presence and noise, aircraft presence and noise, seismic airgun noise, petroleum spills, increased bird predator populations, subsistence hunting, and habitat loss; and a minor level of effect from collisions with structures. Mitigation measures imposed by MMS avoid or minimize adverse effects to ESA-listed birds in the Chukchi Sea. While MMS-authorized actions could result in a small incremental increase in or longer duration of some activities, the total effect would be proportionately lower when compared to other unrestricted activities in the area. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1, and the resultant levels of effect are the same as under Alternative 1. While the greatest potential for a major level of cumulative effects is associated with continuing physical changes in the arctic environment, this deferral alternative would not result in a direct effect on climate change.

4.5.3.6.2.1. Potential Effects to Threatened and Endangered Birds. The potential effects are the same as those described in Section 4.4.1.6.2.1 and 4.5.1.6.2.1.

4.5.3.6.2.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, except that specific measures to minimize disturbance effects to eiders in the spring lead system/Ledyard Bay Critical Habitat Area (LBCHA) during exploratory drilling would not be necessary, because these areas would not be available for leasing.

4.5.3.6.2.3. Anticipated Effects Under Alternative 3.

4.5.3.6.2.3.1. Direct and Indirect Effects of Selecting Alternative 3. This deferral would reduce the size of the lease-sale area, and there could a reduced level of direct or indirect effects compared to Alternative 2. This alternative provides the largest reduction in impact to ESA-protected birds by excluding the largest sources of potential adverse effects away from habitats used extensively by ESA-protected birds. It would preclude exploration and production drilling from designated critical habitat as well as adjacent staging, migration, and rearing habitats. This alternative has the same southern boundary as was recently selected for Lease Sale 193. The adverse effects are lessened compared to Alternative 2.

While development is considered speculative, the increased distance between offshore development and coastal bird habitats conceivably would decrease the percent chance of spilled oil contact with important bird habitats, increase weathering of spilled oil prior to contact, and increase available spill-response time.

4.5.3.6.2.3.2. Cumulative Effects Under Alternative 3. As described in Section 4.5.3.6.2.3.1, this deferral alternative has the same southern boundary as was recently selected for Lease Sale 193 and is anticipated to reduce direct and indirect effects to ESA-protected birds. These reduced effects also would reduce the cumulative effect to a minor level compared to Alternative 2. Impacts to ESA-listed birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to eiders in nearshore areas from unrestricted vessel and low-flying aircraft traffic (all unrelated to OCS leasing activities) would continue to have a negative, but minor level of effect on ESA-protected birds. The greatest source of large, noncrude oil spills would continue to arise from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on ESA-protected bird populations in the Chukchi Sea. Continued climate change is anticipated to result in a major level of effect to threatened and endangered birds. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1, and the resultant levels of effect are the same as under Alternative 1.

4.5.3.6.3. Polar Bear.

Conclusions. Alternative 3 would moderately decrease the overall effects to polar bears by protecting a 25-mi buffer area adjacent to part of the U.S. shoreline of the Chukchi Sea. This area is used by polar bears to den, to opportunistically feed on beach-cast marine mammal carcasses, and to hunt for seals in the open water of the polynyas and spring lead system that occur within this deferral area. The spring leads and coastal polynya areas are important foraging areas for polar bears.

4.5.3.6.3.1. Direct and Indirect Effects Under Alternative 3. This deferral area would remove 882 whole and partial lease blocks, or approximately 4,818,605 acres from the lease sale. The direct effects under this alternative are to protect coastal and nearshore polar bear habitat along the U.S. Chukchi Sea coastline, to buffer a known denning area (USGS, 2007, unpublished data), and to protect the Chukchi Sea spring lead systems and polynya systems. These open-water areas are extremely productive habitats for marine mammals, including seals and polar bears and, therefore, also are extremely important to subsistence hunters (see Section 4.5.3.12). The selection of this deferral would provide a moderate improvement in the effects determination for polar bears. Indirectly, this alternative would protect seal habitat, the primary prey of the polar bear. In addition, it would provide a buffer between potential development activities, the associated chance of a large spill contacting, and the shoreline. It could reduce slightly the chance of contact from LAs 9-13, which represent the highest chance of a large spill contacting the spring lead system and polynya systems (Appendix A, Table A.3-3). This added buffer potentially could afford additional time for cleanup workers to respond to a spill before it reaches the shoreline. Although less is known about use of the U.S. Chukchi Sea coastline by polar bears, both the Russian Chukchi Sea coastline and the Beaufort Sea coastline have seen increased use of shore habitats by polar bears, as ice retreat becomes more pronounced and prolonged. The primary reduction in impact to polar bears of selecting this deferral would be to buffer the shoreline, spring lead system, and polynya areas.

4.5.3.6.3.2. Cumulative Effects Under Alternative 3. Deferring this area reduces the overall footprint of the lease sale and, therefore, reduces some of the cumulative impacts. This deferral would protect polar bear denning and foraging habitat. Selecting this alternative would have a moderately beneficial effect on the overall level of impacts to polar bears. The extent to which this deferral reduces the cumulative effects to polar bears compared to Alternative 2, the Proposed Action, would be negligible.

4.5.3.7. Marine and Coastal Birds.

Summary. In the following analysis, we determined that there likely would be fewer direct or indirect effects if the lease sales were conducted with the Coastal Deferral compared to Alternative 2; there would be a negligible level of effect from vessel presence and noise, aircraft presence and noise, seismic airgun noise, petroleum spills, increased bird predator populations, subsistence hunting, and habitat loss; and a minor level of effect from collisions with structures. While the greatest potential for a major level of cumulative effect is associated with continuing physical changes in the Arctic environment, the lease sales would not result in a direct effect on this impact category. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1 to determine the new cumulative effect under this alternative. Mitigation measures imposed by MMS on future exploration activities on existing or new leases and surrounding waters avoid or minimize adverse effects to marine and coastal birds in the Chukchi Sea. While MMS-authorized actions could result in a small incremental increase in or longer duration of some activities, the total effect would be proportionately lower when compared to other unrestricted activities in the area. The cumulative effect is reduced to a minor level, to the point that they are considered equivalent to those determined under Alternative 1.

4.5.3.7.1. Potential Effects to Marine and Coastal Birds. The potential effects are the same as those described in Section 4.4.1.6.2.1 and 4.5.1.6.2.1.

4.5.3.7.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, except that specific measures to minimize disturbance effects to eiders in the spring lead system/Ledyard Bay Critical Habitat Area during exploratory drilling would not be necessary, because these areas would not be available for leasing.

4.5.3.7.3. Anticipated Effects Under Alternative 3.

4.5.3.7.3.1 Direct and Indirect Effects Under Alternative 3. This deferral alternative provides the largest reduction of adverse effects to marine and coastal birds by deferring habitats used extensively by marine and coastal birds for staging, molting, and migration. This alternative has the same southern boundary as was recently selected for Lease Sale 193. The level of adverse effect under this alternative is lower than that under Alternative 2.

While development is considered speculative, the increased distance between offshore development and coastal bird habitats conceivably would decrease the percent chance a large spill contacting, increase weathering of spilled oil prior to contact, and increase available spill-response time. Habitat alterations and surface developments still could occur in adjacent areas.

4.5.3.7.3.2. Cumulative Effects Under Alternative 3. As described above, this deferral alternative has the same southern boundary as was recently selected for Lease Sale 193 and provides the largest reduction in adverse effects to marine and coastal birds compared to Alternative 2. The direct and indirect effects under this alternative were combined with the cumulative effects under Alternative 1. Impacts to marine and coastal birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic (all unrelated to OCS leasing activities) would continue to have a negative, minor level of effect on marine and coastal birds. The greatest source of large, noncrude oil spills would continue to arise from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on marine and coastal bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to marine and coastal birds. The cumulative effect under this alternative is reduced to a minor level, to the point that it is considered equivalent to those under Alternative 1.

4.5.3.8. Other Marine Mammals. This alternative would offer about 6,444 whole or partial blocks in the lease sale area (Figure 2-2). The following analyses describe the anticipated effects under Alternative 3, the Coastal Deferral, on non-ESA listed marine mammals of the Alaskan Chukchi Sea. The Coastal Deferral constitutes about 12% of the Chukchi Sea lease-sale area.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects under this alternative would be similar to those under Alternative 2.

Pacific Walrus. Alternative 3 has fewer potential adverse effects for walruses than Alternative 2. By deferring a 25-mi buffer area adjacent to part of the U.S. shoreline of the Chukchi Sea, important walrus habitat is afforded some protection. Portions of this coastline are used by walruses to haul out and rest when the pack ice retreats beyond the Continental Shelf in summer and fall. Walrus haulouts have formed near Point Lay, Cape Lisburne, Icy Cape, and Wainwright in recent years. In 2007, several thousand walruses, including females with calves, were hauled out near Cape Lisburne for several months. As the sea ice retreats further, these terrestrial haulouts are likely to increase in importance for walruses. Preventing disturbance events at these terrestrial haulout sites may be critical for preventing stampedes, which can injure, sometimes fatally, large numbers of walruses. This alternative also would defer portions of the open water of the annual polynyas and spring lead system that occur near the coast within this deferral area. The spring leads and coastal polynya areas are important resting and foraging areas for walruses.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales, and Gray Whales. The direct, indirect, and cumulative adverse effects under this alternative would reduce slightly adverse effects compared to those determined under Alternative 2, the Proposed Action (Section 4.4.2.8.1). The reduction in adverse effects would are not substantial and do not change the levels of effect determined under Alternative 2.

4.5.3.8.1. Potential Effects to Marine Mammals. The potential effects to ice seals and walruses in the Chukchi Sea are described in Section 4.5.1.8.1. Potential effects to whales were described in Sections 4.5.1.6.1.1 and 4.5.1.8.1. These potential effects apply to activities identified under Alternative 3, the Coastal Deferral that could occur if the entire Chukchi Sea Planning Area, except that the Coastal Deferral area would be open to proposed Lease Sales 212 and 221.

4.5.3.8.2. Mitigation Measures. Mitigation measures for ice seals and walruses are described in Section 4.5.2.8.2. Mitigation measures for baleen and toothed whales are described in Section 4.5.2.6.1.2.

4.5.3.8.3. Anticipated Effects Under Alternative 3.

4.5.3.8.3.1. Direct and Indirect Effects Under Alternative 3.

Ringed, Spotted, Ribbon, and Bearded Seals. The coastal zone deferral could slightly lessen the cumulative chance of disturbances occurring. During summer, this area is particularly important to spotted and bearded seals that have been known to use coastal haulouts. This deferral can be expected to result in added scrutiny of the leased areas through reallocation of resources, leading to a level of effects similar to those described in 4.5.2.8.3.1 for the Alaskan Chukchi Sea. Consequently, the direct and indirect effects would be similar to those under Alternative 2 in Section 4.5.2.8.3.1.

Pacific Walrus. The direct effect of this alternative is to defer coastal and nearshore walrus habitat along the U.S. Chukchi Sea coastline, to buffer known haulout sites (USDOI, FWS, 2007, Unpublished data), and to defer from leasing the Chukchi Sea spring lead systems and polynya systems. These open-water areas are extremely productive habitats for marine mammals, including walruses and, therefore, also are extremely important to subsistence hunters (see Section 4.5.3.12). The selection of this deferral would decrease the potential adverse effects in the effects determination for walruses. Indirectly, this alternative would provide a buffer between potential development activities, the associated chance of oil spills, and the shoreline. It would slightly reduce the risk of spills occurring from LAs 9-13, which represent the highest risk of spills contacting the spring lead system and polynya systems (Appendix A, Table A.3-3). This added buffer potentially could afford additional time for cleanup workers to respond to a spill before it reaches the shoreline. Both the Russian Chukchi Sea coastline and the Beaufort Sea coastline have seen increased use of shore habitats by walruses as ice retreat becomes more pronounced and prolonged. The primary reduction in impacts to walruses of selecting this deferral would be to buffer terrestrial haulout habitats along the shoreline, spring lead system, and polynya areas.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales, and Gray Whales. The lease-sale area is set 25-mi away from the Chukchi Sea coastline. The 25-mi buffer of the Chukchi Sea between shore and the southern boundary of the proposed Chukchi Sea lease-sale area provides the majority of protection for the spring lead system. The Coastal Deferral would slightly decrease adverse effects to beluga whales during the spring and fall migration periods, molting, birthing and feeding aggregations. This deferral also would slightly increase the distance between whale habitats within the 25-mi no-lease zone and potential activities on OCS lease blocks to the north, effectively decreasing exposure to high noise levels associated with lease activities (vessel traffic, drilling, construction) in the lease area. Potential displacement from important whale prey concentration and feeding habitats would be reduced in some years from noise and vessel traffic related to OCS lease activities within the deferral area. The 25-mi buffer area, however, still could be subject to product transportation facilities and potential spills and would be evaluated incrementally if such actions are proposed.

This deferral would exclude disturbance and collision impacts to whales arising from exploration activities in the deferral for the remainder of the present 5-Year Program. These sources of potential adverse effects would occur farther away from a small portion of important migration, molting, birthing and feeding habitats. While development is considered speculative, the increased distance between potential offshore launch areas and whale habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. Any OCS-related infrastructure (pipelines) to transport product still could occur within the deferral, and potential for petroleum spills from these pipelines and vessel fuel spills still could occur.

This alternative would not result in detectable population-level effects. Some whales would maintain or improve nutrient and energy intake over the life of any new leases, and the direct and indirect effects are not substantially different from those under Alternative 2, the Proposed Action.

4.5.3.8.3.2. Cumulative Effects Under Alternative 3. The cumulative effects are the combination of the direct and indirect effects under this alternative (above) and the cumulative effects under Alternative 1 (Section 4.5.1.8.3.2).

Ringed, Spotted, Ribbon, and Bearded Seals. Cumulative effects are similar to those described for Alternative 2 in Section 4.5.2.8.3.2.

Pacific Walrus. Alternative 3 would reduce the overall footprint of the lease sale in important walrus habitats and, therefore, would slightly reduce the cumulative effects. This alternative would cause a decrease in the cumulative effects to walruses when compared with Alternative 2. This deferral would protect walrus resting and foraging habitat. Alternative 3 would decrease adverse effects to walruses by protecting a 25-mi buffer area adjacent to part of the U.S. shoreline of the Chukchi Sea. Portions of this area are used by walruses to haul out and rest when the pack ice retreats beyond the Continental Shelf in summer and fall. Terrestrial haulouts are likely to increase in importance for walruses. Preventing disturbance events at these terrestrial haulout sites may be critical for preventing stampedes, which can injure, sometimes fatally, large numbers of walruses. This alternative also would defer portions of the open water of the polynyas and spring lead system, which are important resting and foraging areas for walruses. Given the scenario described in Section 2.2, Alternative 3 would have a minor level of effect on the Pacific walrus population.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales, and Gray Whales. As explained in Section 4.5.3.8.3.1 (above), this alternative would result in a slight reduction of direct and indirect effects to whales within the Coastal Deferral area compared to Alternative 2, the Proposed Action. The 25-mi buffer of the Chukchi Sea between shore and the southern boundary of the proposed Chukchi Sea lease sale area provides the majority of protection for the spring lead system from OCS-related activities.

Impacts to whales and their habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue to have a minor level of adverse effect on whales. The greatest source of large, refined oil spills would continue to arise from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect to these whales in the Chukchi Sea.

This alternative would not result in detectable population-level effects. Some whales would maintain or improve nutrient and energy intake over the life of any new leases, and the cumulative effects are considered to be the same as under Alternative 2, the Proposed Action, with the exception of changes in the physical environment. Changes in the physical environment resulting from arctic warming or climate change are anticipated to continue; however, effects are difficult to predict with any certainty and may result in an expansion of the distribution and numbers of minke and gray and killer whales, harm beluga whales because they are semi-dependent on sea-ice habitats, and may not affect harbor porpoises.

4.5.3.9. Terrestrial Mammals. This alternative would offer for leasing all of the area described for Chukchi Sea Alternative 2 except for a corridor located landward of the planning area. Chukchi Sea Alternative 3 would offer 6,444 whole or partial blocks, comprising 35,374,261 million acres (about 14.3 million hectares). The area that would be removed by the Coastal Deferral consists of 882 whole or partial blocks, approximately 4,818,605 million acres (about 1.9 million hectares), approximately 12% of the proposed sale area

This analysis identifies the anticipated level of effect under this alternative on terrestrial mammals. The anticipated effects of implementing this alternative are separated into direct and indirect effects (Section 4.5.3.9.3.1.) and cumulative effects (Section 4.5.3.9.3.2).

4.5.3.9.1. Potential Effects to Terrestrial Mammals. Potential effects are described in Section 4.5.1.9.1.

4.5.3.9.2. Mitigation Measures. Mitigation measures are the same as described in Section 4.5.2.9.2.

4.5.3.9.3. Anticipated Effects Under Alternative 3.

4.5.3.9.3.1. Direct and Indirect Effects Under Alternative 3. The direct and indirect effects would be similar to those described in Section 4.5.2.9.3.1.

4.5.3.9.3.2. Cumulative Effects Under Alternative 3. The cumulative effects would be the same as those described in Section 4.5.2.9.3.2.

4.5.3.10. Vegetation and Wetlands. Effects under Alternative 3, Coastal Deferral, on vegetation and wetlands would be essentially the same as those under Alternative 2, the Proposed Action. The extent to which this deferral reduces the cumulative effects to vegetation and wetlands compared to Alternative 2, the Proposed Action, would be negligible.

4.5.3.11. Economy. There would be no effective difference between the economic effects under Alternative 3 and Alternative 2, the Proposed Action.

4.5.3.12. Subsistence-Harvest Patterns and Resources. This alternative was developed in response to scoping comments received during the Lease Sale 193 scoping process, as well as the current scoping process for the Beaufort Sea Lease Sales 209 and 217 and Chukchi Sea Lease Sales 212 and 221 EIS. This option is analyzed for protection of subsistence-use zones and wildlife areas. This alternative would offer for leasing all of the area described under Alternative 2 except for a corridor located landward of the planning area. Alternative 3 would offer 6,444 whole or partial blocks, comprising 35,374,261 million acres (about 14.3 million hectares). The area that would be removed by the Coastal Deferral consists of 882 whole or partial blocks, approximately 4,818,605 million acres (about 1.9 million hectares), approximately 12% of the proposed sale area.

4.5.3.12.1. Direct and Indirect Effects Under Alternative 3. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By excluding 882 whole or partial blocks along the shoreward edge of the sale area, impacts to nearshore subsistence resources, habitats, and hunting areas would potentially be reduced. This alternative was developed in response to comments received during the scoping process to reduce impacts to bowhead whale subsistence hunting. This alternative would offer for leasing all of the area described in Alternative 2 except for a corridor extending offshore from the Chukchi Sea coastline to protect important bowhead whale habitat used for migration, feeding, nursing calves, and breeding and important beluga whale habitat near Point Lay. This alternative is analyzed for its particular protection of subsistence-whaling areas important to the communities of Barrow, Wainwright, Point Lay, and Point Hope, the subsistence whale hunt, and the subsistence hunts for other marine mammals.

Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, and onshore habitats. In this way, subsistence resources, habitats, and hunting areas would be afforded more protection from potential impacts. Also, the chance of spring bowhead whale encounters with industrial noise likely would be reduced.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

Conclusion. Effects to subsistence-harvest patterns are expected to be reduced, because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts on subsistence resources, subsistence whaling, and other marine mammal hunting. The chance of spring bowhead whale encounters with industrial noise likely would be reduced from that under Alternative 2, the Proposed Action. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

4.5.3.12.2. Cumulative Effects Under Alternative 3.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale and, therefore, reduces the cumulative effects to subsistence resources and harvest patterns from those under Alternative 2, the Proposed Action.

4.5.3.13. Sociocultural Systems. This option is analyzed for protection of subsistence-use zones and wildlife areas.

4.5.3.13.1. Direct and Indirect Effects Under Alternative 3. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. This alternative was developed in response to comments received during the scoping process to reduce impacts to bowhead whale subsistence hunting. By excluding 882 whole or partial blocks along the shoreward edge of the sale area, impacts to nearshore subsistence resources, habitats, and hunting areas potentially would be reduced and, thereby reduce potential sociocultural effects. This alternative is analyzed for its particular protection of subsistence-whaling areas important to the communities of Barrow, Wainwright, Point Lay, and Point Hope, the subsistence whale hunt, and the subsistence hunts for other marine mammals.

Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, and onshore habitats. In this way, subsistence resources, habitats, and hunting areas, and consequent sociocultural effects, would be reduced.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

Conclusion. Because no exploration or production activities would occur in the deferral area, sources for chronic noise and disturbance impacts to subsistence resources, subsistence whaling, and other marine mammal hunting, and to sociocultural systems, likely would be reduced from Alternative 2, the Proposed Action. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

4.5.3.13.2. Cumulative Effects Under Alternative 3.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale and, therefore, negligibly reduces the cumulative effects to subsistence resources and harvest patterns, and consequent effects on sociocultural systems, from Alternative 2, the Proposed Action.

4.5.3.14. Archaeological Resources. This deferral would prohibit leasing, exploration, development, and production activities on 6,444 whole or partial blocks.

4.5.3.14.1. Direct and Indirect Effects Under Alternative 3.

Conclusion. The potential effects under Alternative 3 to archaeological resources are essentially the same as discussed under Alternative 2, the Proposed Action, except the areas deferred would be removed from any bottom-disturbing activities. More potential effects are likely to occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Prehistoric and historic resources, both onshore and offshore, would be identified by archaeological surveys and avoided or mitigated.

4.5.3.14.2. Cumulative Effects Under Alternative 3.

Conclusion. Deferring this area reduces the overall footprint of the lease sale and, therefore, negligibly reduces the cumulative effects to archaeological resources from those under Alternative 2, the Proposed Action.

4.5.3.15. Environmental Justice. This alternative was developed in response to scoping comments received during the Lease Sale 193 scoping process, as well as the current scoping process for the Beaufort Sea Lease Sales 209 and 217 and Chukchi Sea Lease Sales 212 and 221 EIS. This option is analyzed for protection of subsistence-use zones and wildlife areas.

4.5.3.15.1. Direct and Indirect Effects Under Alternative 3. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By excluding 882 whole or partial blocks along the shoreward edge of the sale area, impacts to nearshore subsistence resources, habitats, and hunting areas and sociocultural systems potentially would be reduced. This alternative was developed in response to comments received during the scoping process to reduce impacts to bowhead whale subsistence hunting. This alternative is analyzed for its particular protection of subsistence-whaling areas important to the communities of Barrow, Wainwright, Point Lay, and Point Hope, the subsistence whale hunt, and the subsistence hunts for other marine mammals.

Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, and onshore habitats. In this way, subsistence resources, habitats, and hunting areas, sociocultural systems, and EJ would be afforded more protection from potential impacts.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

The reduction in economic, employment, and demographic change related to influx of nonresident workers to and through Chukchi villages would be expected to be minimal compared with Alternative 2, the Proposed Action. Public health effects, therefore, would be reduced mainly through reduction in subsistence-related health effects; and as subsistence forms the foundation of health in rural Alaskan Native villages (as described in section 4.4.1.15. and subsections for the Beaufort Sea Alternative 1, EJ discussion), such reductions would result in a lower incremental risk of adverse subsistence-related health effects on general health and well-being, diet and nutrition, injury rates, and rates of nutrition-related chronic diseases such as diabetes, hypertension, and cardiovascular disease. This alternative also would prevent discharges to some areas used by subsistence hunters in the Chukchi Sea region, which could reduce subsistence-related health effects by allaying community fears about contamination, and could also result in a small incremental reduction in the risk posed by contamination of subsistence resources by OCS discharges. Airborne emissions from OCS activities also would occur farther from shore and farther from subsistence-use areas, resulting again in a small incremental reduction in the risk of emissions-related health effects.

Conclusion. Because no exploration or production activities would occur in the deferral area, sources for chronic noise and disturbance impacts to subsistence resources, subsistence whaling, other marine mammal hunting, sociocultural systems, and associated effects on public health, likely would be reduced from Alternative 2, the Proposed Action, thus, reducing consequent effects to EJ. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

4.5.3.15.2. Cumulative Effects Under Alternative 3.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the likely impacts on subsistence resources in key nearshore subsistence regions. It also would reduce the risk that people would limit consumption of subsistence resources because of fears of contamination. Vulnerable populations (such as elders, people with chronic lung and cardiovascular disease, and infants), particularly subsistence hunters, could benefit from a reduced chance of exposure to unhealthful levels of air pollution. Deferring this area negligibly reduces the cumulative effects to subsistence resources and harvest patterns, sociocultural systems, associated effects on public health, and consequent effects to EJ from Alternative 2, the Proposed Action.

4.5.4. Alternative 4, Chukchi Sea Ledyard Bay Deferral.

This alternative addresses issues of protecting a critical habitat area designated by the FWS for the protection of spectacled eiders. This alternative would offer for lease all of the area described for Chukchi Sea Alternative 2, except for an area located in and around Ledyard Bay. This alternative is a subset of Alternative 3. This alternative would offer for lease 7,135 whole or partial blocks comprising approximately 39,104,542 acres (about 15.8 million hectares), minus any blocks currently leased at the time of the sale. The area deferred under this alternative consists of 191 whole or partial blocks, approximately 1,088,324 acres (about 364,334 thousand hectares), which is about 3% of the Proposed Action area. This alternative would result in a reduction of 7% of the commercial resource potential from the Proposed Action.

4.5.4.1. Water Quality. Alternative 4 would not significantly reduce the estimated oil resource or the activities associated with exploration and development and production. Therefore, this alternative does not substantially lessen the effects on Chukchi Sea water quality for any of the activities discussed in Section 4.5.2.1. There would be some reduction of the local impacts within any deferred area from construction and permitted discharges, but the risk of effects from oil spills to the deferred area would be unaffected.

Conclusion. The effects under Alternative 4 are expected to be minor on local water quality and negligible on regional water quality, the same as under the Proposed Action.

4.5.4.2. Air Quality. The effects to Air Quality under Alternative 4, Ledyard Bay Deferral, would be the same as under Alternative 2, the Proposed Action.

4.5.4.3. Lower Trophic-Level Organisms. Alternative 4, the Ledyard Bay Deferral, is located along the coast near Point Lay. As explained in Section 3.3.1, planktonic habitats that are productive are located in coastal water. However, deferral of the Ledyard Bay tracts has only a small influence on the likelihood that spills would contact the coast.

As explained in Section 4.5.2.3, three aspects of the proposed lease sale that might affect the organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells likely may be local and minor, as concluded in the Sale 193 EIS. For any development, it is estimated that a network of buried pipelines would radiate from a central production platform on the central shelf, and that a single long pipeline would extend to shore. This assessment assumes that produced hydrocarbons would not be transport to shore by tanker or barge. Pipeline burial likely would disturb up to 2,000 acres of typical benthic organisms. These organisms likely would recolonize the pipeline corridors over a decade, just as they slowly recolonize ice gouges. Site-specific disturbance effects would be assessed later; some assessments will need more accurate information on recolonization and coastal erosion rates.

Any exploratory discharges during summer likely may have immeasurable or negligible effects on the planktonic and benthic communities. Produced water from all Beaufort Sea developments to date have been reinjected voluntarily rather than discharged; this assessment assumes that produced water would be reinjected also at Chukchi Sea developments. Any discharge proposal would be reviewed in detail by MMS and EPA.

The OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of Alternative 2 (Section 4.3.2.1.4). If the assumed spills occur in broken ice, cleanup would present substantial challenges (Section 4.3.3.1.7). The model estimates up to a 39% chance that spills would contact ERA Land within 30 days during summer from all launch areas and pipelines (Appendix A, Table A.3-33). The likelihood of contact is the same without LAs 10 and 11 in the deferral area. Therefore, the level of effects on lower trophic-level organisms is similar with or with the Ledyard Bay Deferral.

If a large spill occurs during summer near the center of the proposed lease area, the model estimates a <20% chance that the spill would drift within 30 days to the U.S. Chukchi coast. The model estimates a <22% chance a large spill would drift into Russian water within 10 days, where U.S. responses might be difficult. The same chances decrease to <7% and 3% within 10 days. If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for more than a decade. Some lower-trophic-level organisms would experience a larger effect than others.

Conclusion. Three aspects of Alternative 4 that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells may likely be local and minor. Any exploratory discharges during summer would likely have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaskan coastline, the hydrocarbons would likely affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL about pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. Therefore, the cumulative level of effects, including the effect of ongoing climate change, would be major. The extent to which this deferral reduces the cumulative effects to lower trophics compared to Alternative 2, the Proposed Action, would be negligible.

4.5.4.4. Fish Resources.

Summary. This deferral would reduce the size of the lease-sale area. It was not specifically designed to minimize adverse effects to fish resources. This deferral could serve to protect fish resources and fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative would result in more than a negligible level of effect for certain fish resources, but still an overall minor level of cumulative effect compared to Alternative 2.

4.5.4.4.1. Potential Effects to Fish Resources. The potential effects to fish resources in the Chukchi Sea were described in Section 4.5.1.4.1.

4.5.4.4.2. Mitigation Measures. The potential effects can be moderated by the mitigation measures identified in Section 4.5.2.4.2.

4.5.4.4.3. Anticipated Effects Under Alternative 4. This deferral would reduce the size of the lease-sale area. It was not specifically designed to minimize adverse effects to fish resources. This deferral could serve to protect fish resources and fish habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative is anticipated to result in reduced direct and indirect effects, which would somewhat reduce cumulative effects, but still an overall minor level of adverse effect is anticipated. The extent to which this deferral reduces the cumulative effects to fish resources compared to Alternative 2, the Proposed Action, would be negligible.

4.5.4.5. Essential Fish Habitat.

Summary. This deferral would reduce the size of the lease-sale area. It was not specifically designed to minimize adverse effects to EFH; however, this deferral could serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to EFH. To the extent that salmon habitats are separated from adverse effects, this alternative would result in more than a negligible level of effect for certain fish resources, but still an overall minor level of cumulative effect compared to Alternative 2.

4.5.4.5.1. Potential Effects to Essential Fish Habitat. The potential effects to EFH in the Chukchi Sea lease sale area were described in Section 4.5.1.5.1.

4.5.4.5.2. Mitigation Measures. The potential effects would be moderated by the mitigation measures indentified in Section 4.5.2.5.2.

4.5.4.5.3. Anticipated Effects Under Alternative 4. This deferral would reduce the size of the lease sale area. It was not specifically designed to minimize adverse effects to EFH; however, the deferral would serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to EFH. To the extent that salmon habitats are separated from adverse effects, this alternative would result in more than a negligible level of effect for certain fish resources, but still an overall minor level of cumulative effect compared to Alternative 2.

4.5.4.6. Threatened and Endangered Species.

4.5.4.6.1. Threatened and Endangered Whales.

Summary. Endangered Species Act-listed whales that can occur within or near Chukchi Sea Planning Area or that could potentially be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. The direct, indirect and cumulative adverse effects of Alternative 4 may improve slightly over those under Alternative 2, the Proposed Action (Section 4.5.2.6.1), but reductions in impacts are not substantial and effects are considered to be the same (negligible to minor) as those under Alternative 2.

After reviewing the current status of endangered bowhead, fin, and humpback whales, the environmental baseline for the action area, the Proposed Action, and the cumulative effects, it is NMFS's biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that the Proposed Action is not likely to jeopardize the continued existence of Western Arctic bowhead whales, North Pacific fin whales, or humpback whales. No critical habitat has been designated for these species; therefore, none will be affected. The NMFS concludes at this time, there is reasonable likelihood that oil and gas development and production in the Alaska Beaufort and Chukchi seas, as described, would not violate Section 7(a)(2) of the ESA (NMFS, 2008c).

The following analysis describes potential adverse effects to endangered whales from OCS activities associated with oil and gas exploration and development activities as described in Section 2.4.1, Scenario for the "Typical" Chukchi Sea lease sales (Sales 212 and 221) in Section 4.4.1.6.1.1, mitigation measures to avoid or minimize potential adverse effects to endangered whales in Section 4.4.1.6.1.2, and the anticipated effects resulting from application of mitigation to potential adverse effects in Section 4.4.1.6.1.3. Anticipated effects discussed herein consider mitigation measures applied to potential effects to determine the effects under Alternative 4, the Ledyard Bay Deferral, to bowhead, fin, and humpback whales. In this section we address the important differences between the Proposed Action (Alternative 2) and this alternative.

4.5.4.6.1.1. Potential Effects to Threatened and Endangered Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified in Alternative 4 that could occur if the entire Chukchi Sea Planning Area except the Ledyard Bay Deferral area would be open to proposed Lease Sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain identical for all alternatives, including the Ledyard Bay Deferral, and will not be repeated here.

4.5.4.6.1.2. Mitigation Measures. The mitigation measures listed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.2 are applied, as appropriate, to OCS activities to protect ESA-listed whales and other marine mammals during Federal seismic and exploratory drilling in the Beaufort Sea and Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities associated with all alternatives for Lease Sales 212 and 221, including the Ledyard Bay Deferral.

4.5.4.6.1.3. Anticipated Effects Under Alternative 4. This section describes the most important differences in the anticipated effects between the Proposed Action (Alternative 2) and the Ledyard Bay Deferral (Alternative 4). Anticipated effects consider mitigation measures and specific biological and activity characteristics discussed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.3.

4.5.4.6.1.4. Conclusions.

4.5.4.6.1.4.1. Direct and Indirect Effects Under Alternative 4.

Summary. This deferral would reduce impacts to bowhead whales during the spring and fall migration periods and summer and fall feeding aggregations of bowheads and humpback whales. Potential displacement from important prey concentrations and feeding areas would be reduced slightly, but less than under Alternative 3, the Coastal Deferral, from reduction in noise and vessel traffic related to OCS activities on the lease blocks identified in the deferral. The deferral would further buffer the contiguous areas south of the deferral by increasing the distance (effectively decreasing exposure to and high noise levels) between potential activities on OCS lease blocks further north. The effects analysis and conclusions are slightly improved. The effects of this alternative would not result in detectable population-level effects. Some whales would maintain or slightly improve nutrient and energy intake and experience slightly decreased exposure to noise levels stimulating adverse behavioral response and displacement effects over the life of the Proposed Action, but effects are slight and considered to be the same as those identified under Alternative 2.

This alternative would defer 882 full or partial lease blocks along the southern boundary of the Chukchi Planning Area (Figure 2-2). The primary reduction in impacts of this deferral would be to exclude disturbance and collision impacts to endangered whales arising from exploration activities in these blocks for the remainder of the 5-Year Program period. These sources of potential adverse effects would occur farther away from the important spring lead system migration and calving corridor of bowhead whales. Feeding habitats and fall migration would be slightly less impacted by a reduction in area subject to oil and gas exploration and development and production noise that would have been associated with leases in the deferral area. While development is considered speculative, the increased distance between potential offshore launch areas and nearshore whale habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. The OCS-related infrastructure (pipelines) to transport product still could occur on these blocks, and the potential for petroleum spills from these and vessel fuel spills still could occur. Anticipated direct and indirect effects are anticipated to be the same as under the Proposed Action, Alternative 2.

4.5.4.6.1.4.2. Cumulative Effects Under Alternative 4.

Summary. The cumulative effects under this alternative are considered to be the same as under Alternative 2.

As explained under Potential Effects above, this alternative would reduce impacts to endangered whales during the bowhead migration periods and periods of concentrated summer-fall feeding. Its small size, however, limits the reduction in impacts and the effects analysis, and conclusions are only slightly improved compared to those under Alternative 2, and would not allow oil- and gas-related activities during periods when endangered whales are not present or accessing petroleum resources via extended-reach technology from adjacent active lease blocks. The reduced impact level slightly reduces the total cumulative effect. Impacts to endangered whales and habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue to have a negative, moderate level of effect to whales. The greatest source of large, noncrude oil spills would continue to come from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could increase the potential for marine accidents and large fuel spills, which could result in major adverse effects on endangered whales in the Chukchi Sea. Climate change is likely to continue and, although speculative and unpredictable at this time, effects may be positive and/or adverse to endangered whales or their habitat in the Chukchi Sea.

4.5.4.6.2. Threatened and Endangered Birds.

Summary. In the following analysis, we determined this deferral alternative would reduce the size of the lease sale area, which would reduce adverse effects to ESA-listed birds, especially the spectacled eider, compared to Alternative 2 (the Proposed Action), but to a lesser extent than Alternative 3. Direct and indirect effects associated with exploration drilling in the spring lead system adjacent to the LBCHA would be the same as those under Alternative 2, but these are still greater than those determined under Alternative 3.

Impacts to ESA-protected birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic—all unrelated to OCS leasing activities—would continue to have a negative, minor level of effect on marine and coastal birds. The greatest source of large, noncrude oil spills would continue to arise from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on ESA-listed bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to threatened and endangered birds. The adverse effects under this alternative are decreased compared to Alternative 2, but the reductions are modest and the increased potential of adverse effects from exploration drilling in the spring lead system (adjacent to the LBCHA) brings the cumulative effects closer to those determined under Alternative 2, not Alternative 1.

4.5.4.6.2.1. Potential Effects to Threatened and Endangered Birds. The potential effects would be the same as those described in Sections 4.4.1.6.2.1 and 4.5.1.6.2.1.

4.5.4.6.2.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, except that specific measures to minimize disturbance effects to eiders in the LBCHA during exploratory drilling would not be necessary, because this area would not be available for leasing.

4.5.4.6.2.3. Anticipated Effects Under Alternative 4.

4.5.4.6.2.3.1. Direct and Indirect Effects Under Alternative 4. This deferral alternative would reduce the size of the lease sale area, which would reduce adverse effects to ESA-listed birds, especially the spectacled eider, compared to Alternative 2 (the Proposed Action), but to a lesser extent than Alternative 3. The deferral of leasing in the LBCHA would preclude the disturbance effects that could occur from certain activities such as exploration, delineation, and production drilling. Habitat alterations and surface developments still could occur in adjacent areas, such as the remainder of the spring lead system. The adverse effects are less than those determined under Alternative 2, but the reduction in adverse effects to ESA-protected birds is not as great as those under Alternative 3.

While development is considered speculative, the increased distance between offshore development and coastal bird habitats conceivably would decrease the percent chance of a large spill contacting, increase weathering of spilled oil prior to contact, and increase available spill-response time.

4.5.4.6.2.3.2. Cumulative Effects Under Alternative 4. As described in Section 4.5.4.6.2.3.1, this deferral alternative would reduce adverse effects to ESA-listed birds, especially the spectacled eider, compared to Alternative 2 (the Proposed Action), but to a lesser extent than Alternative 3. Direct and indirect effects associated with exploration drilling in the spring lead system adjacent to the LBCHA would be the same as those under Alternative 2, but these are still greater than those determined under Alternative 3.

Impacts to ESA-protected birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic—all unrelated to OCS leasing activities—would continue to have a negative, minor level of effect on marine and coastal birds. The greatest source of large, noncrude oil spills would continue to come from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on ESA-listed bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to threatened and endangered birds. The adverse effects under this alternative are decreased compared to those under Alternative 2, but the reductions are modest and the increased potential of adverse effects from exploration drilling in the spring lead system (adjacent to the LBCHA) brings the cumulative effects closer to those determined under Alternative 2, not Alternative 1.

4.5.4.6.3. Polar Bear.

Conclusions. Alternative 4 would decrease the potential impacts to polar bears by deferring from sale an area adjacent to Ledyard Bay and a portion of the U.S. shoreline of the Chukchi Sea. This area is used by polar bears to den, to opportunistically feed on beach-cast marine mammal carcasses, and to hunt for seals in the open water of the polynyas and spring lead system that occur within this deferral area. The spring leads and coastal polynya areas are important foraging areas for polar bears. This deferral would have a minor decrease in the potential impacts to polar bears.

4.5.4.6.3.1. Direct and Indirect Effects Under Alternative 4. This deferral area would remove 191 whole and partial lease blocks, or approximately 1,088,324 acres from the lease sale. The direct and indirect effects are identical to those described under Alternative 3 in Section 4.5.3.6.3. Alternative 4 provides less protection for polar bears than Alternative 3 due to the smaller size of the deferral area, roughly 3 million acres less. The selection of this deferral would provide a minor improvement in the effects determination for polar bears. Indirectly, this deferral would protect seal habitat in the Point Lay polynya area and in the spring lead system. It would provide a buffer between potential development activities, the associated chance of oil spills, and the shoreline. It could reduce slightly the chance of a large spill contacting from LAs 10 and 11, which represent the highest chance of a large spill contacting the spring lead system and the Point Lay polynya system (Appendix A, Table A.3-3). This added buffer potentially could afford additional time for cleanup workers to respond to a spill before it reaches the polynyas, spring lead system, or shoreline. The primary reduction in impacts to polar bears of selecting this deferral would be to buffer a portion of the shoreline, spring lead system, and the Point Lay polynya area.

4.5.4.6.3.2. Cumulative Effects Under Alternative 4. Deferring this area reduces the overall footprint of the lease sale and, therefore, reduces the cumulative impacts. This deferral would protect some polar bear denning and foraging habitat. This alternative would have a minor beneficial effect on the overall level of impacts to polar bears. The extent to which this deferral reduces the cumulative effects to polar bears compared to Alternative 2, the Proposed Action, would be negligible.

4.5.4.7. Marine and Coastal Birds.

Summary. In the following analysis, we determined this deferral alternative would reduce adverse effects to marine and coastal birds compared to Alternative 2, but to a lesser extent than Alternative 3. Direct and indirect effects associated with exploration drilling in the spring lead system adjacent to the LBCHA would be the same as those under Alternative 2, but these still are greater than those determined under Alternative 3.

Impacts to marine and coastal birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic—all unrelated to OCS leasing activities—would continue to have a negative, minor level of effect on marine and coastal birds. The greatest source of large, noncrude oil spills would continue to come from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on some bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to some marine and coastal birds. The adverse effects for this alternative are decreased compared to Alternative 2, but the reductions are modest, and the increased potential of adverse effects from exploration drilling in the spring lead system (adjacent to the LBCHA) brings the cumulative effects closer to those determined under Alternative 2, not Alternative 1.

4.5.4.7.1. Potential Effects to Marine and Coastal Birds. The potential effects would be the same as those described in Sections 4.4.1.6.2.1 and 4.5.1.6.2.1.

4.5.4.7.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, except that specific measures to minimize disturbance effects to birds in the LBCHA during exploratory drilling would not be necessary, because this area would not be available for leasing.

4.5.4.7.3. Anticipated Effects Under Alternative 4.

4.5.4.7.3.1. Direct and Indirect Effects Under Alternative 4. This deferral alternative is anticipated to provide a reduction in adverse effects to marine and coastal birds compared to Alternative 2, especially marine and coastal birds using the LBCHA for staging, molting, and migration, but to a lesser extent than Alternative 3. The deferral of leasing in the LBCHA would preclude the disturbance effects that could occur from activities such as exploration and delineation drilling.

While development is considered speculative, the increased distance between offshore development and coastal bird habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. Habitat alterations and surface developments could still occur in adjacent areas, such as the remainder of the spring lead system.

4.5.4.7.3.2. Cumulative Effects Under Alternative 4. As described in Section 4.5.4.7.3.1, this deferral alternative would reduce adverse effects to marine and coastal birds compared to Alternative 2, but to a lesser extent than Alternative 3. Direct and indirect effects associated with exploration drilling in the spring lead system adjacent to the LBCHA would be the same as those under Alternative 2, but these still are greater than those determined under Alternative 3.

Impacts to marine and coastal birds from (1) continued community and oil and gas infrastructure developments, (2) collisions with community and oil and gas infrastructure facilities, and (3) disturbances to birds in nearshore areas from unrestricted vessel and low-flying aircraft traffic (all unrelated to OCS leasing activities) would continue to have a negative, minor level of effect on marine and coastal birds. The greatest source of large, noncrude oil spills would continue to come from bulk fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could dramatically increase the potential for marine accidents and large fuel spills, which could result in a major level of adverse effect on marine and coastal bird populations in the Chukchi Sea. Continued climate change is likely to result in a major level of effect to some species of marine and coastal birds. The adverse effects for this alternative are decreased compared to Alternative 2, but the reductions are modest and the increased potential of adverse effects from exploration drilling in the spring lead system (adjacent to the LBCHA) brings the cumulative effects closer to those determined under Alternative 2, not Alternative 1.

4.5.4.8. Other Marine Mammals.

Summary. This alternative would offer about 7,135 whole or partial blocks in the lease-sale area (Figure 2-2). The following analyses describe the anticipated effects under Alternative 4, the Ledyard Bay Deferral, on marine mammals of the Alaskan Chukchi Sea. The Ledyard Bay Deferral constitutes about 3% of the Chukchi Sea lease sale area.

Ringed, Spotted, Ribbon, and Bearded Seals. The anticipated effects under this alternative on ice seals would be similar to those under Alternative 2.

Pacific Walrus. The selection of Alternative 4 could slightly decrease adverse effects for walruses by deferring an area adjacent to Ledyard Bay and a portion of the U.S. shoreline of the Chukchi Sea. This area is used by walruses to haul out when the pack ice retreats over the shelf in summer and fall. In 2007, several thousand walruses were observed hauling out along the coastline, including females with calves. Walruses may forage in Ledyard Bay and adjacent areas when hauled out along the coast. Walruses also use the open water of the polynyas and spring lead system, which occur within this deferral area. The spring leads and coastal polynya areas are important foraging and resting areas for walruses.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales and Gray Whales. The direct, indirect, and cumulative adverse effects under this alternative may slightly reduce adverse effects compared to those under Alternative 2, the Proposed Action (Section 4.4.2.6.1), but this reduction is considered small and effects are considered to be the same as those under Alternative 2 (negligible to minor).

4.5.4.8.1. Potential Effects to Marine Mammals. Potential effects for walruses and ice seals would be the same as those described under Alternative 2 in Section 4.5.2.8.1. Potential effects to whales were described in Sections 4.4.1.6.1.1 and 4.5.1.8.1 and remain identical for all alternatives, including the Ledyard Bay Deferral.

4.5.4.8.2. Mitigation Measures. Mitigation measures for this alternative would be the same as those described in Section 4.5.2.8.2.

4.5.4.8.3. Anticipated Effects Under Alternative 4.

4.5.4.8.3.1. Direct and Indirect Effects Under Alternative 4.

Ringed, Spotted, Ribbon, and Bearded Seals. Deferring the Ledyard Bay area from leasing could slightly lessen the cumulative chance of disturbances occurring in that area. However this deferral can be expected to result in added scrutiny of the leased areas through reallocation of resources, leading to a level of effects similar to those described in Section 4.5.2.8.3.1 for the Alaskan Chukchi Sea. Consequently, the expected direct and indirect effects on ice seals are similar to those described in Section 4.5.2.8.3.1.

Pacific Walrus. Direct and indirect effects to walruses are identical to those described under Alternative 3 in Section 4.5.3.8.3. Alternative 4 has more adverse impacts tor walruses than Alternative 3, due to the smaller size of the deferral area, roughly 3 million acres less. The selection of this deferral would provide a minor improvement in the effects determination for walruses when compared with Alternative 2. Indirectly, this deferral would provide a buffer between potential development activities and the associated chance of oil spills, and a portion of the shoreline. It would reduce slightly the risk of spills occurring from LAs10 and 11, which represent the highest risk of spills contacting the spring lead system and the Point Lay polynya system (Appendix A, Table A.3-3). This added buffer potentially could afford additional time for cleanup workers to respond to a spill before it reaches the polynyas, spring lead system, or shoreline. The primary reduction of impacts to walruses under Alternative 4 would be to buffer a portion of the shoreline used for terrestrial haulouts and the spring lead system and the Point Lay polynya area, which may be important foraging and resting areas.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales and Gray Whales. The Ledyard Bay deferral would reduce adverse effects to whales during the spring and fall migration periods and feeding aggregations. However, its small size may not add substantially to the contiguous State and OCS areas to the west that are not subject to leasing, but it does protect key areas where known feeding concentrations have been documented. Potential displacement from important prey concentrations and feeding would be reduced in some years from noise and vessel traffic related to OCS lease activities on the lease blocks identified in the deferral. This deferral further would provide additional buffer for the contiguous areas east and south of the deferral by increasing the distance (effectively decreasing exposure to high noise levels) between potential activities on OCS lease blocks to the east. The effects of this alternative would not result in detectable population-level effects. Some whales would maintain or slightly improve nutrient and energy intake over the life of the Proposed Action, but effects are considered to be the same as under Alternative 2.

This deferral would exclude disturbance and collision impacts to whales arising from exploration activities in the deferral area for the remainder of the present 5-Year Program. These sources of potential adverse effects would occur farther away from a small portion of important beluga migration, molting and birthing areas and baleen whale feeding habitats. While development is considered speculative, the increased distance between potential offshore launch areas and whale habitats conceivably would decrease the percent chance of spilled-oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. Any OCS-related infrastructure (pipelines) to transport product still could occur on these blocks, and potential for petroleum spills from pipelines and vessel fuel spills still could occur.

4.5.4.8.3.2. Cumulative Effects Under Alternative 4. This analysis describes the anticipated level of effect to marine mammals resulting from the implementation of Alternative 4. The cumulative effects are the combination of the direct and indirect effects under this alternative (above) and the cumulative effects under Alternative 1 (Section 4.5.1.8.3.2).

Ringed, Spotted, Ribbon, and Bearded Seals. Anticipated cumulative effects would be similar to those described in Section 4.5.2.8.3.2. The extent to which this deferral reduces the cumulative effects to seals compared to Alternative 2, the Proposed Action, would be negligible.

Pacific Walrus. This deferral would slightly decrease potential adverse impacts to walruses compared with Alternative 2. The primary reduction of impacts to walruses under this deferral would be to buffer a portion of the shoreline used for terrestrial haulouts, the spring lead system, and the Point Lay polynya area. Deferring this area reduces the overall footprint of the lease sale in walrus habitat and, therefore, slightly reduces the cumulative impacts. This deferral would protect some recurring walrus resting and foraging habitat. The Ledyard Bay Deferral area is used by walruses during late summer and fall periods, when walruses haul out to rest. Alternative 4 would have minor impacts on the walrus population. The extent to which this deferral reduces the cumulative effects to walrus compared to Alternative 2, the Proposed Action, would be negligible.

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales, and Gray Whales. Cumulative effects would be similar to those described in Sections 4.5.2.8.3.2 and 4.5.4.6.2.1.1.

The Ledyard Bay Deferral would reduce adverse effects to whales during migration periods and period of concentrated summer-fall feeding; however, its small size limits the size of the reduction, and the effects are only slightly reduced compared to those under Alternative 2. Potential displacement from important prey concentrations and feeding areas would be reduced slightly, but less than under Alternative 3, from reduction in noise and vessel traffic related to OCS lease activities on the lease blocks identified in the deferral. The deferral further would increase the distance between whale habitats and potential OCS activities on lease blocks farther north, effectively decreasing exposure to high noise levels. The effects of this alternative would not result in detectable population-level effects. Some whales would maintain or slightly improve nutrient and energy intake and experience slightly decreased exposure to noise levels and displacement effects over the life of any new leases, but these effects would be slight and are considered to be the same as those identified under Alternative 2.

4.5.4.9. Terrestrial Mammals. Alternative 4, the Ledyard Bay Deferral, is described in Section 2.1.2.4. The following analysis describes the anticipated effects to terrestrial mammals if the lease sale took place with a Ledyard Bay subarea deferral in the Proposed Action area. The Ledyard Bay deferral zone constitutes 3% of the Proposed Action area; however, the impacts to terrestrial mammals under this alternative would be similar to those under Alternative 2, if adequate mitigation strategies are implemented. In this section, we describe the anticipated effects to terrestrial mammals from the Proposed Action with mitigation measures in place. The effects of selecting Alternative 4 versus Alternative 2 are the same for terrestrial mammals. A complete description of the Proposed Action, exploration, and development scenarios is located in Section 2.2.

This analysis identifies the anticipated level of effect under this alternative to terrestrial mammals. The anticipated effects under this alternative are separated into direct and indirect effects (Section 4.5.4.9.3.1) and cumulative effects (Section 4.5.4.9.3.2).

4.5.4.9.1. Potential Effects to Terrestrial Mammals. Potential effects are described in Section 4.5.1.9.1.

4.5.4.9.2. Mitigation Measures. Mitigation measures are the same as described in Section 4.5.2.9.2.

4.5.4.9.3. Anticipated Effects Under Alternative 4.

4.5.4.9.3.1. Direct and Indirect Effects Under Alternative 4. The direct and indirect effects would be similar to those described in Section 4.5.2.9.3.1.

4.5.4.9.3.2. Cumulative Effects Under Alternative 4. The cumulative effects would be the same as those described in Section 4.5.2.9.3.2.

4.5.4.10, Vegetation and Wetlands. The effects to vegetation and wetlands under Alternative 4, Ledyard Bay Deferral, would be the same as those under Alternative 2, the Proposed Action.

4.5.4.11. Economy. There would be no effective difference between the economic effects under Alternative 4 and Alternative 2, the Proposed Action.

4.5.4.12. Subsistence-Harvest Patterns and Resources. This alternative would offer for leasing all of the area described under Alternative 2 except for a subarea located in and around Ledyard Bay, and is a subset of Alternative 3. This alternative offers for lease approximately 7,135 whole or partial blocks consisting of 39,104,542 acres (15.8 million hectares). The area that would be removed by the Ledyard Bay Deferral consists of 191 whole or partial blocks, approximately 1,088,324 acres (364,334 thousand hectares). This alternative addresses issues of protecting a critical habitat area designated by the FWS for the protection of spectacled and Steller's eiders.

4.5.4.12.1. Direct and Indirect Effects Under Alternative 4. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 191 whole or partial blocks along the shoreward edge of the sale area, impacts to Point Lay nearshore subsistence resources, habitats, and hunting areas potentially would be reduced. This alternative was developed in response to comments received during the scoping process to reduce impacts to bowhead whale subsistence hunting. This alternative was developed by

MMS with FWS for the protection of spectacled and Steller's eiders, but it also would buffer important sea mammal subsistence harvest areas for the community of Point Lay.

Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities in the deferred area, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, onshore habitats, and Point Lay marine mammal harvest areas. In this way, subsistence resources, habitats, and hunting areas would be afforded more protection from potential impacts.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

Conclusion. Effects to Point Lay subsistence-harvest patterns are expected to be reduced, because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts to subsistence resources and marine mammal hunting from Alternative 2, the Proposed Action. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

4.5.4.12.2. Cumulative Effects Under Alternative 4.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Point Lay marine mammal hunting areas and, therefore, negligibly reduces the cumulative effects to subsistence resources, harvests, and harvest patterns from Alternative 2, the Proposed Action.

4.5.4.13. Sociocultural Systems. The area deferred by the Ledyard Bay Deferral consists of 191 whole or partial blocks and addresses issues of protecting a critical habitat area designated by the FWS for the protection of spectacled and Steller's eiders.

4.5.4.13.1. Direct and Indirect Effects Under Alternative 4. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 191 whole or partial blocks along the shoreward edge of the sale area, impacts to Point Lay nearshore subsistence resources, habitats, and hunting areas potentially would be reduced. Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities in the deferred area, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, onshore habitats, and Point Lay marine mammal harvest areas. In this way, subsistence resources, habitats, and hunting areas would be afforded more protection from potential impacts.

Conclusion. Effects to sociocultural systems are expected to be reduced by this deferral alternative to the extent they reduce effects to subsistence-harvest patterns, particularly on Point Lay subsistence marine mammal harvest areas. Because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts on subsistence resources and marine mammals hunting, effects on sociocultural systems would be reduced accordingly. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. Effects to sociocultural systems likely would be reduced from Alternative 2, the Proposed Action

4.5.4.13.2. Cumulative Effects Under Alternative 4.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Point Lay marine mammal hunting areas. By reducing cumulative effects to subsistence harvests areas and subsistence practices, an expected consequent negligible reduction of effects to sociocultural systems also would be expected from Alternative 2, the Proposed Action.

4.5.4.14. Archaeological Resources. This deferral would prohibit leasing, exploration, development, and production activities in 191 whole or partial blocks.

4.5.4.14.1. Direct and Indirect Effects Under Alternative 4.

Conclusion. The potential effects under Alternative 4 on archaeological resources are essentially the same as discussed under Alternative 2, the Proposed Action, except the areas deferred would be removed from any bottom-disturbing activities. More potential effects are likely to occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Prehistoric and historic resources both onshore and offshore would be identified by archaeological surveys and avoided or mitigated.

4.5.4.14.2. Cumulative Effects Under Alternative 4.

Conclusion. Deferring this area reduces the overall footprint of the lease sale and, therefore, negligibly reduces the cumulative effects to archaeological resources from Alternative 2, the Proposed Action.

4.5.4.15. Environmental Justice. The area deferred by the Ledyard Bay Deferral consists of 191 whole or partial blocks and addresses issues of protecting a critical habitat area designated by the FWS for the protection of spectacled and Steller's eiders.

4.5.4.15.1. Direct and Indirect Effects Under Alternative 4. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 191 whole or partial blocks along the shoreward edge of the sale area, impacts to Point Lay nearshore subsistence resources, habitats, and hunting areas potentially would be reduced and afforded more protection.

Moving the shoreward boundary of the lease sale offshore would prohibit leasing, exploration, development, and production activities in the deferred area, thus, moving the zone for potential noise, disturbance, and oil-spill effects farther away from the Chukchi Sea spring-lead system, nearshore coastal waters, onshore habitats, and Point Lay marine mammal harvest areas. Health effects in Point Lay would be reduced primarily through reduction in subsistence impacts, which would result in a lower incremental risk of adverse subsistence-related health effects on general health and well-being, diet and nutrition, injury rates, and rates of nutrition-related chronic diseases such as diabetes, hypertension, and cardiovascular disease. This alternative also would prevent discharges in some areas used by subsistence hunters from Point Lay, which could reduce subsistence-related health effects by allaying community fears about contamination, and also could result in a small incremental reduction in the risk posed by contamination of subsistence resources by OCS discharges. Airborne emissions from OCS activities also would also occur farther from shore and farther from subsistence-use areas, resulting again in a small incremental reduction in the risk of emissions-related health effects.

Conclusion. Effects to EJ are expected to be reduced by this deferral alternative to the extent they reduce effects on subsistence-harvest patterns, sociocultural systems, and associated effects on public health. Because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts to subsistence resources, marine mammals hunting, and sociocultural systems, effects to EJ would be reduced accordingly. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. Effects to EJ likely would be negligibly reduced from Alternative 2, the Proposed Action

4.5.4.15.2. Cumulative Effects Under Alternative 4.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Point Lay marine mammal hunting areas. By reducing the likely impacts to subsistence resources in key subsistence areas used by Point Lay, there would be an expected reduction in the cumulative impacts of past, present, and reasonably foreseeable actions on the public health in this community. Vulnerable populations, such as elders, people with chronic lung and cardiovascular disease, and infants, and particularly subsistence hunters, could benefit from an incrementally reduced chance of exposure to unhealthful levels of air pollution. By reducing cumulative effects on subsistence harvests areas, subsistence practices, sociocultural systems, and associated effects on public health, an expected consequent negligible reduction of effects to EJ also would be expected from Alternative 2, the Proposed Action.

4.5.5. Alternative 5, Chukchi Sea Hanna Shoal Deferral.

This alternative addresses issues associated with minimizing impacts to a recognized ecologically sensitive area. The habitat associated with Hanna Shoal has been documented as an important feeding area for Pacific walrus and grey whales. This alternative would offer for lease all of the area described for Chukchi Sea Alternative 2, except for an area encompassing Hanna Shoal. This alternative would offer for lease 7,085 whole or partial blocks comprising approximately 39,057,422 acres (about 15.7 million hectares), minus any blocks currently leased at the time of the sale. The area deferred under this alternative consists of 241 whole or partial blocks, approximately 1,135,444 acres (about 459,498 thousand hectares), which is about 28% of the Proposed Action area. This alternative would result in a reduction of 4% of the commercial resource potential from the Proposed Action.

4.5.5.1. Water Quality. Alternative 5 would not significantly reduce the estimated oil resource or the activities associated with exploration and development and production. Therefore, this alternative does not substantially lessen the effects to Chukchi Sea water quality for any of the activities discussed in Section 4.5.2.1. There would be some reduction of the local impacts within any deferred area from construction and permitted discharges, but the risk of effects from oil spills to the deferred area would be unaffected.

Conclusion. The effects under Alternative 5 are expected to be minor on local water quality and negligible on regional water quality, the same as under the Proposed Action.

4.5.5.2. Air Quality. The effects to air quality under Alternative 5, Hanna Shoal Deferral, would be the same as under Alternative 2, the Proposed Action.

4.5.5.3. Lower Trophic-Level Organisms. Hanna Shoal is located in the northern part of the proposed lease area. The deferral of Hanna Shoal would have only a small influence on the level of effects. There would be no disturbance of the benthos from drilling rigs. However, the area could be explored with floating rigs without disturbing the benthos. Further, pipelines might be routed across the shoal and other unleased areas, in spite of the deferral. There would be no discharges on the shoal, but there might be discharges “upstream” of the shoal. The most serious effects to lower trophic-level organisms would be due to spills that contact the Alaska coastline. The likelihood that spills would contact the U.S. coastline is due primarily to tracts that are near the coastline (Appendix A, Table A.3-43). Therefore, the chance of a large spill contacting would be similar with or without the Hanna Shoal Deferral. Further, the combination of the Hanna Shoal Deferral with the Ledyard Bay and/or the Deepwater deferrals would not alter the level of effects, but the combination of the Hanna Shoal Deferral with the Coastal Deferral and with or without the Ledyard Bay and Deepwater deferrals would lower the level of effects.

As explained in Section 4.5.2.3, three aspects of the proposed lease sale that might affect the organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells likely might be local and minor, as concluded in the Sale 193 EIS. For development, it is estimated that a network of buried pipelines would radiate from a central production platform on the central shelf, and that a single long pipeline would extend to shore. This assessment assumes that produced hydrocarbons would not be transport to shore by tanker or barge. Pipeline burial likely would disturb up to 2,000 acres of typical benthic organisms. These organisms would likely recolonize the pipeline corridors over a decade, just as they slowly recolonize ice gouges. Site-specific disturbance effects would be assessed later; some assessments will need more accurate information on recolonization and coastal erosion rates.

Any exploratory discharges during summer likely may have immeasurable or negligible effects on the planktonic and benthic communities. Produced water from all Beaufort Sea developments to date have been reinjected voluntarily rather than discharged; this assessment assumes that produced water would be reinjected also at Chukchi Sea developments. Any discharge proposal would be reviewed in detail by MMS and EPA.

The OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of Alternative 2 (Section 4.3.2.1.4). If the assumed spills occur in broken ice, cleanup would present substantial challenges (Section 4.3.3.1.7). If a large spill occurs during summer near the center of the proposed lease area, the model estimates a <20% chance that the spill would drift within 30 days to the U.S. Chukchi coast. The model estimates a <22% chance a large spill would drift into Russian water within 10 days, where U.S. responses might be difficult. The same chances decrease to <7 and 3% within 10 days, indicating a reduction in impacts for lower trophic-level organisms of the requirements for rapid-response capabilities (Section 4.3.3.1.5.5). If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for more than a decade. Some lower-trophic organisms would experience a larger effect than others.

Conclusion. Three aspects of the lease sales without Hanna Shoal that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells may likely be local and minor. Any exploratory discharges during summer likely would have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaska coastline, the hydrocarbons would likely affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL on pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. So, the cumulative level of effects, including the effect of ongoing climate change, would be major. The extent to which this deferral reduces the cumulative effects to lower trophics compared to Alternative 2, the Proposed Action, would be negligible. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.5.4. Fish Resources.

Summary. This deferral reduces the size of the lease-sale area. This reduction in size would reduce adverse effects to fish resources in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative would result in fewer effects, but still at a minor level, compared to Alternative 2.

4.5.5.4.1. Potential Effects to Fish Resources. The potential effects to fish resources in the Chukchi Sea were described in Section 4.5.1.4.1.

4.5.5.4.2. Mitigation Measures. The potential effects can be moderated by the mitigation measures identified in Section 4.5.2.4.2.

4.5.5.4.3. Anticipated Effects Under Alternative 5. This deferral reduces the size of the lease-sale area. This reduction in size could reduce adverse effects to fish resources in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. To the extent that fish resources are separated from adverse effects, this alternative would result in fewer effects, but still at a minor level, compared to Alternative 2. The extent to which this deferral reduces the cumulative effects to fish resources compared to Alternative 2, the Proposed Action, would be negligible.

4.5.5.5. Essential Fish Habitat.

Summary. This deferral reduces the size of the lease-sale area. This reduction in size would reduce adverse effects to EFH in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important components of EFH. To the extent that EFH in the deferral area is separated from adverse effects, this alternative would result in fewer effects, but still at a minor level, compared to Alternative 2.

4.5.5.5.1. Potential Effects to Essential Fish Habitat. The potential effects to EFH in the Chukchi Sea lease-sale area were described in Section 4.5.1.5.1.

4.5.5.5.2. Mitigation Measures. The potential effects would be moderated by the mitigation measures identified in Section 4.5.2.5.2.

4.5.5.5.3. Anticipated Effects of Selecting Alternative 5. This deferral reduces the size of the lease-sale area. This reduction in size would reduce adverse effects to EFH in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Deferral areas commonly are associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important components of EFH. To the extent that EFH in the deferral area is separated from adverse effects, this alternative would result in fewer effects, but still at a minor level, compared to Alternative 2.

4.5.5.6. Threatened and Endangered Species.

4.5.5.6.1. Threatened and Endangered Whales.

Summary. Endangered Species Act-listed whales that can occur within or near Chukchi Sea Planning Areas or that potentially could be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. The direct, indirect, and cumulative adverse effects under Alternative 5 may improve slightly over those noted under Alternative 2, the Proposed Action (Section 4.5.2.6.1.), but reductions in impacts are not substantial and effects are considered to be the same (negligible to minor) as those under Alternative 2.

After reviewing the current status of endangered bowhead, fin, and humpback whales, the environmental baseline for the action area, the Proposed Action, and the cumulative effects, it is NMFS's biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that the Proposed Action is not likely to jeopardize the continued existence of Western Arctic bowhead whales, North Pacific fin whales, or humpback whales. No critical habitat has been designated for these species; therefore, none will be affected. The NMFS concludes at this time, there is reasonable likelihood that oil and gas development and production in the Alaska Beaufort and Chukchi seas, as described, would not violate Section 7(a)(2) of the ESA (NMFS, 2008c).

The following analysis describes potential adverse effects to endangered whales from OCS activities associated with oil and gas exploration and development activities as described in Section 2.4.1. Scenario for the "Typical" Chukchi Sea Lease Sale (Sales 212 and 221) in Section 4.4.1.6.1.1, mitigation measures to avoid or minimize potential adverse effects to endangered whales in Section 4.4.1.6.1.2, and the anticipated effects resulting from application of mitigation to potential adverse effects in Section 4.4.1.6.1.3. Anticipated effects discussed herein consider mitigation measures applied to determine the effects under Alternative 5, the Hanna Shoal Deferral, to bowhead, fin, and humpback whales. In this section, we address the important differences between the Proposed Action (Alternative 2) and this alternative.

4.5.5.6.1.1. Potential Effects to Threatened and Endangered-Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified under Alternative 5, the Hanna Shoal Deferral, that could occur if the entire Chukchi Sea Planning Area except the Hanna Shoal Deferral area would be open to proposed Lease Sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain identical for all alternatives, including the Hanna Shoal, and will not be repeated here.

4.5.5.6.1.2. Mitigation Measures. The mitigation measures listed in Section 4.4.1.6.1.2 and Section 4.4.2.6.1.2 are applied, as appropriate, to OCS activities to protect ESA-listed whales and other marine mammals during Federal seismic and exploratory drilling in the Beaufort Sea and Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities associated with all alternatives for Lease Sales 212 and 221, including the Hanna Shoal Deferral.

4.5.5.6.1.3. Anticipated Effects Under Alternative 5. This section describes the most important differences in the anticipated effects between the Proposed Action (Alternative 2) and the Hanna Shoal Deferral (Alternative 5). Anticipated effects consider mitigation measures and specific biological and activity characteristics discussed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.1.2.

4.5.5.6.1.4. Conclusions.

4.5.5.6.1.4.1. Direct and Indirect Effects Under Alternative 5.

Summary. This deferral would reduce impacts to bowhead whales during the fall migration period; summer and fall feeding aggregations of endangered bowhead, as well as gray whales (not ESA listed), and protects key areas where known feeding concentrations of bowhead and gray whales have been documented. Potential displacement from important prey concentrations and feeding would be reduced in some years from noise and vessel traffic related to OCS lease activities on the lease blocks identified in the deferral. The effects analysis and conclusions are slightly improved over Alternative 2. It is unknown if effects of this alternative would not result in positive detectable population-level effects. Some whales would maintain or slightly improve nutrient and energy intake and experience decreased exposure frequency to noise levels stimulating behavioral response from oil and gas activities over the life of the Proposed Action, but effects are considered to be the same as for Alternative 2.

This alternative would defer 241 full or partial lease blocks to include Hanna Shoal and associated known whale aggregation areas from the proposed Chukchi Sea sale area (Figure 2-2). The primary reduction in impacts of this deferral would be to exclude disturbance, displacement, and collision impacts to endangered whales arising from exploration activities in these blocks for the remainder of the 5-Year Program period. These sources of potential adverse effects would occur farther away from important feeding habitats and decrease displacement from use of the Hanna Shoal-associated habitats. While development is considered speculative, the increased distance between potential offshore launch areas and whale habitats conceivably would decrease the percent chance of a large spill contacting whale habitat, increase weathering of spilled oil prior to contact, and increase available spill-response time. The OCS-related infrastructure (pipelines) to transport product still could occur on these blocks, and potential for petroleum spills from these and vessel fuel spills still could occur.

4.5.5.6.1.4.2. Cumulative Effects Under Alternative 5.

Summary. The cumulative effects under this alternative are considered to be the same as under Alternative 2, the Proposed Action.

As explained in Section 4.5.4.6.1, the Hanna Shoal Deferral would reduce impacts to bowhead endangered whales during the fall migration period and period of concentrated summer-fall feeding for bowhead as well as gray whales; however, the reduction in impacts and the effects analysis and conclusions are uncertain but considered slightly improved compared to those under Alternative 2. Oil- and gas-related activities would not occur during periods when endangered whales are not present nor would accessing petroleum resources via extended reach technology from adjacent active lease blocks occur. The reduced impact level slightly reduces the total cumulative effect. Impacts to endangered whales and habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue to have a negative, moderate level of effect on whales. The greatest source of large, refined oil spills would continue to arise from bulk-fuel deliveries to coastal villages. The anticipated increase in traffic from tourism, research, and/or shipping vessels could increase the potential for marine accidents and large fuel spills, which could result in major adverse effects on endangered whales in the Beaufort and Chukchi seas. Climate change is likely to continue and, although speculative and unpredictable at this time, effects may be positive and/or adverse to endangered whales or their habitat in the Chukchi Sea.

4.5.5.6.2 Threatened and Endangered Birds.

Summary. This deferral would not affect ESA-protected birds, because the excluded area is not used by these species. The cumulative effects are anticipated to be the same as those under Alternative 2.

4.5.5.6.2.1. Potential Effects to Threatened and Endangered Birds. The potential effects are the same as those described in Section 4.5.1.6.2.1.

4.5.5.6.2.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, including specific measures to minimize disturbance effects to eiders in the Ledyard Bay Critical Habitat Area during exploratory drilling.

4.5.5.6.2.3. Anticipated Effects Under Alternative 5. This deferral would not affect ESA-protected birds because the excluded area is not used by these species. The anticipated effects are the same as those under Alternative 2.

4.5.5.6.3. Polar Bear.

Conclusions. **A**lternative 5, Hanna Shoal Deferral, likely would not decrease impacts to polar bears. Although little is known about the offshore movements of polar bears in the Chukchi Sea, the Hanna Shoal area is not known to have any particular significance for polar bears.

4.5.5.6.3.1. Direct and Indirect Effects Under Alternative 5. This deferral area would remove 241 lease blocks and partial lease blocks, or approximately 1,135,444 acres from the lease sale. There are no known direct effects from this alternative for polar bears. Indirectly, this deferral would protect foraging habitat of walruses and gray whales, and may offer some reduction in impacts to polar bear prey species (the walrus). This deferral would reduce slightly the chance of a large spill contacting from LAs 6 and 7 by reducing the overall footprint of these launch areas (Appendix A, TableA.3-3).

4.5.5.6.3.2. Cumulative Effects Under Alternative 5. Deferring this area reduces the overall footprint of the lease sale and, therefore, reduces potential cumulative impacts. This deferral would not offer any known direct protection to polar bears but would protect foraging habitat for one of the polar bear's prey species, the walrus. This alternative would have no or minor effects on the overall level of impacts to polar bears compared to Alternative 2, the Proposed Action.

4.5.5.7. Marine and Coastal Birds.

Summary. This deferral would not change the adverse effects to marine and coastal birds to an appreciable extent compared to Alternative 2, because the excluded area is not used extensively by marine and coastal birds. The anticipated effects are the same as those under Alternative 2.

4.5.5.7.1. Potential Effects to Marine and Coastal Birds. The potential effects would be the same as those described in Section 4.4.1.6.2.1.

4.5.5.7.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, including specific measures to minimize disturbance effects to eiders in the Ledyard Bay Critical Habitat Area during exploratory drilling.

4.5.5.7.3. Anticipated Effects Under Alternative 5. This deferral would not change the adverse effects to marine and coastal birds to an appreciable extent compared to Alternative 2, because the excluded area is not used extensively by marine and coastal birds. The anticipated effects are the same as those under Alternative 2.

4.5.5.8. Other Marine Mammals.

Summary. This alternative would offer about 7,085 whole or partial blocks in the lease-sale area (Figure 2-2). The following analyses describe the anticipated effects under Alternative 5, the Hannah Shoal Deferral, to marine mammals of the Alaskan Chukchi Sea. The Hanna Shoal deferral constitutes about 28% of the Chukchi Sea lease-sale area.

Ringed, Spotted, Ribbon, and Bearded Seals. There is very little information published about ice seal distribution in the Hanna Shoal area. This may be an important foraging area for some ice seal species in spring or fall, but it is unclear whether the impacts under Alternative 5 would vary greatly from those under Alternative 2.

Pacific Walrus. Although little is known about the offshore movements of walruses in the Chukchi Sea, the Hanna Shoal area has been identified as an important foraging area for walruses. Earlier marine mammal monitoring programs have observed large aggregations of walruses in the Hanna Shoals area during September and October. Brueggeman et al. (1992) identified this area as an important walrus foraging area. Alternative 5 may decrease adverse impacts to walruses compared with Alternative 2. Alternatives 5 and 3 may have negligible impacts to walrus. Alternative 5 would have minor impacts to walrus.

Beluga Whale, Killer Whale, and Harbor Porpoise, Minke Whale and Gray Whale. The direct, indirect, and cumulative adverse effects of this alternative may be slightly reduced compared to those determined under Alternative 2, the Proposed Action, but this reduction is not substantial and effects are considered to be the same (minor).

4.5.5.8.1. Potential Effects to Marine Mammals. Potential effects to walruses and ice seals are described in Section 4.5.1.8.1. Potential effects to whales are described in Sections 4.4.1.6.1.1 and 4.5.1.8.1. Potential effects described in Sections 4.5.1.8.1 and 4.4.1.6.1.1 remain identical for all alternatives, including the Hanna Shoal Deferral.

4.5.5.8.2. Mitigation Measures. Mitigation measures are described in Section 4.5.2.8.2.

4.5.5.8.3. Anticipated Effects Under Alternative 5.

4.5.5.8.3.1. Direct and Indirect Effects Under Alternative 5.

Ringed, Spotted, Ribbon, and Bearded Seals. Hanna Shoal is believed to be a particularly important resource area for benthic feeders (Nelson et al. 1993; Brueggeman et al., 1992), which may include bearded and ringed seals. For this reason, one could logically conclude that some species of ice seals may occur in higher densities in the Hanna Shoal area. Investigations into densities and distributions of bearded seals in the Chukchi Sea are few, as are studies looking into the seasonal use of habitat in Hanna Shoal by ice seals. Offshore production facilities have been known to create lead systems, the preferred foraging habitat for ice seals (Nelson et al. 1993). However this deferral can be expected to result in added scrutiny of the leased areas through reallocation of resources, leading to a level of effects similar to those described in 4.5.2.8.3.1 for the Alaskan Chukchi Sea.

Pacific Walrus. The direct impact of Alternative 5 is to defer important walrus foraging habitat from the lease sale. Indirectly, this deferral would slightly reduce the risk of spills occurring from LAs 6 and 7 by reducing the overall footprint of these launch areas (Appendix A, TableA.3-3).

Beluga Whale, Killer Whale, and Harbor Porpoise. This alternative could slightly reduce disturbance and displacement effects due to exploration drilling in an area that could be used by these whales during portions of the open-water period. These whales are not known to concentrate in the Hannah Shoal area, however, and the reduction in direct and indirect effects is considered small. This small reduction would not change the level of direct effect under this alternative, and the level of effect is the same as under Alternative 2.

Minke Whale and Gray Whale. This deferral would affect gray whales during the summer and fall feeding periods. It would protect key areas where known feeding gray whale concentrations have been documented. Potential displacement from important prey concentrations and feeding would be reduced in some years from noise and vessel traffic related to OCS lease activities on the lease blocks identified in the deferral. This deferral further would buffer the contiguous areas around the deferral area by increasing the distance (effectively decreasing exposure to high noise levels) between potential activities on OCS lease blocks around Hanna Shoal. The effects of this alternative may not result in detectable population-level effects. Some gray whales would maintain or improve nutrient and energy intake over the life of the Proposed Action, but the overall minor level of effects under this alternative is considered the same as under Alternative 2.

This alternative defers 241 full or partial lease blocks along Hanna Shoal from the proposed Chukchi Sea lease-sale area (Figure 2-2). The primary reduction in impacts of this deferral would be to exclude disturbance and collision impacts to whales arising from exploration activities in these blocks for the remainder of the present 5-Year Program. These sources of potential adverse effects would occur farther away from an important portion of gray whale feeding habitats. While development is considered speculative, the increased distance between potential offshore oil spill launch areas and whale habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering period of spilled oil prior to whale contact, and increase available spill-response time. Any OCS-related infrastructure (pipelines) to transport product still could occur on these blocks, and potential for petroleum spills from these and vessel fuel spills still could occur.

4.5.5.8.3.2. Cumulative Effects Under Alternative 5. The cumulative effects are the combination of the direct and indirect effects under this alternative (above) and the cumulative effects under Alternative 1 (Section 4.5.1.8.3.2).

Ringed, Spotted, Ribbon, and Bearded Seals. Cumulative effects are believed to be similar to those described in Section 4.5.2.8.3.2.

Pacific Walrus. Alternative 5 rather than Alternative 2 reduces the overall footprint of the lease sale and, therefore, reduces potential cumulative impacts. This deferral would decrease adverse impacts to important foraging habitat for walruses. Selecting this alternative could reduce the overall level of impacts to walruses. Alternative 5 likely would result in minor impacts to walrus. Alternatives 5 and 3 may reduce the level of impact to negligible.

Beluga Whale, Killer Whale, and Harbor Porpoise. This alternative could slightly reduce disturbance and displacement effects due to exploration drilling in an area that could be used by these whales during portions of the open-water period. These whales are not known to concentrate in the Hannah Shoal area, however, and the reduction in direct and indirect effects is considered small. This small reduction would not change the level of cumulative effect under this alternative. Other sources of non-OCS activity would continue to affect whales in this area, and the level of effect is the same as under Alternative 2.

Minke Whale and Gray Whale. The cumulative effects of this alternative would be similar to those described in Sections 4.5.2.8.3.2., 4.5.4.6.2.1.2, and 4.4.3.6.2.1.2. Anticipated effects would be similar to those described in Section 4.5.2.8.3.

The Hanna Shoal Deferral primarily would reduce impacts to gray whales during periods of concentrated summer-fall feeding. Potential displacement from important prey concentrations and feeding areas of Hanna Shoal tracts would be reduced from levels experienced under Alternative 2. The effects analysis and conclusions are improved for some gray whales. The effects under this alternative may not result in detectable population-level effects. Some gray whales would maintain or improve nutrient and energy intake and experience decreased exposure to noise levels stimulating adverse behavioral response and displacement effects over the life of the Proposed Action, but overall effects to whales are considered to be the minor, as those identified under Alternative 2.

The Hanna Shoal Deferral would not allow oil- and gas-related activities during periods when whales are present. The reduced impact level slightly reduces the total cumulative effect. Impacts to whales and habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue. Climate change is likely to continue and, although speculative and unpredictable at this time, effects may be positive and/or adverse to gray whale use of the Hanna Shoal area as well as other habitats in the Chukchi Sea.

Gray whale feeding habitats would be less impacted by a reduction in area subject to oil and gas exploration, and development and production noise that would have been associated with leases in the deferral area. While development is considered speculative, the increased distance between potential offshore launch areas and offshore Hanna Shoal gray whale habitats conceivably would decrease the percent chance of spilled oil contact, increase weathering of spilled oil prior to contact, and increase available spill-response time. Any OCS-related infrastructure (pipelines) to transport product still could occur on these blocks, and the potential for petroleum spills from these and vessel fuel spills still could occur. Anticipated direct and indirect effects are anticipated to be the same as under the Proposed Action, Alternative 2, for most whales, with some reduction in level of effects to gray whales, but not substantial enough to reduce overall level of effects to whales noted under Alternative 2.

4.5.5.9. Terrestrial Mammals. The Hanna Shoal deferral, Alternative 5, is described in Section 2.1.2.5. The following analysis describes the anticipated effects to terrestrial mammals if the lease sale took place with a Hanna Shoal subarea deferral in the Chukchi Sea analysis area. The coastal deferral zone constitutes 28% of the Proposed Action area; however, the impacts to terrestrial mammals under this alternative would be similar to those under Alternative 2 if adequate mitigation strategies are implemented. In this section, we describe the anticipated effects to terrestrial mammals from the Proposed Action with mitigation measures in place. The effects under Alternative 5 versus Alternative 2 are the same for terrestrial mammals.

This analysis identifies the anticipated level of effect for this alternative on terrestrial mammals. The anticipated effects under this alternative are separated into direct and indirect effects (Section 4.5.5.9.3.1.) and cumulative effects (Section 4.5.5.9.3.2.).

4.5.5.9.1. Potential Effects to Terrestrial Mammals. Potential effects are described in Section 4.5.1.9.1.

4.5.5.9.2. Mitigation Measures. Mitigation measures are the same as described in Section 4.5.2.9.2.

4.5.5.9.3. Anticipated Effects Under Alternative 5.

4.5.5.9.3.1. Direct and Indirect Effects Under Alternative 5. The direct and indirect effects would be similar to those described in Section 4.5.2.9.3.1.

4.5.5.9.3.2. Cumulative Effects Under Alternative 5. The cumulative effects would be the same as those described in Section 4.5.2.9.3.2.

4.5.5.10. Vegetation and Wetlands. The effects to vegetation and wetlands under Alternative 5, Hanna Shoal Deferral, would be the same as those under Alternative 2, the Proposed Action.

4.5.5.11. Economy. There would be no effective difference between the economic effects under Alternative 5, Hanna Shoal Deferral, and Alternative 2, the Proposed Action.

4.5.5.12. Subsistence-Harvest Patterns and Resources. This alternative would offer for leasing all of the area described under Alternative 2 except for a subarea defining Hanna Shoal. This alternative offers for lease approximately 7,085 whole or partial blocks consisting of 39,057,422 acres (15.7 million hectares). The area that would be removed by the Hanna Shoal Deferral consists of 241 whole or partial blocks. This alternative addresses issues associated with minimizing impacts on habitat associated with Hanna Shoal that has been documented as an important feeding area for Pacific walrus and grey whales.

4.5.5.12.1. Direct and Indirect Effects Under Alternative 5. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 241 whole or partial blocks in the vicinity of Hanna Shoal, impacts to gray whale and Pacific walrus feeding areas potentially would be reduced. Reductions in impacts to walrus habitat would be expected to reduce potential impacts to the subsistence walrus hunt.

By prohibiting leasing, exploration, development, and production activities in the deferred area, the zone for potential noise, disturbance, and oil-spill effects would be moved farther away Hanna Shoal and afford greater protection for Pacific walruses, an important subsistence resource to Chukchi Sea coastal communities.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

Conclusion. Effects to subsistence-harvest patterns are expected to be reduced, because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts to Pacific walruses from Alternative 2, the Proposed Action. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

4.5.5.12.2. Cumulative Effects Under Alternative 5.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Pacific walrus habitat and, therefore, negligibly reduces the cumulative effects to subsistence resources, harvests, and harvest patterns from those under Alternative 2, the Proposed Action.

4.5.5.13. Sociocultural Systems. This area deferred by the Hanna Shoal Deferral consists of 241 whole or partial blocks and addresses issues associated with minimizing impacts to habitat associated with Hanna Shoal that has been documented as an important feeding area for Pacific walruses and grey whales.

4.5.5.13.1. Direct and Indirect Effects Under Alternative 5. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 241 whole or partial blocks in the vicinity of Hanna Shoal, impacts to gray whale and Pacific walrus feeding areas potentially would be reduced. Reductions in impacts to walrus habitat would be expected to reduce potential impacts to the subsistence walrus hunt.

By prohibiting leasing, exploration, development, and production activities in the deferred area, the zone for potential noise, disturbance, and oil-spill effects would be moved farther away from Hanna Shoal and afford greater protection for Pacific walruses, an important subsistence resource to Chukchi Sea coastal communities.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area.

Conclusion. Effects to sociocultural systems are expected to be reduced by this deferral alternative to the extent they reduce effects to subsistence-harvest patterns, particularly by deferring important Pacific walrus habitat. Because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts to Pacific walruses, an important subsistence resource, effects to sociocultural systems would be reduced accordingly. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. Effects to sociocultural systems likely would be reduced negligibly from those under Alternative 2, the Proposed Action.

4.5.5.13.2. Cumulative Effects of Selecting Alternative 5.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Pacific walrus habitat. By reducing cumulative impacts to subsistence resources, an expected consequent reduction of effects to sociocultural systems would be expected from those under Alternative 2, the Proposed Action.

4.5.5.14. Archaeological Resources. This deferral would prohibit leasing, exploration, development, and production activities in 241 whole or partial blocks.

4.5.5.14.1. Direct and Indirect Effects Under Alternative 5.

Conclusion. The potential effects under Alternative 5 to archaeological resources are essentially the same as discussed under Alternative 2, the Proposed Action, except the areas deferred would be removed from any bottom-disturbing activities. More potential effects are likely to occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Prehistoric and historic resources, both onshore and offshore, would be identified by archaeological surveys and avoided or mitigated.

4.5.5.14.2. Cumulative Effects Under Alternative 5.

Conclusion. Deferring this area reduces the overall footprint of the lease sale and, therefore, negligibly reduces the cumulative effects to archaeological resources from those under Alternative 2, the Proposed Action.

4.5.5.15. Environmental Justice. The area that would be removed by the Hanna Shoal Deferral consists of 241 whole or partial blocks. This alternative addresses issues associated with minimizing impacts habitat associated with Hanna Shoal that has been documented as an important feeding area for Pacific walruses and grey whales.

4.5.5.15.1. Direct and Indirect Effects Under Alternative 5. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By deferring 241 whole or partial blocks in the vicinity of Hanna Shoal, impacts from potential noise, disturbance, and oil-spill effects to gray whale and Pacific walrus feeding areas potentially would be reduced. Reductions in impacts to walrus habitat would be expected to reduce potential impacts to the subsistence walrus hunt, an important subsistence hunt for Chukchi Sea coastal communities.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area. Health effects in Chukchi villages would be reduced primarily through reduction in subsistence impacts, which would result in a lower incremental risk of adverse subsistence-related health effects on general health and well-being, diet and nutrition, injury rates, and rates of nutrition-related chronic diseases such as diabetes, hypertension, and cardiovascular disease.

Conclusion. Effects to EJ are expected to be reduced under this deferral alternative to the extent they reduce effects to subsistence-harvest patterns, sociocultural systems, and associated effects on public health. Because no exploration or production activities would occur in the deferral area, potentially reducing sources for chronic noise and disturbance impacts on subsistence resources, sociocultural systems, and associated effects on public health, effects to EJ would be reduced accordingly. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. Effects to EJ likely would be reduced from those under Alternative 2, the Proposed Action.

4.5.5.15.2. Cumulative Effects Under Alternative 5.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale in critical Pacific walrus habitat. By reducing cumulative effects to subsistence resources, consequent negligible reductions in effects to sociocultural systems, to associated public health effects, and to EJ would be expected under Alternative 2, the Proposed Action.

4.5.6. Alternative 6, Chukchi Sea Deepwater Deferral.

Available information indicates that the deepwater area of the Chukchi Sea (the area below the continental shelf) is unlikely to contain economically viable fields. This alternative was developed by MMS to reduce unnecessary work on an area likely to have low industry interest and to help focus the NEPA process on the issues and environmental resources of areas likely to received bids should a lease sale be held. This alternative would offer for lease 6,354 whole or partial blocks comprising approximately 34,575,585 acres (about 14 million hectares), minus any blocks currently leased at the time of the sale. The area deferred under this alternative consists of 972 whole blocks, approximately 5,617,281 acres (about 2.2 million hectares), which is about 13.9% of the Proposed Action area. This deferral would result in a negligible reduction of the oil and gas potential in relation to Alternative 2, the Proposed Action.

4.5.6.1. Water Quality. Alternative 6 would not significantly reduce the estimated oil resource or the activities associated with exploration and development and production. Therefore, this alternative does not substantially lessen the effects on Chukchi Sea water quality for any of the activities discussed in Section 4.5.2.1. There would be some reduction of the local impacts within any deferred area from construction and permitted discharges, but the risk of effects from oil spills to the deferred area would be unaffected.

Conclusion. The effects under Alternative 6 are expected to be minor on local water quality and negligible on regional water quality, the same as under the Proposed Action.

4.5.6.2. Air Quality. The effects to air quality under Alternative 6, Deepwater Deferral, would be the same as under Alternative 2, the Proposed Action.

4.5.6.3. Lower Trophic-Level Organisms. Off-lease activities, such as seismic exploration, would not be affected under Alternative 6. A few leases have been issued in relatively deepwater and operations could be conducted on them, but the deepwater deferral would delay any additional effects of operations from on-lease activities. As explained in Section 4.5.2.3, the effects of discharges and spills would be most serious near to the coast, so the deepwater deferral would not reduce the most serious effects. However, one effect, disturbance of benthos by pipeline construction, would be different. Any additional pipeline systems might be as long and disturb as much benthos as under the Proposed Action, but the disturbance in deepwater would not be reduced under Alternative 6.

As explained in Section 4.5.2.3, three aspects of the proposed lease sale that might affect the organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells likely might be local and minor, as concluded in the Sale 193 EIS. For development, it is estimated that a network of buried pipelines would radiate from a central production platform on the central shelf, and that a single long pipeline would extend to shore. This assessment assumes that produced hydrocarbons would not be transport to shore by tanker or barge. Pipeline burial likely would disturb up to 2,000 acres of typical benthic organisms. These organisms likely would recolonize the pipeline corridors over a decade, just as they slowly recolonize ice gouges. Site-specific disturbance effects would be assessed later; some assessments will need more accurate information on recolonization and coastal erosion rates.

Any exploratory discharges during summer may likely have immeasurable or negligible effects on the planktonic and benthic communities. Produced water from all Beaufort Sea developments to date have been reinjected voluntarily rather than discharged; this assessment assumes that produced water would be reinjected also at Chukchi Sea developments. Any discharge proposal would be reviewed in detail by MMS and EPA.

The OSRA model estimates the chance of one or more spills ≥1,000 bbl occurring over the production life of Alternative 2 (Section 4.3.2.1.4). If the assumed spills occur in broken ice, clean-up would present substantial challenges (Section 4.3.3.1.7). If a large spill occurs during summer near the center of the proposed lease area, the model estimates a <20% chance that the spill would drift within 30 days to the U.S. Chukchi coast. The model estimates a <22% chance a large spill would drift into Russian water within 10 days, where U.S. responses might be difficult. The same chances decrease to <7 and 3% within 10 days, indicating a reduction in impacts for lower trophic-level organisms of the requirements for rapid-response capabilities (Section 4.3.3.1.5.5). If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for more than a decade. Some lower-trophic organisms would experience a larger effect than others.

Conclusion. Three aspects of the lease sales without deepwater areas that might affect benthic, intertidal, and other lower trophic-level organisms are physical disturbance, discharges, and spills. The disturbance effect of 14 anticipated exploratory wells may likely be local and minor. Any exploratory discharges during summer would likely have immeasurable or negligible effects on the planktonic and benthic communities. If a large spill occurs during summer near the center of the proposed lease area, we estimate a low chance that the spill would drift to the U.S. Chukchi coast. If a large spill did contact the Alaskan coastline, the hydrocarbons likely would affect an estimated 25 km (16 mi) of coastline, persisting in the few noneroding areas for a couple of decades. Even though development is unlikely and MMS has proposed an ITL on pipelines (Section 2.2.3.3), we are concerned about the cumulative effect of development on benthic and coastal organisms. We conclude that the organisms would be affected moderately by the mitigated direct and indirect consequences of foreseeable industry operations. The cumulative effects include the effect of ongoing climate change. As explained in Section 3.3.1, the change would have a widespread, annual, population-level effect on epontic (under ice) and other lower trophic-level organisms that depend on the summer/autumn ice cover. Therefore, the cumulative level of effects, including the effect of ongoing climate change, would be major. The extent to which this deferral reduces the cumulative effects to lower trophics compared to Alternative 2, the Proposed Action, would be negligible. The proposed action would have no more than a negligible effect on greenhouse gas emissions.

4.5.6.4. Fish Resources.

Summary. This deferral reduces the size of the lease-sale area. This deferral was not specifically designed to minimize adverse effects to fish resources. This deferral could serve to protect fish resources and fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall impact to fish resources. A deepwater deferral would not produce such a reduction in impacts. This alternative would result in the same level of effects as Alternative 2.

4.5.6.4.1. Potential Effects to Fish Resources. The potential effects to fish resources in the Chukchi Sea were described in Section 4.5.1.4.1.

4.5.6.4.2. Mitigation Measures. The potential effects can be moderated by the mitigation measures identified in Section 4.5.2.4.2.

4.5.6.4.3. Anticipated Effects Under Alternative 6. This deferral reduces the size of the lease-sale area. This deferral was not specifically designed to minimize adverse effects to fish resources. This deferral could serve to protect fish resources and habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. Deferral areas are commonly associated with nearby communities and traditional subsistence-use areas. Nearshore deferrals could serve to delay the time it would take for a large spill to contact adjacent land segments, estuaries, and shorelines known to be important to fish, thereby reducing the overall adverse effect to fish resources. A deepwater deferral would not produce such a reduction in impacts. This alternative would result in the same level of effects as Alternative 2.

4.5.6.5. Essential Fish Habitat.

Summary. This deferral reduces the size of the lease-sale area. It was not specifically designed to minimize adverse effects to EFH; however, the deferral could serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with OCS oil and gas exploration and development. This alternative would result in the same level of effect as Alternative 2.

4.5.6.5.1. Potential Effects to Essential Fish Habitat. The potential effects to EFH in the Chukchi Sea lease-sale area were described in Section 4.5.1.5.1.

4.5.6.5.2. Mitigation Measures. The potential effects can be moderated by the mitigation measures identified in Section 4.5.2.5.2.

4.5.6.5.3. Anticipated Effects Under Alternative 6. This deferral reduces the size of the lease-sale area. It was not specifically designed to minimize adverse effects to EFH; however, the deferral could serve to protect fish habitat in the immediate deferral area from potentially injurious activities associated with oil and gas exploration and development. This alternative would result in the same level of effect as Alternative 2.

4.5.6.6. Threatened and Endangered Species.

4.5.6.6.1. Threatened and Endangered Whales.

Summary. Endangered Species Act-listed whales that can occur within or near Chukchi Sea Planning Areas or that could potentially be adversely affected by activities within this planning area are the bowhead whale, fin whale, and humpback whale. The direct, indirect, and cumulative adverse effects under Alternative 6 may improve slightly over those noted under Alternative 2, the Proposed Action (Section 4.5.2.6.1), but reduction in impacts are not substantial and effects are considered to be the same (negligible to minor) as under Alternative 2.

After reviewing the current status of endangered bowhead, fin, and humpback whales, the environmental baseline for the action area, the Proposed Action, and the cumulative effects, it is NMFS's biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that the Proposed Action is not likely to jeopardize the continued existence of Western Arctic bowhead whales, North Pacific fin whales, or humpback whales. No critical habitat has been designated for these species; therefore, none will be affected. The NMFS concludes at this time there is reasonable likelihood that oil and gas development and production in the Alaska Beaufort and Chukchi seas, as described, would not violate Section 7(a)(2) of the ESA (NMFS, 2008c).

The following analysis describes potential adverse effects to endangered whales from OCS activities associated with oil and gas exploration and development activities as described in Section 2.4.1, Scenario for the "Typical" Chukchi Sea lease sale (Sales 212 and 221) in Section 4.4.1.6.1.1., mitigation measures to avoid or minimize potential adverse effects to endangered whales in Section 4.4.1.6.1.2, and the anticipated effects resulting from application of mitigation to potential adverse effects in Section 4.4.1.6.1.3. Anticipated effects discussed herein consider mitigation measures applied to potential effects to determine the effects under Alternative 6, the Deepwater Deferral, to bowhead, fin, and humpback whales. In this section, we address the important differences between the Proposed Action (Alternative 2) and this alternative.

4.5.6.6.1.1. Potential Effects to Threatened and Endangered Whales. Potential effects to endangered whales were described in Section 4.4.1.6.1.1 and apply to activities identified in Alternative 6, the Deepwater Deferral, that could occur if the entire Chukchi Sea Planning Area except the Deepwater Deferral area would be open to proposed Lease Sales 212 and 221. Potential effects described in 4.4.1.6.1.1 remain identical for all alternatives, including the Deepwater Deferral, and will not be repeated here.

4.5.6.6.1.2. Mitigation Measures. The measures listed in Sections 4.4.1.6.1.2 and Section 4.4.2.6.1.2 are applied, as appropriate, to OCS activities to protect ESA-listed whales and other marine mammals during seismic and exploratory drilling in the Beaufort Sea and Chukchi Sea. It is anticipated these mitigation measures would be implemented in future activities associated with all alternatives for Lease Sales 209 and 217, including the Deepwater Deferral.

4.5.6.6.1.3. Anticipated Effects Under Alternative 6. This section describes the most important differences in the anticipated effects between the Proposed Action (Alternative 2) and the Deepwater Deferral (Alternative 6). Anticipated effects consider mitigation measures, specific biological and activity characteristics discussed in Sections 4.4.1.6.1.2 and 4.4.2.6.1.2.

4.5.6.6.1.4. Conclusions - Effects Under Alternative 6 to Endangered Whales.

4.5.6.6.1.4.1. Direct and Indirect Effects Under Alternative 6.

Summary. Reductions in impacts of this deferral are uncertain in regard to bowhead, humpback, and fin whales. The effects analysis and conclusions indicate adverse effects would decrease slightly from those indicated under the Proposed Action. The effects under this alternative would not result in detectable population-level effects. Some whales would experience lower levels of effect or fewer stress-inducing events, but effects are not substantial and considered to be the same as under Alternative 2.

This alternative would defer 1,020 full or partial lease blocks (approximately 16%) from the Chukchi Sea sale area (Figure 2-2). The primary reduction in impacts of this deferral would be to exclude opportunity for large spills, disturbance, and collision impacts to endangered whales arising from exploration activities in these blocks for the remainder of the 5-Year Program period. These sources of potential adverse effects would not occur in the deepwater portion of the lease area where information is lacking on important endangered whale habitat and habitat use. While development is considered speculative, the elimination of potential launch areas and pipelines within the deferral area would eliminate spilled oil from these source areas, potential OCS-related vessel fuel spills and decrease the percent chance of spilled oil contacting the deferral area and other environmental resource areas important to endangered whales. The OCS-related infrastructure (pipelines) likely would not occur on these deferral blocks that lie seaward of the remaining area open to leasing.

4.5.6.6.1.4.2. Cumulative Effects Under Alternative 6.

Summary. The cumulative effects under this alternative are considered to be the same as under Alternative 2, the Proposed Action.

As explained above, little is known about bowhead and other endangered whale habitat and habitat use in the deepwater area. Its large size, location, and lack of information regarding endangered whales limit rigorous evaluation of a reduction in impacts. Conceivably, the effects analysis and conclusions may improve compared to those under Alternative 2 from decreased potential oil spill launch areas and pipeline infrastructure. The Deepwater Deferral would not allow oil and gas lease-sale related activities on deferred lease blocks during period when endangered whales are not present or accessing petroleum resources via extended reach technology from adjacent active lease blocks. The reduced impact level slightly reduces the total cumulative effect. Impacts to endangered whales and habitats from activities unrelated to OCS leasing activities and potential oil and gas infrastructure developments would continue to have an adverse, moderate level of effect on whales. The anticipated increase in traffic from tourism, research, and/or shipping vessels could increase the potential for vessel-whale interaction (collision and propeller injury), marine accidents and large fuel spills, which could result in moderate to major adverse effects on endangered whales in the Beaufort and Chukchi seas. Climate change is likely to continue and, although speculative and unpredictable at this time, effects may be positive and/or adverse to endangered whales or their habitat in the Chukchi Sea. Continued monitoring, evaluation, and adaptive management actions to protect endangered whales and their habitats would be likely.

4.5.6.6.2. Threatened and Endangered Birds.

Summary. This deferral would not affect ESA-protected birds, because the excluded area is not used by these species. The cumulative effects are anticipated to be the same as those under Alternative 2.

4.5.6.6.2.1. Potential Effects to Threatened and Endangered Birds. The potential effects would be the same as those described in Section 4.5.1.6.2.1.

4.5.6.6.2.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, including specific measures to minimize disturbance effects to eiders in the Ledyard Bay Critical Habitat Area during exploratory drilling.

4.5.6.6.2.3. Anticipated Effects Under Alternative 6. This deferral would not affect ESA-protected birds, because the deferral area is not used by these species. The anticipated effects would be the same as those under Alternative 2.

4.5.6.6.3. Polar Bear.

Conclusions. Alternative 6 would not provide any known decrease in the potential impacts to polar bears. Although little is known about the offshore movements of polar bears in the Chukchi Sea, the deepwater area is not known to have any particular significance for polar bears.

4.5.6.6.3.1. Direct and Indirect Effects Under Alternative 6. This deferral area would remove 972 lease blocks, or approximately 5,617,281 acres, from the lease sale. There are no known direct effects under this alternative to polar bears. Indirectly, this deferral would reduce slightly the chance of a large spill contacting from LAs 8 and 14 by reducing the overall footprint of these launch areas (Appendix A, Table A.3-3).

4.5.6.6.3.2. Cumulative Effects Under Alternative 6. Deferring this area reduces the overall footprint of the lease sale but may not reduce potential cumulative impacts to polar bears. This deferral would not offer any known direct protection to polar bear denning or foraging habitat. This alternative would have no known beneficial effect to the overall level of impacts on polar bears. The extent to which this deferral reduces the cumulative effects to polar bears compared to Alternative 2, the Proposed Action, would be negligible.

4.5.6.7 Marine and Coastal Birds.

Summary. This deferral would not reduce adverse effects to marine and coastal birds to an appreciable extent compared to Alternative 2, because the deepwater habitats excluded are not used extensively by marine and coastal birds. The anticipated effects are the same as those under Alternative 2.

4.5.6.7.1. Potential Effects to Marine and Coastal Birds. The potential effects would be the same as those described in Section 4.4.1.6.2.1.

4.5.6.7.2. Mitigation Measures. Mitigation measures would be the same as those identified in Section 4.5.2.6.2.2, including specific measures to minimize disturbance effects to eiders in the Ledyard Bay Critical Habitat Area during exploratory drilling.

4.5.6.7.3. Anticipated Effects Under Alternative 6. This deferral would not reduce adverse effects to marine and coastal birds to an appreciable extent compared to Alternative 2, because the deepwater habitats excluded are not used extensively by marine and coastal birds. The anticipated effects are the same as those under Alternative 2.

4.5.6.8. Other Marine Mammals.

Summary. This alternative would offer about 6,354 whole blocks in the lease-sale area (Figure 2-2). The following analyses describe the anticipated effects under Alternative 6, the Deepwater Deferral, to marine mammals in the Alaskan Chukchi Sea. The Deepwater Deferral constitutes about 14% of the Chukchi Sea lease-sale area.

Ringed, Spotted, Ribbon, and Bearded Seals. The effects to ice seals under this alternative would be similar to those under Alternative 2 (Section 4.5.2.8.3).

Pacific Walrus. The deepwater area is not likely to provide foraging habitat for walruses. Although little is known about the offshore distribution and movements of walruses in the Chukchi Sea, walruses generally limit their foraging dives to roughly 100 m (300 ft). Alternative 6 would exclude an area that is not particularly valuable to walruses, and the impacts to walruses under this alternative would be similar to those described under Alternative 2 (Section 4.5.2.8.3).

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales, and Gray Whales. Little is known regarding whale use of the deepwater area. Gray whales are not expected to use habitats related to the deepwater area. Beluga whales appear to use the shelf edge for summer and fall foraging. The direct, indirect, and cumulative adverse effects under this alternative may be slightly reduced compared to those noted under Alternative 2, the Proposed Action, but the differences are not substantial and the effects are considered to be the same as under Alternative 2 (Section 4.5.2.8.3).

4.5.6.8.1. Potential Effects to Marine Mammals. Potential effects to ice seals and walruses are described in Section 4.5.1.8.1. Potential effects to whales would be the same as those described in Sections 4.4.1.8.1 and 4.5.1.8.1. Additional information on potential effects that may apply to minke and gray whales is in Section 4.4.1.6.1.1.

4.5.6.8.2. Mitigation Measures. Mitigation measures are identified in Section 4.5.2.8.2.

4.5.6.8.3. Anticipated Effects Under Alternative 6.

4.5.6.8.3.1. Direct and Indirect Effects Under Alternative 6.

Ringed, Spotted, Ribbon, and Bearded Seals. Deferring the deepwater zone from leasing could slightly lessen the cumulative chance of disturbances occurring. However, this deferral can be expected to result in added scrutiny of the leased areas through reallocation of resources, leading to levels of effect similar to those described in Section 4.5.2.8.3.1 for the Alaskan Chukchi Sea. Consequently the expected direct and indirect effects on ice seals are similar to those described in Section 4.5.2.8.3.1.

Pacific Walrus. There are no known differences in the direct effects under Alternative 6 versus Alternative 2 for walruses. Indirectly, the selection of this deferral would slightly reduce the risk of spills occurring from LAs 8 and 14 by reducing the overall footprint of these launch areas (Appendix A, Table A.3-3).

Beluga Whales, Killer Whales, Harbor Porpoises, Minke Whales and Gray Whales. This alternative defers 972 full or partial lease blocks in the proposed Chukchi Sea lease-sale area (Figure 2-2). There are no substantial differences in the direct effects under Alternative 6 versus Alternative 2.

4.5.6.8.3.2. Cumulative Effects Under Alternative 6. The cumulative effects are the combination of the direct and indirect effects under this alternative (above) and the cumulative effects under Alternative 1 (Section 4.5.1.8.3.2).

Ringed, Spotted, Ribbon, and Bearded Seals. Cumulative effects are similar to those described for Alternative 2 in Section 4.5.2.8.3.2. The extent to which this deferral reduces the cumulative effects to seals compared to Alternative 2, the Proposed Action, would be negligible.

Pacific Walrus. Alternative 6 rather than Alternative 2 reduces the overall footprint of the lease sale, but may not reduce potential cumulative impacts to walruses. This deferral would not offer decreased adverse impacts to walrus resting or foraging habitat. This alternative would have no known effect on the overall level of impacts to walruses when compared with Alternative 2. Alternative 6 would have minor or moderate impacts to walruses, depending on the location and extent of exploration and development activities.

Beluga Whale, Killer Whale, and Harbor Porpoise, Minke Whale and Gray Whale. The Deepwater Deferral would reduce the size of the lease-sale area. We determined that the effects under this alternative would be slightly reduced from those described under Alternative 2. The reduced effects level slightly reduces the total cumulative effect, and the anticipated cumulative effects under this alternative are similar to those described under Alternative 2 in Section 4.5.2.8.3.2.

4.5.6.9. Terrestrial Mammals. Alternative 6, the Deepwater Deferral, is described in Section 2.1.2.6. The following describes the anticipated effects to marine mammals if the lease sale took place with a coastal subarea deferral in the Chukchi Sea analysis area. We describe the anticipated effects to terrestrial mammals under the Proposed Action with mitigation measures in place. The effects under Alternative 6 versus Alternative 2 are the same for terrestrial mammals.

This analysis identifies the anticipated level of effect under this alternative to terrestrial mammals. The anticipated effects under this alternative are separated into direct and indirect effects (Section 4.5.6.9.3.1) and cumulative effects (Section 4.5.6.9.3.2).

4.5.6.9.1. Potential Effects to Terrestrial Mammals. Potential effects are described in Section 4.5.1.9.1 and are not repeated here.

4.5.6.9.2. Mitigation Measures. Mitigation measures are the same as described in Section 4.5.2.9.2.

4.5.6.9.3. Anticipated Effects Under Alternative 6.

4.5.6.9.3.1. Direct and Indirect Effects Under Alternative 6. The direct and indirect effects would be similar to those described in Section 4.5.2.9.3.1.

4.5.6.9.3.2. Cumulative Effects Under Alternative 6. The cumulative effects would be the same as those described in Section 4.5.2.9.3.2.

4.5.6.10. Vegetation and Wetlands. The effects to vegetation and wetlands under Alternative 6, Deepwater Deferral, would be the same as those under Alternative 2, the Proposed Action.

4.5.6.11. Economy. There would be no effective difference between the economic effects under Alternative 6, the Deepwater Deferral, and Alternative 2, the Proposed Action.

4.5.6.12 Subsistence-Harvest Patterns and Resources. Alternative 6 offers for lease approximately 6,354 whole or partial blocks, consisting of 34,575,585 acres (about 1.4 million hectares). The area removed by the Deepwater Deferral encompasses 972 whole blocks. This area minus leased blocks would be offered in both sales.

4.5.6.12.1. Direct and Indirect Effects Under Alternative 6. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. This deferral would prohibit leasing, exploration, development, and production activities in the deferred area. There is little industry interest in the area far offshore, as it holds little resource potential. Additionally, subsistence resources normally are harvested closer to shore, so the potential for disturbance to subsistence resources and practices is very low.

Conclusion. Effects to subsistence-harvest patterns are expected to be reduced, because no exploration or production activities would occur in the deferral area, although subsistence resources normally are harvested closer to shore and the potential for disturbance to subsistence resources and practices from activities in this region is very low. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area. The extent to which this deferral reduces noise effects to subsistence resources and practices from those under Alternative 2, the Proposed Action, would be negligible.

4.5.6.12.2. Cumulative Effects Under Alternative 6.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale, although subsistence resources normally are harvested closer to shore, and the potential for disturbance to subsistence resources and practices from activities in this region is very low. The extent to which this deferral reduces the cumulative noise effects to subsistence resources and practices from those under Alternative 2, the Proposed Action, would be negligible.

4.5.6.13. Sociocultural Systems. The area removed by the Deepwater Deferral encompasses 972 whole blocks. This area minus leased blocks would be offered in both sales.

4.5.6.13.1. Direct and Indirect Effects Under Alternative 6. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. This deferral would prohibit leasing, exploration, development, and production activities in the deferred area. There is little industry interest in the area far offshore, as it holds little resource potential. Additionally, subsistence resources normally are harvested closer to shore, so the potential for disturbance to subsistence resources and practices is very low.

Conclusion. Effects to sociocultural systems are expected to be reduced by this deferral alternative to the extent they reduce effects to subsistence-harvest patterns. Even though no exploration or production activities would occur in the deferral area, subsistence resources normally are harvested closer to shore, and the potential for disturbance to subsistence resources, and practices and consequent effects on sociocultural systems, from activities in this region is very low. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area. The extent to which this deferral reduces noise effects to subsistence resources and practices and sociocultural systems from those under Alternative 2, the Proposed Action, would be negligible.

4.5.6.13.2. Cumulative Effects Under Alternative 6.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale, although subsistence resources normally are harvested closer to shore, and the potential for disturbance to subsistence resources and practices and sociocultural systems from activities in this region is very low. The extent to which this deferral reduces the cumulative noise effects to subsistence resources and practices and sociocultural systems from those under Alternative 2, the Proposed Action, would be negligible.

4.5.6.14. Archaeological Resources

4.5.6.14.1. Direct and Indirect Effects Under Alternative 6. This deferral would prohibit leasing, exploration, development, and production activities in 972 whole or partial blocks.

Conclusion. The potential effects under Alternative 6 to archaeological resources essentially are the same as discussed under Alternative 2, the Proposed Action, except the areas deferred would be removed from any bottom-disturbing activities. More potential effects are likely to occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Prehistoric and historic resources, both onshore and offshore, would be identified by archaeological surveys and avoided or mitigated.

4.5.6.14.2. Cumulative Effects Under Alternative 6.

Conclusion. Deferring this area reduces the overall footprint of the lease sale and, therefore, negligibly reduces the cumulative effects to archaeological resources under Alternative 2, the Proposed Action.

4.5.6.15. Environmental Justice. The area removed by the Deepwater Deferral encompasses 972 whole blocks. This area minus leased blocks would be offered in both sales.

4.5.6.15.1. Direct and Indirect Effects Under Alternative 6. By offering a reduced area for leasing, a reduction in adverse impacts from exploration, development, and production activities in the deferral area would be expected. By prohibiting leasing, exploration, development, and production activities in the deferred area, the zone for potential noise, disturbance, and oil-spill effects would be moved farther away from nearshore subsistence resources and harvest areas, affording greater protection for these resources to Chukchi Sea coastal communities. The potential for disturbance to subsistence resources and practices is very low.

Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area, and pipeline routes from areas farther offshore still would cross deferred areas. There would be no reduction in effects from potentially permitted seismic surveys onshore or in the sale area. Health effects in Chukchi villages would be reduced primarily through reduction in subsistence impacts, which would result in a lower incremental risk of adverse subsistence-related health effects to general health and well-being, diet and nutrition, injury rates, and rates of nutrition-related chronic diseases such as diabetes, hypertension, and cardiovascular disease.

Conclusion. Effects to EJ are expected to be reduced under this deferral alternative to the extent they reduce effects to subsistence-harvest patterns and sociocultural systems. Even though no exploration or production activities would occur in the deferral area, subsistence resources normally are harvested closer to shore, and the potential for disturbance to subsistence resources and practices, sociocultural systems, and consequent effects to EJ from activities in this region is very low. Resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area. This deferral reduces noise effects to subsistence resources and practices, sociocultural systems, and associated effects to public health and, consequently, to EJ under Alternative 2, the Proposed Action.

4.5.6.15.2. Cumulative Effects Under Alternative 6.

Conclusion. By offering a reduced area for leasing, a reduction in adverse cumulative impacts would be expected. Deferring this area reduces the overall footprint of the lease sale, although subsistence resources normally are harvested closer to shore, and the potential for disturbance to subsistence resources and practices from activities in this region is very low. This deferral negligibly reduces cumulative noise effects to subsistence resources and practices, sociocultural systems, and associated effects to public health and, consequently, to EJ under Alternative 2, the Proposed Action.

4.6. Unavoidable Adverse Effects.

This section summarizes the unavoidable adverse effects if the Proposed Actions for the Beaufort and Chukchi seas are held as scheduled and result in exploration, development, and production. Many of the adverse effects identified in analyses in this EIS would occur only if a large (≥1,000 bbl) oil spill occurred. Such an event has a low probability of occurrence. The potential effects of such an event are discussed in the alternative analyses and are not included in the discussion below.

Water Quality. A wide range of water quality degradation could occur associated with nonpoint-source and point-source discharges, construction activities, normal operational activities, noncompliant operational activities and/or permitted processes, and chronic small-volume spills. The proportions and amounts of discharged wastes change considerably during the life cycle of OCS activities – exploration drilling to development through production to decommissioning. To the extent that regulatory programs, engineering measures, and operational procedures are effective in minimizing or eliminating discharges, unavoidable adverse effects normally associated with OCS activities are reduced. It is expected that any discharges of waste to marine waters will conform with existing regulatory programs and requirements; and to the MMS policies and management programs. Activities resulting from the Proposed Actions may cause small, localized increases in the concentrations of pollutants affecting water quality. Effects to local water quality are expected to be low, while regional effects are expected to be very low.

Air Quality. Activities resulting from the Proposed Actions would cause small, localized increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards (NAAQS), and would be below the level considered harmful to public health and welfare.

Lower Trophic-Level Organisms. Extensive pipeline systems would be needed for development of any OCS prospects in the Chukchi Sea and any in the Beaufort Sea not feasibility developed using extended reach drilling. Pipeline burial would disturb 1,000-2,000 acres of typical benthos for less than a decade. The effect to lower trophic-level organisms would be local and moderate.

For analysis purposes, we assume that OCS pipelines would be cleaned, plugged, and left in place during decommissioning. Unavoidable adverse effects on lower trophic-level organisms would occur if OCS pipelines are physically removed by pulling them up out of the seafloor sediments during decommissioning.

Fish Resources. Unavoidable adverse impacts to fish resources would be related to unavoidable impacts to water quality. Effects on local water quality are expected to be low and regional effects to water quality are expected to be very low; therefore, the unavoidable adverse effects to fish resources are expected to be very low.

Essential Fish Habitat. Unavoidable adverse effects to EFH would be related to contaminated fish habitats. To the extent that regulatory programs, engineering measures, and operational procedures are effective in minimizing or eliminating discharges and maintaining water and habitat quality, unavoidable adverse effects to EFH would be minimized and are expected to be very low.

Threatened and Endangered Marine Mammals. Bowhead, humpback, and fin whales exposed to disturbance associated with routine activities (e.g., noise due to seismic surveys, vessel activity, aircraft overflights, drilling activities, or construction activities) resulting from the Proposed Actions likely would experience temporary, nonlethal effects, such as behavioral changes. For bowhead whales, these behavioral responses are most likely to occur during the migration or during feeding activities, but these effects are not expected to preclude migrations or to disrupt feeding activities on a long-term basis. Polar bears exposed to disturbance associated with routine activities (e.g., noise due to on-ice seismic surveys, vessel activity, aircraft overflights, drilling activities, or construction activities) resulting from the Proposed Actions likely would experience temporary, nonlethal effects, such as behavioral changes. Some foraging and denning habitat may be lost due to construction of production platforms and facilities. These impacts are not expected to have more than minor impacts on polar bears.

Threatened and Endangered Marine and Coastal Birds. Seismic-survey, exploration and production drilling, and development activities resulting from the Proposed Actions could result in unavoidable adverse effects to threatened and endangered birds from a large or chronic small-volume spills that could result in substantial mortality; chronic vessel, platform, and aircraft disturbance; direct impacts to critical habitat and other nesting, foraging, and molting habitats during construction/operation of a platform, shore base, pipeline, and maintenance road; mortality from collisions with vessels and aircraft; and increased hunting access. Most of these adverse effects could be minimized through appropriate mitigation measures.

Marine and Coastal Birds. Seismic-survey, exploration and production drilling, and development activities resulting from the Proposed Actions could result in unavoidable adverse effects to marine and coastal birds from a large spill or chronic small-volume spills that could result in substantial mortality; chronic vessel, platform, and aircraft disturbance; direct impacts to critical habitat and other nesting, foraging, and molting habitats during construction/operation of a platform, shore base, pipeline, and maintenance road; and mortality from collisions with vessels and aircraft. Most of these adverse effects could be minimized through appropriate mitigation measures.

Other Marine Mammals. Seismic-survey, drilling, and development activities resulting from the Proposed Actions would cause unavoidable adverse effects to marine mammals from chronic small-volume spills, noise, and disturbance. These factors could adversely affect marine mammals' habitat use, particularly that of whales, in the Proposed Actions areas.

Terrestrial Mammals. Grizzly bear populations of the Arctic coast rely on salmon runs as a critical portion of their seasonal nutrition. Unavoidable impacts to grizzly bears would be related to unavoidable impacts to fish resources and water quality. Unavoidable effects to local water quality are expected to be low to very low, and the unavoidable effects to fish resources are expected to be very low; therefore, unavoidable effects to grizzly bears are expected to be very low.

Vegetation and Wetlands. Effects from any onshore-pipeline and road-construction on wetlands would be unavoidable. The effects of gravel fill, thermokarst, road dust, and small oil spills are unavoidable. These damaging effects are expected to be local (within 100 m of the pipeline-road corridor). Less than 1% of the coastal plain wetlands of the North Slope is likely to be unavoidably affected.

Economy. Unavoidable effects to the economy generally are considered to be beneficial, but some people may consider any one or a combination of the effects as adverse. Production from the Proposed Actions is expected to generate increase revenues for the NSB (e.g., property taxes), the State of Alaska, and the Federal Government. The Proposed Actions also are expected to generate direct oil industry jobs for workers residing in the NSB and Southcentral Alaska; and to generate additional indirect and induced jobs.

Subsistence-Harvest Patterns. Noise and disturbance from exploration, development, and production activities resulting form the Proposed Actions periodically could affect subsistence resources harvested by the local Arctic coastal communities. Effects to subsistence resources could lower the overall success of subsistence harvests.

Sociocultural Systems. Unavoidable effects to governmental functions (e.g., land use) and subsistence values would result from the placement of onshore infrastructure.

Archaeological Resources. Unavoidable effects to archaeological resources are unlikely because of MMS site-clearance requirements and required consultation with the State Historic Preservation Office.

Environmental Justice. Unavoidable environmental justice effects would derive from short-term noise and disturbance effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems.

4.7. Relationship Between Local-Short-Term Uses and Maintenance and Enhancement of Long Term Productivity.

In this section, the short-term effects and uses of various components of the environment are related to the long-term effects and the maintenance and enhancement of long-term productivity. The effects of the Proposed Actions would vary in kind, intensity, and duration, beginning with preparation activities (such as seismic surveying and exploration drilling), through development and production, and ending with decommissioning and restoration of natural environmental balances.

"Short term" refers to the total duration of the Proposed Actions from exploration to decommissioning, whereas "long term" refers to an indefinite period beyond the termination of any oil and gas production. The overall life of the Proposed Actions in the Beaufort Sea OCS under the hypothetical scenarios is estimated to be about 30 years, including 8 years of exploration, a 20-year period of development and production, and a 2-year decommissioning period. The overall life of the Proposed Actions in the Chukchi Sea OCS under the hypothetical scenarios is estimated to be about 34 years, including 7 years of exploration, a 25-year period of development and production, and a 2-year decommissioning period.

Many of the effects discussed in Chapter 4 are considered to be short term and are reduced by the required review processes discussed in Section 1.7, the mitigation measures discussed in Section 2.2, and the proposed mitigation measures for the Proposed Actions and Alternatives discussed in Section 2.2.3. All OCS activities must meet the legal mandates listed in Section 1.2.

Consumption of OCS oil and natural gas would be a short-term use of nonrenewable resources. Economic, political, and social benefits would accrue to the Federal Government, the State of Alaska, and North Slope communities from the leasing, exploration, and development of oil and natural gas resources from the OCS. Most benefits would be short-term (during the production life of any development resulting from the Proposed Actions).

The Alternatives to the Proposed Actions—the No Action Alternative (Alternative 1) and the deferral alternatives (Alternatives 3-6)—would reduce to varying degrees both the long- and short-term environmental effects as well as the long- and short-term benefits.

The overall long-term effect of Proposed Actions would be a small reduction in the productivity of the environment, as described in the following paragraphs.

Water Quality. Oil and gas development projects resulting from the Proposed Action sales may cause small, localized increases in the concentrations of pollutants to water quality. Adverse effects to local water quality are expected to be low, while regional effects are expected to be very low. These effects are considered to be temporary in nature; diminishing over a short period of time after discharges discontinue.

Air Quality. Oil and gas development projects resulting from the Proposed Actions would cause small, localized increases in the concentrations of criteria air pollutants. Adverse effects would be a short-lived and the pristine air quality of the OCS area may be impaired temporarily. Long-term adverse effects would be insignificant.

Lower Trophic-Level Organisms. Buried pipelines associated with development projects resulting from the Proposed Actions likely would disturb the benthos for less than a decade. A large spill could result in oil persisting in some tidal and subtidal sediments for a couple decades, a local but moderate lower-trophic impact. Overall, the effect to lower trophic-level organisms would be local but moderate.

Fish Resources. Exploration activities resulting from the Proposed Actions would have minimal short-term adverse effects to fish resources in and adjacent to the program areas. Development activities could result in longer but still short-term adverse effects to fish resources. A large spill could result in a level of mortality that could eliminate reproduction and subsequent recruitment from contaminated habitats along tens of miles of coastline for extended periods of time. Some populations could recover to pre-impact levels in fewer than 3 generations once habitats have recovered; other populations, particularly discrete runs of salmon, could be eliminated and would only recover by strays from unaffected populations colonizing the vacant streams, a process that could take decades.

Essential Fish Habitat. There are no designated EFH in or adjacent to the program areas. Exploration activities resulting from the Proposed Actions would have minimal short-term adverse effects on fish habitat in and adjacent to the program areas. Development activities could result in longer but still short-term adverse effects to fish habitat. A large spill could result in contamination of fish habitats.

Threatened and Endangered Marine Mammals. Threatened and Endangered marine mammals may be affected by noise from OCS activities resulting from the Proposed Actions on a short-term basis, over the life of the project.

Threatened and Endangered Marine and Coastal Birds. Exploration activities resulting from the Proposed Actions would have adverse short-term effects on threatened and endangered birds in the program areas. Most effects would result from frequent vessel, drillship, and aircraft disturbance to molting eiders, collisions with vessels and aircraft, direct seafloor impacts to spectacled eider critical habitat, and potential contamination of eider foraging habitats. Development activities could result in longer but still short-term adverse effects to threatened and endangered birds. Short-term adverse effects would arise from chronic vessel, platform, and aircraft disturbance; direct impacts to critical habitat and other nesting, foraging, and molting habitats during construction/operation of a platform, shore base, pipeline, and maintenance road; mortality from collisions with vessels and aircraft; and indirect impacts from increased predator populations and increased hunting access. A large spill and/or chronic small-volume spills could result in a level of mortality that would jeopardize the continued existence of the spectacled eider population on the North Slope. Most adverse effects can be avoided or minimized with conservation measures.

Marine and Coastal Birds. Exploration activities resulting from the Proposed Actions would have moderate short-term adverse effects on coastal and marine birds in the program areas. Most effects would result from frequent vessel, drillship, and aircraft disturbance resulting in periodic disturbance and/or displacement of foraging or molting birds. Development activities could result in longer but still short-term adverse effects to marine and coastal birds. Short-term adverse effects would arise from chronic vessel, platform, and aircraft disturbance; direct impacts to critical habitat and other nesting, foraging, and molting habitats during construction/operation of a platform, shore base, pipeline, and maintenance road; mortality from collisions with vessels and aircraft; and indirect impacts from increased predator populations and increased hunting access. Most of the adverse effects would arise from a large spill and/or chronic small-volume spills that could result in a level of mortality that would substantially reduce or eliminate specific breeding colonies of murres, puffins, and black guillemots. An oil spill entering Kasegaluk Lagoon or Peard Bay could impact tens of thousands of birds or contaminate important breeding, foraging, or molting habitats for years. Most adverse effects can be avoided or minimized with conservation measures.

Other Marine Mammals. Exploration activities resulting from the Proposed Actions would have moderate short-term adverse effects on marine mammals in the program areas. These effects would result from frequent vessel, drillship, and aircraft disturbance resulting in periodic disturbance and/or displacement of animals. Development activities could result in longer but still short-term adverse effects to marine mammals from chronic vessel, platform, and aircraft disturbance; and direct impacts to critical habitat during construction/operation of platforms, shore-bases, and pipelines. A large spill could result in significant, adverse effects to marine mammals.

Terrestrial Mammals. Exploration activities resulting from the Proposed Actions would have moderate, short-term adverse effects on terrestrial mammals in areas adjacent to the program areas. These effects would result from frequent aircraft disturbance resulting in periodic disturbance and/or displacement of animals from important habitats. Development activities could result in longer but still short-term adverse effects to terrestrial mammals from chronic vehicle and aircraft disturbance; direct impacts to habitats during construction/operation of shore bases, pipelines, and maintenance roads; and indirect impacts from increased hunting access. A large spill could result in significant, adverse effects to marine mammals.

Vegetation and Wetlands. Onshore construction activities and onshore spills would result in damage or destruction of a few acres of vegetation and wetlands local impacts to some wetlands. Such effects would be considered localized and long-term.

Economy. Increased revenues, employment, and income generated by the Proposed Actions would be short-term, by definition the life of the Proposed Actions. Any production resulting from the Proposed Actions would be a short-term increase domestic oil and gas production, which might decrease the nation's dependency on oil imports.

Subsistence-Harvest Patterns. Activities resulting from the Proposed Actions could have short-term adverse effects on regional subsistence-harvest patterns by causing redistribution, reduction, tainting, or displacement of subsistence species. Such short-term effects are not expected to have long-term consequences.

Sociocultural Systems. Adverse and beneficial effects to governmental functions (e.g., land use, zoning, and revenues) and subsistence values that result from the placement of onshore infrastructure and pipelines are expected to be short term and not continue past the end of the Proposed Actions. Short-term effects on social systems, cultural values, and institutional organization are not expected to have long-term adverse consequences.

Archaeological Resources. Archaeological resources discovered as a result of the surveys required prior to development of a lease, would enhance our knowledge of the history and early inhabitants of the area. Any destruction of archaeological sites or unauthorized removal of artifacts would represent permanent loss of historical information.

Environmental Justice. Short-term effects on subsistence resources that become chronic effects over the lifetime of the Proposed Actions would be considered disproportionate high adverse effects on the Inupiat people. Such an effect is expected to occur only in the event of a large oil spill.

4.8. Irreversible and Irretrievable Commitment of Resources.

Irreversible and irretrievable commitment of resources refers to impacts or losses to resources that cannot be reversed or recovered. Holding an OCS lease sale and issuance of OCS leases do not constitute an irreversible and irretrievable commitment of resources. The OCS Lands Act prescribes a four-stage process for the OCS program. This four-level review process gives the Secretary of the Interior a "continuing opportunity for making informed adjustments" to ensure that all OCS oil-and-gas activities are conducted in an environmentally sound manner. In the first stage, MMS prepares a 5-year leasing program to identify the size, timing, and location of proposed lease sales and an EIS under NEPA. In the second stage, MMS conducts the prelease process and sale-specific NEPA reviews. The third stage involves exploration of the leased tracts. Lessees must notify MMS at least 30 days before any proposed ancillary activities on their lease(s). The MMS reviews proposed ancillary activities to ensure they comply with the OCS Lands Act and other laws and MMS authorization is required prior to conducting any on-lease ancillary activities. Prior to any exploratory drilling, a lessee must submit an exploration plan (EP) to MMS for review and approval. The EP must comply with the OCS Lands Act, implementing regulations, lease provisions, and other Federal laws, and is subject to environmental review under NEPA.

Irreversible and irretrievable effects would occur only if the Proposed Actions are held as scheduled and result in exploration, development, and production activities.

Water Quality. No irreversible or irretrievable effects to water quality are expected from the Proposed Actions. The highest pollutant concentrations from OCS activities would be confined to areas within a short range of OCS facilities. Because of dilution, ocean currents, and wind effects, the pollutant concentrations at any one particular location would be variable, with higher concentrations lasting for a short duration (typically a few hours up to a day). The pollutant concentrations would be within the National Pollutant Discharge Elimination System permit requirements as set by the Environmental Protection Agency.

Air Quality. No irreversible or irretrievable effects on air quality are expected from the Proposed Actions. The highest pollutant concentrations emitted from OCS activities would be confined to areas within a short range of OCS facilities. Because of shifting winds and changing meteorological conditions, the pollutant concentrations at any one particular location would be variable, with higher concentrations lasting for a short duration (typically a few hours up to a day). The pollutant concentrations would be within the NAAQS set by the Environmental Protection Agency.

Lower Trophic-Level Organisms. No irreversible or irretrievable effects to lower trophic-level organisms or seafloor communities are expected from the Proposed Actions.

Fish Resources. No irreversible or irretrievable effects to fish resources are expected from the Proposed Actions.

Essential Fish Habitat. No irreversible or irretrievable effects on to EFH are expected from the Proposed Actions.

Threatened and Endangered Marine Mammals. The MMS concluded consultation with the NMFS under Section 7 of the ESA. The Biological Opinion of July 17, 2008, for bowhead, fin and humpback whales states that after reviewing the current status of the endangered bowhead, fin, and humpback whales; the environmental baseline for the action area; the proposed actions; and the cumulative effects, it is NMFS' biological opinion that individual bowhead, fin, and humpback whales within the action area may be adversely affected, but that the proposed action is not likely to jeopardize the continued existence of the Western Arctic bowhead whales, North Pacific fin whales, and humpback whales. No critical habitat has been designated for these species; therefore, none will be affected.

The MMS is in the process of consultation with the FWS on polar bears under Section 7 of the ESA. In their Biological Opinions on existing Beaufort Sea and Chukchi Sea regulations for incidental take during oil and gas activities, FWS concluded that the total expected takings of polar bear would have a negligible impact on these species. The Biological Opinion considered exploration and development in both seas, and production in the Beaufort Sea for the next few years. Any adverse effects to polar bears could prevent recovery of the Beaufort Sea or the Chukchi Sea populations of polar bear. Some denning habitat could be irretrievably or irreversibly altered by activities associated with OCS development (see Vegetation and Wetlands below). Mortality is not expected, but habitat losses would represent an irreversible effect to the Beaufort and Chukchi sea populations of polar bear.

Threatened and Endangered Marine and Coastal Birds. Any adverse effects to threatened and endangered birds could prevent recovery of these imperiled populations. Foraging, nesting, staging, or molting habitats used by threatened and endangered birds, including designated critical habitat, could be irretrievably or irreversibly altered by activities associated with OCS development. Mortality and habitat losses could represent an irreversible effect to these populations, because no suitable alternate habitats are available. Mortality from collisions with structures could be an irreversible effect if populations are declining, but they presently are stable. Constructing in critical habitat or constructing a pipeline/access road could result in long-term or permanent loss of nesting habitats.

Marine and Coastal Birds. Foraging, nesting, staging, or molting habitats used by small, habitat-specific populations, and/or declining populations of coastal and marine birds could be irretrievably or irreversibly altered by activities associated with OCS development. Mortality from collisions with structures could be an irreversible effect if populations are declining, but they presently are stable. Constructing in critical habitat or constructing a pipeline/access road could result in long-term or permanent loss of nesting habitats. In some cases, no suitable alternate habitats are available. Such mortality and habitat losses could represent an irreversible effect to these populations.

Other Marine Mammals. No irreversible or irretrievable effects to marine mammals are expected from the Proposed Actions.

Terrestrial Mammals. No irreversible or irretrievable effects to terrestrial mammals are expected from the Proposed Actions.

Vegetation and Wetlands. Small acreages of tundra habitat would be irreversibly altered by gravel fill at the coastal support bases, pipeline-valve pads, and gravel mine sites on the North

Slope. (Note: The biggest loss of these habitats likely would come from a pipeline/road from Chukchi Sea development.)

Economy. Irreversible or irretrievable effects on the local and State economies are expected from the Proposed Actions. Thee effects would be short term and long term. Routine activity resulting form the Proposed Actions would generate employment at an enclave on the Chukchi shoreline or the Prudhoe Bay complex for workers who otherwise would reside permanently primarily in Southcentral Alaska or elsewhere. OCS related activities would generate a small increase in resident employment in the NSB communities.

Subsistence Harvest Patterns. No irreversible or irretrievable effects to subsistence-harvest patterns are expected from the Proposed Actions.

Sociocultural Systems. No irreversible or irretrievable effects on social systems, cultural values, and institutional organization are expected from the Proposed Actions.

Archaeological Resources. Any damage or destruction to archaeological resources would be irreversible and the archaeological information lost would be irretrievable.

Environmental Justice. No irreversible or irretrievable environmental-justice-related effects on social systems, cultural values, and institutional organization are expected from the Proposed Actions.

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5. CONSULTATION AND COORDINATION

CHAPTER 5

CONSULTATION AND COORDINATION

5. CONSULTATION AND COORDINATION

5.1. Development of the Proposal.

In 2007, the Secretary of the Interior issued the Final OCS Oil and Gas Leasing Program for 2007-2012 (5-Year Program) (USDOI, MMS, 2006g). The 5-Year Program includes five lease sales in the Beaufort Sea and Chukchi Sea OCS. This EIS addresses four proposed lease sales in the Beaufort Sea and Chukchi Sea Planning Areas: Beaufort Sea Sales 209 and 217, and Chukchi Sea Sales 212 and 221. Sale 209 is scheduled to be held in 2009, Sale 212 in 2010, Sale 217 in 2011, and Sale 221 in 2012. The fifth sale in the 5-Year Program is Chukchi Sea Sale 193, which was held in February 2008.

On August 23, 2007, the Call for Information and Nominations (Call) and Notice of Intent (NOI) for Oil and Gas Lease Sales 209, 212, 217, and 221 was published in the *Federal Register* (72 *FR* 48296). The Call was published to gather preliminary information and nominations from interested parties on oil and gas leasing, exploration, and development and production within the proposed sale areas. This provided an opportunity for the oil industry, government organizations, tribal and local governments, environmental groups, the general public, and all other interested parties to comment on areas of interest or special concern in the proposed sale areas. The Call also requested stakeholders to identify information that should be considered by MMS in determining the area for the Proposed Actions. In response to the Call, two nominations were received. The nominations received indicated that different companies had interest in various portions of the sale areas and, when considered in total, they cover the entire sale areas. Comments also were received from the State of Alaska, Department of Natural Resources; the North Slope Borough (NSB), Office of the Mayor; the Alaska Eskimo Whaling Commission; the Native Village of Point Hope; Inupiat Community of the Arctic Slope (ICAS); the Center for Biological Diversity; Oceana; the U.S. Environmental Protection Agency; a letter from a group of 12 environmental Non-Government Organizations (NGOs), as well as letters from private citizens.

The Area Identification (Area ID) formally identified the location and extent of the area of study for the EIS.

- The area to be evaluated for Beaufort Sea Sales 209 and 217, scheduled for 2009 and 2011, respectively, encompasses approximately 33 million acres and extends from 3 statute miles off the northern coast of Alaska to 205 statute miles off the northern coast of Alaska. The area stretches east from Barrow to the Canadian border (see Figure 2-1).
- The area for sales proposed for the Chukchi Sea, Sales 212 and Sale 221, scheduled for 2010 and 2012, respectively, encompasses approximately 40 million acres and extends from 25 statute miles off the coast of Alaska to 275 statute miles off the coast of Alaska. The proposed sale area stretches from north of Point Barrow to northwest of Cape Lisburne (see Figure 2-2).

5.2. Development of the EIS.

The August 23, 2007, NOI initiated the formal scoping process for the EIS. Scoping is defined as "an early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). The NOI published for Oil and Gas Lease Sales 209, 212, 217, and 221 describes the scoping process MMS followed for this EIS. Throughout the scoping process, comments are invited from any interested persons, including affected Federal, State, tribal, and local governments; any affected Native groups; conservation groups; and private industry for early identification of the most important issues for analysis in this EIS. Through scoping, the agency receives stakeholder input on the issues, alternatives, and mitigation measures to consider in the EIS. The scoping report summarizing the scoping comments is posted on the MMS website at http://www.mms.gov/alaska/cproject/ArcticMultiSale/scoping_rpt.pdf.

Scoping for this multiple-sale EIS included reviewing the comments received on the Call/NOI; comments submitted at the scoping meetings; re-evaluation of the issues raised and analyzed in the EISs for previous NEPA processes for proposed lease sales in Beaufort Sea and Chukchi Sea Planning Areas as embodied in the 2003 Beaufort Sea Multiple-Sale EIS and the Chukchi Sea Sale 193 EIS; and MMS staff evaluation and input. Scoping comments were used to identify major issues, alternatives to the Proposed Actions, and measures that could mitigate the effects of the proposed Federal actions.

Scoping comments were requested from the public through newspaper and radio advertisements in the NSB communities of Barrow, Nuiqsut, Kaktovik, Point Lay, Wainwright, Point Hope, and in Anchorage. Scoping meetings were held in Nuiqsut (October 30, 2007), Kaktovik (October 29, 2007), Barrow (November 1, 2007), Point Lay (September 18, 2007), Point Hope (September 17, 2007), Wainwright (November 2, 2007), and Anchorage (September 27, 2007).

Executive Order 13175 (*Consultation and Coordination with Indian Tribal Governments*), states that the U.S. Government will continue "to work with Indian tribes on a government-to-government basis to address issues concerning Indian Tribal self-government, trust resources, and Indian Tribal treaty and other rights." Government-to-Government Meetings were held with the Nuiqsut Tribal Council (October 30, 2007) and the Native Village of Point Hope (September 18, 2007). An additional meeting was held with the Inupiat Community of the Arctic Slope on October 4, 2007. All commenters from the communities were strongly opposed to the lease sales. Environmental Justice issues were discussed with participants on the North Slope, both in the Government-to-Government meetings and with individual participants at the scoping meetings.

While formal scoping is complete, the information gathering process will continue during development of the draft EIS and additional meetings with stakeholders will be held as needed or requested.

5.3. Review of the Draft EIS.

The following is a list of the Federal, State, Tribal and local government agencies; academic institutions; members of the oil and gas industry; special interest groups; and other organizations who were sent copies of the draft EIS for review.

Federal – Executive Branch

Department of Commerce

- Office of the Assistant Secretary for Oceans and Atmosphere
- National Marine Fisheries Service
  - Bowhead Whale Project
  - Alaska Regional Office, Anchorage
- National Oceanic and Atmospheric Administration
  - Policy and Strategic Planning
  - Information Services Division

Department of Defense

- U.S. Army Corps of Engineers
  - Regulatory Branch, Alaska District
- U.S. Navy
  - NEPA Natural Resources

Department of Homeland Security

- U.S. Coast Guard

Department of the Interior

- Bureau of Indian Affairs
  - West Central Alaska Field Office
- Bureau of Land Management
  - State Director
  - Northern Field Office, Fairbanks
- U.S. Fish and Wildlife Service
  - Regional Office
  - Fairbanks Ecological Services
  - Migratory Bird Management
  - Subsistence and Fisheries
  - Anchorage Ecological Services
- U.S. Geological Survey
  - Biological Resources Division
- National Park Service
  - Regional Director
  - Subsistence Division
- Office of Environmental Policy and Compliance
- Special Assistant to the Secretary for Alaska
- Senior Advisor to the Secretary for Alaskan Affairs
- Special Assistant to the Secretary for Alaskan Affairs

Federal – Legislative Branch

U.S. Senate

- Alaska delegates

U.S. House of Representatives

- Alaska delegates

Federal – Administrative Agencies and Other Agencies

Arctic Research Commission

Marine Mammal Commission

Environmental Protection Agency

- Office of Federal Activities
- Region 10, NPDES Permit Unit
- Alaska Operations Office, Anchorage

State of Alaska

Alaska Oil and Gas Conservation Commission

Alaska's Washington Representative

Department of Community and Regional Affairs

Department of Environmental Conservation

Anchorage District Office
Northern Alaska District Office

Department of Fish and Game

Region II, H&R
Subsistence Division

Department of Natural Resources

Citizen's Advisory Commission on Federal Areas
Division of Geological and Geophysical Surveys
Division of Oil and Gas
Division of Water, Fairbanks
Office of Project Management and Permitting

Dept. of Transportation and Public Facilities

State Pipeline Coordinator, Joint Pipeline Office

Office of the Governor

Governor

Tribal and Local Governments - Native Organizations

Alaska Eskimo Walrus Commission, Barrow
Alaska Eskimo Walrus Commission, Nome
Alaska Eskimo Whaling Commission
Alaska Federation of Natives
Alaska Inter-Tribal Council
Alaska Native Science Commission
Arctic Slope Native Association
Arctic Slope Regional Corporation
Atqasuk Inupiat Corporation, Atqasuk
Barrow Whaling Captains Association
Bering Straits CRSA, Unalakleet
City of Anaktuvuk Pass, Mayor
City of Barrow, Mayor
City of Kaktovik, Mayor
City of Kotzebue, Planning Division
City of Nome, City Manager
City of Nuiqsut, Mayor
City of Point Hope, Mayor
City of Wainwright, Mayor
Cully Corporation, Point Lay
Inupiat Community of the Arctic Slope (ICAS)
Kaktovik Inupiat Corporation
Kaktovik Whaling Captains Association
Kikiktagruk Iñupiat Corporation, Kotzebue
Nagsragmuit Tribal Council, Anaktuvuk Pass
Point Hope Whaling Captains Association
Kuukpik Village Corporation, Nuiqsut
NANA Regional Corporation Inc., Kotzebue
Natichiq Inc
    Ice Sea Committee
Native Village of Barrow
    Environmental Program Manager
    Inupiat Traditional Government
    Tribal Council President
Native Tribal Village of Atqasuk
Native Village of Kaktovik
Native Village of Kivalina
Native Village of Kotzebue IRA
Native Village of Nuiqsut
Native Village of Point Hope
Native Village of Point Lay
Native Village of Shishmaref IRA
Native Village of Wainwright
North Slope Borough
    Department of Wildlife Management
    Mayor's Office
    Planning Department
    Public Information Office
    Village Coordinator, Anaktuvuk Pass
    Village Coordinator, Atqasuk
    Village Coordinator, Kaktovik
    Village Coordinator, Nuiqsut
    Village Coordinator, Point Hope
    Village Coordinator, Wainwright
Nunamiut Corporation, Anaktuvuk Pass
Olgoonik Corporation, Wainwright
Tigara Corporation, Point Hope
Tikigaq Corporation, Point Hope
Ukpeagvik Inupiat Corporation

Libraries

Alaska Pacific University
    Academic Support Center Library
Alaska Resources Library and Information Service (ARLIS)
Alaska State Library
    Government Publications, Juneau
Canadian Circumpolar Library, Edmonton AB
Canadian Joint Secretariat Librarian, Inuvikon NT
Fairbanks North Star Borough
    Noel Wien Library
Ilisaavik Library, Shishmaref
Juneau Public Library
Kaveolook School Library, Kaktovik
Kegoyah Kozpa Public Library, Nome
Tikigaq Library, Point Hope
Trapper School Community Library, Nuiqsut
Tuzzy Consortium Library, Barrow
University of Alaska, Anchorage
    Consortium Library
University of Alaska, Fairbanks
    Elmer E. Rasmuson Library
    Geophysical Institute
    Government Documents
    Institute of Arctic Biology
University of Alaska, Southeast (Juneau)
Valdez Consortium Library
Z.J. Loussac Library, Anchorage

Petroleum Industry

AEC Oil and Gas (USA) Inc.
Alaska Clean Seas
Alaska Support Industry Alliance
Amerada Hess Corporation
American Petroleum Institute
Amoco Production Co.
Anadarko Petroleum Corporation
Armstrong Oil and Gas Inc.
Atofina Petrochemicals, Inc.
Aurora Gas LLC
BP Exploration (Alaska) Inc.
Burlington Resources
Chevron U.S.A. Inc.
ConocoPhillips Alaska Inc
Devon Energy Production Company
Encana Oil and Gas, Inc.
Eni Petroleum Exploration Co Inc
ExxonMobil Oil Corporation
ExxonMobil Production Company
Forest Oil Corporation
Hess Corporation
Liberty Petroleum Corporation
Marathon Oil Company
Murphy Exploration (Alaska), Inc.
Murphy Exploration and Production Company
Pennzoil
Petrobras-USA
Petro-Canada (Alaska) Inc.
Phillips Alaska, Inc.
Phillips Petroleum Company
Pioneer Natural Resources USA Inc
Shell Frontier Oil & Gas, Inc.
Shell Offshore Inc
Texaco Inc.
Total E&P USA Inc
Union Oil Company of California
Western Geophysical Company

Associations, Companies, Special Interest Groups, and Others

Alaska Coalition
Alaska Conservation Foundation
Alaska Journal of Commerce
Alaska Marine Conservation Council
Alaska Native Knowledge Network, Fairbanks
Alaska Natural Heritage Program
Alaska Newspapers, Inc.
Alaska Oil and Gas Association
Alaska Public Interest Research Group
Alaska Public Radio Network, Anchorage
Alaska Wilderness League Anchorage Daily News
Applied Sociocultural Research
Arctic Connections
Arctic Marine Resource Commission
Arctic Sounder, Anchorage
Barrow Cable TV
Bering Air, Inc., Nome
Coastal Marine Institute, School of Fisheries & Ocean Science, University of Alaska, Fairbanks
EarthJustice, Juneau
Exxon Valdez Oil Spill Trustee Council
Fairbanks Daily News-Miner
Green Peace
Ilisagvik College, Barrow
Indigenous Peoples Council for Marine Mammals
Inupiat Heritage Center
LGL, Environmental Research Associates
LGL, Alaska Research Associates
Munger Oil Information Services
National Ocean Industries Association
Prince William Sound RCAC
URS Corporation
University of Alaska, Anchorage
Institute of Social and Economic Research
KBRW News, Barrow
Marine Advisory Program
National Audubon Society
National Parks and Conservation Association
National Wildlife Federation
Northern Alaska Environmental Center
Sierra Club
Trustees for Alaska
US Arctic Research Commission
Wilderness Society

5.4. Consultation.

The MMS completes consultations pursuant to Section 7 of the Endangered Species Act (ESA); pursuant to the Magnuson-Stevens Fishery Conservation and Management Act on Essential Fish Habitat; and pursuant to National Historic Preservation Act. Correspondence related to consultation is in Appendix H. The Biological Evaluations and Biological Opinions in support of ESA Section 7 consultations are available on the MMS website at http://www.mms.gov/alaska/ref/Biological_opinionsevaluations.htm.

Section 7(a)(2) of the Endangered Species Act (ESA) requires each Federal agency to insure that any action that they authorize, fund or carry out is not likely to jeopardize the continued existence of a listed species or result in the adverse modification of designated critical habitat. To satisfy its ESA obligations on proposed lease sales, the MMS consults with FWS and NMFS for listed species under each Service's jurisdiction. For ESA consultation on proposed lease sales, MMS specifically requests incremental Section 7 consultation. Regulations at 50 C.F.R. 402.14 (k) allow consultation on part of the entire action as long as that step does not violate section 7(a)(2), there is a reasonable likelihood that the entire action will not violate section 7(a)(2), and the agency continues consultation with respect to the entire action, obtaining a biological opinion (BO) for each step. Thus, at the lease sale stage, MMS consults on the early lease activities (seismic surveying, ancillary activities, and exploration drilling), to insure that activities under any leases issued will not result in jeopardy to a listed species or cause adverse modification of designated critical habitat. Consultation with NMFS for the proposed lease sales, including seismic surveying and exploration activities, has already been completed for species under NMFS jurisdiction. The MMS is pursuing incremental consultation with FWS on the potential effects of leasing and exploration activities on those species under FWS jurisdiction.

Any proposed development and production would require further consultation with the FWS and NMFS. Details regarding the specific locations and operational parameters of future development are unknown, and development and production are not considered reasonably foreseeable. However, for NEPA purposes, this EIS evaluates potential effects of production and development; and for purposes of incremental consultation, the MMS and Services evaluate and assess the likelihood that the entire action could jeopardize the continued existence of any listed species. Any future development proposals arising from the proposed lease sales in the Chukchi Sea (212 and 221) and Beaufort Sea (209 and 217) will be subject to future Section 7 consultation and, as with exploration, can not result in jeopardy or adverse modification of designated critical habitat as determined by FWS or NMFS.

5.4.1. Consultation with NMFS for ESA-listed Marine Mammals.

On August 12, 2005, MMS requested from NMFS a list of threatened, endangered, and candidate species and critical habitats under their jurisdiction pursuant to Section 7 of the Endangered Species Act. The NMFS responded with a list that included the endangered bowhead whale and noted critical habitat has not been designated for bowhead whale (dated September 30, 2005). The NMFS also noted that the endangered humpback and fin whale are found in the Chukchi and Bering seas outside of the OCS planning areas. The MMS provided a request for programmatic Arctic Regionwide consultation and a Biological Evaluation (BE) (USDOI, MMS, 2006c). The MMS described the potential impacts that OCS activities could have on endangered bowhead whales and included a brief discussion of potential impacts to the endangered humpback and fin whale. The BE discussed mitigation measures to avoid and minimize impacts to these species. On June 16, 2006, NMFS provided their Arctic Region Biological Opinion (ARBO) stating that the activities associated with seismic surveys in the Beaufort and Chukchi seas may adversely affect but not jeopardize the continued existence of any species listed under the ESA that is under the jurisdiction of NMFS.

On December 3, 2007, MMS requested from NMFS concurrence to reinitiate consultation under the ESA for endangered fin and humpback whales in response to new information regarding these species under their jurisdiction. The NMFS responded in a letter dated December 13, 2007, acknowledging receipt of the December 3, 2007, letter to reinstate ESA consultation. They indicated that if fin and humpback whales are determined to have a regular presence in arctic waters, their interaction with oil and gas activities should be addressed prior to further consultation under the ESA. Subsequent to this correspondence, MMS discussed with NMFS new information related to sightings of fin and humpback whales in the southwest Chukchi Sea and easternmost Beaufort Sea. In a letter dated January 10, 2008, NMFS recommended MMS reinitiate consultation for potential impacts on humpback and fin whales from airgun-supported seismic-survey activities, and provided additional discussion on the potential consequences of continued climate change and diminished sea ice on bowhead, humpback, and fin whales. Subsequently, MMS initiated new programmatic Regionwide consultation. The 2008 ARBE was submitted to NMFS on May 8, 2008, and on June 3, 2008, NMFS acknowledged receipt of the 2008 ARBE and reminded MMS that the 2006 ARBO remained valid until a supplemental opinion and applicable Incidental Take Statement have been completed. On July 17, 2008, NMFS provided the ARBO, stating that individual bowhead, humpback, and fin whales in the action area may be adversely affected, but the Proposed Action is not likely to jeopardize the continued existence of Western Arctic bowhead whales, North Pacific fin whales, and humpback whales.

5.4.2. Consultation with FWS for ESA-Listed Birds Species.

On October 2, 2007, MMS requested from FWS a list of threatened, endangered, and candidate species and critical habitats under their jurisdiction pursuant to Section 7 of the ESA. On October 10, 2007, FWS responded with a list that included the spectacled eider (threatened), the Steller’s eider (threatened), and the Kittlitz’s murrelet (a candidate species), and the Ledyard Bay Critical Habitat Area.

The MMS has integrated the required elements of a BE into this draft EIS (per section 402.06 of the ESA), determining that the proposed lease sales are likely to adversely affect listed species, but not adversely modify critical habitat. The MMS intends to send the draft EIS to FWS to initiate formal Section 7 consultation on the proposed actions.

5.4.3. Consultation with FWS for ESA Listed Marine Mammals (Polar Bear).

On May 15, 2008, the FWS listed the polar bear as threatened throughout its range. The FWS published an Interim Final 4(d) Rule concurrently which provides guidance on the implementation of the ESA. This special rule adopts the existing conservation regulatory requirements currently in place under the Marine Mammal Protection Act of 1972 as amended (MMPA), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as the appropriate regulatory provisions for this threatened species.

After several meetings between FWS and MMS in late May and early June, MMS sent a letter to FWS on June 27, 2008, requesting reinitiation of Section 7 consultation for polar bear. The MMS received a written reply from FWS on July 15, 2008. Since that time, MMS and FWS have been engaged in an iterative informal consultation process to exchange important information about polar bear biology; identify past, present and future oil and gas and other activities relevant to an effects analysis and to clarify and refine the most appropriate scope of the action for consultation purposes. The MMS has integrated the required elements of a BE into this draft EIS (per section 402.06 of the ESA), determining that the proposed lease sales are likely to adversely affect listed species. The MMS intends to send the draft EIS to FWS to initiate formal Section 7 consultation. The FWS has not yet designated critical habitat for the polar bear, however the FWS has begun the process of determining what areas would receive this protection.

The polar bear also is a protected species under the MMPA. All exploration, development, and production activities are subject to provisions of the MMPA and the ESA. Incidental take of marine mammals cannot be authorized under ESA until incidental take has first been authorized under the Marine Mammal Protection Act. Incidental take regulations (ITRs) under the MMPA provide a process for authorizing activities that may cause the incidental "take" of marine mammals but have no more than a negligible impact upon the population or stock of that species. The FWS can promulgate ITRs for specific geographic areas and species only after being requested to do so by one or more U.S. citizens. At this time, there is an ITR in place in the Beaufort Sea that authorizes the nonlethal, incidental, unintentional take of small numbers of polar bears (and walrus) during oil and gas exploration, development, and production activities through August 2, 2011.

There is also an ITR in the Chukchi Sea that similarly authorizes incidental take of small numbers of polar bear (and walrus) during exploration activities through June 11, 2013. Development and production are not considered reasonably foreseeable at this time in the Chukchi Sea, and the current ITRs do not include these activities.

5.4.4. Consultation with NMFS for Essential Fish Habitat.

If a specific Federal action may adversely affect essential fish habitat (EFH), but no existing environmental review process is available (or if project timing does not allow for the development of a Finding for an existing process), and no General Concurrence or programmatic consultation has been completed that applies to that action, then an individual EFH consultation must be completed. The April, 2004 document *Essential Fish Habitat Consultation Guidance* produced by the NMFS's Office of Habitat Conservation provides the following timelines for abbreviated and expanded EFH consultations.

Individual EFH consultations can be abbreviated (50 CFR 600.920 (h)) or expanded (50 CFR 600.920(i)), depending on the extent of the anticipated adverse effects to EFH. Abbreviated consultation allows NOAA Fisheries to determine quickly whether, and to what degree, a Federal action may adversely affect EFH. Abbreviated consultation procedures should be used when the adverse effects of an action can be alleviated through minor modifications to the action. Expanded consultation allows maximum opportunity for NOAA Fisheries and the Federal agency to work together to review the action's impacts on EFH and to develop EFH Conservation Recommendations. Expanded consultation procedures must be used for Federal actions that would result in substantial adverse effects to EFH.

Generally, the action agency determines the appropriate level of consultation. If NOAA Fisheries determines, contrary to the Federal Agency's assessment, that a proposed action will have substantial adverse effects on EFH, NOAA Fisheries may request expanded consultation. Such a request will be in writing and will explain why NOAA Fisheries believes expanded consultation is needed. The determination of substantial adverse effects should be based on project-specific considerations, such as the ecological importance or sensitivity of an area, the type and extent of EFH affected, and the type of activity. Substantial adverse effects are effects that may pose a relatively serious threat to EFH and typically could not be alleviated through minor modifications to a proposed action. Federal Agencies are encouraged to contact NOAA Fisheries at the earliest opportunity to discuss whether the adverse effects of an action makes expanded consultation appropriate.

Procedures. The EFH guidelines provide specific schedules for completion of abbreviated and expanded consultation. The guidelines state, however, that NOAA Fisheries and the Federal Agency may agree to a modified schedule. For example, NOAA Fisheries and the Federal Agency may agree to use a compressed schedule or to conduct EFH consultation earlier in the planning cycle for actions with lengthy approval processes or for cases where regulatory approvals or emergency situations cannot accommodate the following schedules. Alternatively, NOAA Fisheries and the Federal Agency may agree to extend the consultation schedule to allow for further analysis of the effects of the action.

Abbreviated EFH Consultation

1) Notification – Notification generally would occur when NOAA Fisheries receives an EFH Assessment from the Federal agency.

2) EFH Assessment – The Federal agency must submit its EFH Assessment to NOAA Fisheries as soon as practicable, but at least 60 days prior to a final decision on the action. The level of detail in the EFH Assessment should be commensurate with the complexity and magnitude of the potential adverse effects of the action. For relatively simple actions involving minor adverse effects on EFH, the assessment may be very brief.

3) EFH Conservation Recommendations – NOAA Fisheries will provide the Federal agency with EFH Conservation Recommendations, if appropriate, within 30 days of receiving the EFH Assessment. If NOAA Fisheries determines that an action would not adversely affect EFH or that no EFH Conservation Recommendations are needed, NOAA Fisheries will notify the Federal agency either informally or in writing of its determination.

4) Federal Agency Response – The Federal agency must provide a detailed response in writing to NOAA Fisheries within 30 days of receiving EFH Conservation Recommendations. The response must include the information described at 50 CFR 600.920(k)(1). If a response is inconsistent with NOAA Fisheries' recommendations, it must be provided at least 10 days prior to final approval of the action.

Expanded EFH Consultation

1) Notification – Expanded consultation begins when NOAA Fisheries receives an EFH Assessment and a written request for expanded consultation from the Federal agency.

2) EFH Assessment – The Federal agency must submit its EFH Assessment to NOAA Fisheries as soon as practicable, but at least 90 days prior to a final decision on the action. In addition to the information identified at 50 CFR 600.920(e)(3), Federal agencies are encouraged to provide in the EFH Assessment the additional information identified under 50 CFR 600.920(e)(4) to facilitate review of the effects of the action on EFH. If NOAA Fisheries believes that additional analysis is needed to assess the effects of the action, NOAA Fisheries will specify in a letter to the Federal agency any new information needed. The Federal agency should provide the additional information to NOAA Fisheries, to the extent practicable.

3) Review of Effects to EFH – NOAA Fisheries will review the EFH Assessment and any additional, relevant information and conduct a site visit, if appropriate, to assess the quality of the habitat and to clarify the impacts of the Federal agency action. NOAA Fisheries will coordinate the review of the action and any site visits with the appropriate Council(s).

4) EFH Conservation Recommendations – Generally, NOAA Fisheries will provide the Federal agency with EFH Conservation Recommendations within 60 days of receiving the completed EFH Assessment. However, if NOAA Fisheries determines that additional data or analysis would provide better information for development of EFH Conservation Recommendations, NOAA

Fisheries may request additional time for expanded consultation. If NOAA Fisheries and the Federal agency do not agree to extend consultation, NOAA Fisheries must provide the Federal agency with EFH Conservation. Recommendations will be based on the best scientific information available.

5) Federal Agency Response – The Federal agency must provide a detailed response in writing to NOAA Fisheries within 30 days of receiving EFH Conservation Recommendations. The response must include the information described at 50 CFR 600.920(k)(1). If a response is inconsistent with NOAA Fisheries' recommendations, it must be provided at least 10 days prior to final approval of the action.

5.4.5. Consultation with Alaska State Historic Preservation Office. The MMS initiated Section 106 consultation with the State Historic Preservation Officer (SHPO) in a letter sent to the SHPO on May 30, 2008, requesting concurrence with our determination that proposed Lease Sales 209, 212, 217, and 221 would have no effect on known offshore historic and/or prehistoric resources. A letter concurring with this determination was received from the Alaska SHPO on September 30, 2008.

5.4.6. Consultation with Alaska Coastal Management Program - Land Use Plans and Coastal Management Program. The NSB is the largest borough in Alaska, with more than 15% of the State's total land area. It lies north of the Arctic Circle, primarily between the north and northeastern coast of Alaska and the Brooks Range. The Borough encompasses 88,817 mi^2 (ADEC, 2006c).

Land ownership in the Borough is complex. The Federal Government is the predominant land owner, with more than half of the Borough's land area included within the National Petroleum Reserve-Alaska (NPR-A) and the Arctic National Wildlife Refuge (ANWR). Other major landholders include the State of Alaska, Arctic Slope Regional Corporation (ASRC), and eight Native village corporations. Under the terms of the ANCSA, the Native village corporations received only surface-estate rights, whereas ASRC received subsurface-estate rights. Moreover, in ANWR and NPR-A, land selection was restricted to the surface estate for village corporations, and the subsurface estate was reserved for the Federal Government. The ASRC was required to select subsurface estate outside these boundaries.

Major land uses on the North Slope are divided between subsistence use and petroleum-resource extraction. Community sociocultural characteristics are more fully covered in Section 3.4.3. A discussion of the oil and gas development in the Borough is found in Section 3.1. Guiding the growth and development within the Borough are the Statewide Standards of the Alaska Coastal Management Program (ACMP), the NSB Coastal Management Program (NSBCMP), and the NSB Comprehensive Plan and Land Management Regulations (LMRs).

5.4.6.1. Alaska Coastal Zone Management Program. The Federal Coastal Zone Management Act (CZMA) and the Alaska Coastal Management Act were enacted in 1972 and 1977, respectively. Through these acts, development and land use in coastal areas are managed to provide a balance between the use and the need to protect of valuable coastal resources and other uses of the coastal area. Each Federal Agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone must be carried out to be consistent, to the maximum extent practicable, with the enforceable policies of approved State management programs.

The CZMA excludes from the coastal zone "…lands the use of which is by law subject solely to the discretion of or which is held in trust by the Federal Government, its officers, or agents" (16 U.S.C. 1453). Although OCS lands are excluded from the coastal zone, all Federal activities occurring on or within the OCS, such as oil and gas lease sales, are subject to consistency review if they have a reasonably foreseeable effect on a coastal use or resource. Federal consistency review provides Alaska with an important tool for managing its coastal uses and resources, and helps ensure sensible oil and gas exploration and development in the coastal area.

The State of Alaska ACMP program and regulations are found in Title 11, Alaska Administrative Code (AAC), Chapters 110, 112, and 114. The enforceable policies, referred to as "statewide standards" address development and use of lands and natural resources in the coastal zone. The coastal zone and coastal district boundaries are mapped in the *Biophysical Boundaries of Alaska's Coastal Zone*, an atlas prepared by the Alaska Department of Fish and Game. The Statewide standards that may be relevant to activities hypothesized in this EIS are summarized in the following paragraphs under two headings: Uses and Activities, and Resources and Habitats.

Uses and Activities. Under the uses and activities category, the policies that may be relevant to hypothesized OCS activities include: (1) coastal development; (2) natural hazard areas; (3) coastal access; (4) energy facilities; (5) utility routes and facilities; (6) sand and gravel extraction; (7) subsistence; and (8) transportation routes and facilities.

The coastal development standard gives priority to development that is water dependent or water related, and uses that may be neither of these but for which there is no feasible or prudent inland alternative to meet the public need for the use or activity. The intent of the policy is to ensure that onshore development and activities that could be placed inland do not displace activities dependent on coastal locations.

Natural hazards are defined under 11 AAC 112.990(15) as natural processes or adverse conditions that present a threat to life or property in the coastal areas from flooding, earthquakes, active faults, tsunamis, landslides, volcanoes, storm surges, ice formations, snow avalanches, erosion, and beach processes. Natural hazards also may include other natural processes or adverse conditions designated by the Alaska Department of Natural Resources or by a district in a district plan. Natural hazards would be considered during review of individual projects when site-specific information is available. Development plans would need to describe natural hazards in the area, identify site-specific factors that might increase risks, and propose appropriate measures to reduce those risks.

The coastal access standard would require appropriate protection to help maintain the continued desirability of public access to, from, and along coastal waters. Minimizing conflicts between subsistence users and oil and gas activities would be a significant factor for maintaining access and use of the coastal area.

The Statewide energy facilities standard would require that decisions on the siting and approval of energy-related facilities be based, to the extent practicable, on 16 criteria. Practicable as defined in 11 AAC 112.990(18) means feasible in light of overall project purposes after considering cost, exiting technology, and logistics of compliance with the standard. The standard also recognizes that the facilities and activities authorized by the issuance of oil and gas leases in a Federal lease sale are uses of State concern.

Utility routes and facilities, unless water dependent or water related, would need to be sited inland to comply with the utility route and facilities standard. Utility routes and facilities along the coast would need to avoid, minimize, or mitigate (1) alterations in surface and ground water drainage patterns; (2) disruption in known or reasonably foreseeable wildlife transit; (3) blockage of existing or traditional access.

Sand and gravel could be extracted from coastal waters, intertidal areas, barrier islands, and spits under the Statewide standard when no feasible and prudent noncoastal alternative is available to meet the public need. Approval to extract sand and gravel from these areas usually requires a permit from the U.S. Army Corps of Engineers.

The subsistence policy requires the designation of areas in which subsistence is an important use of coastal resources. A Federal OCS project affecting a designated subsistence use area would need to avoid or minimize impacts to subsistence uses. An analysis or evaluation of reasonably foreseeable adverse impacts of the project on subsistence use would also be required.

Transportation routes and facilities would need to avoid, minimize, or mitigate (1) alterations in surface and groundwater-drainage patterns; (2) disruption in known or reasonably foreseeable wildlife transit; and (3) blockage of existing or traditional access.

Resources and Habitats. Three policy areas come under the heading of resources and habitats: (1) habitats; (2) air, land, and water quality; and (3) historic, prehistoric, and archaeological resources.

Nine coastal habitats are identified in the habitat standards: (1) offshore areas; (2) estuaries; (3) wetlands; (4) tidelands; (5) rocky islands and sea cliffs; (6) barrier islands and lagoons; (7) exposed high-energy coasts; (8) rivers, streams, and lakes; and (9) important uplands. Each habitat must be managed to protect the physical characteristics, use or resource for which the habitat is identified. Mitigation under the habitat standard involves a sequencing process:

- first, to avoid adverse impacts to the maximum extent practicable;
- second, when avoidance is not practicable, to minimize adverse impacts to the maximum extent practicable; and
- third, if neither avoidance nor minimization is practicable, to conduct mitigation to the extent appropriate and practicable.

The ACMP defers to the mandates and expertise of the Alaska Department of Environmental Conservation to protect air, land, and water quality. The standards incorporate the Department's statutes, regulations, and procedures. The Department's standards include, but are not limited to:

- Prevention, control, and abatement of any water, land, subsurface land, and air pollution, and other sources or potential sources of pollution of the environment.
- Prevention and control of public health nuisances.
- Safeguard standards for petroleum and natural gas pipeline construction, operation, modification, or alteration.
- Protection of public water supplies by establishing minimum drinking water standards, and standards for the construction, improvement, and maintenance of public water-supply systems.
- Collection and disposal of sewage and industrial waste.
- Collection and disposal of garbage, refuse, and other discarded solid materials from industrial, commercial, agricultural, and community activities or operations.
- Control of pesticides.
- Handling, transportation, treatment, storage, and disposal of hazardous wastes.

The policy addressing historic, prehistoric, and archaeological resources requires the designation of areas of the coastal zone that are important to the study, understanding, or illustration of national, State, or local history or prehistory, including natural processes. A project with a properly designated area would need to comply with the applicable requirements of AS 41.35.010-41.35.240 and 11 AAC 16.010-11 AAC 16.900.

5.4.6.2. North Slope Borough District Coastal Management Plan. *The Borough's coastal zone includes all State-owned submerged lands in the Beaufort and Chukchi seas; however, because*

Federal land is excluded from the coastal zone, the Borough's inland coastal zone boundary is divided into two sectors: the mid-Beaufort coastal sector and the Point Hope/Point Lay coastal sector. The mid-Beaufort coastal sector lies between ANWR and NPR-A. The Point Hope/Point Lay coastal sector lies west of NPR-A and north of the Northwest Arctic Borough. In these two sectors, the coastal zone boundary extends inland roughly 25 mi from the coast and along the full length of all major river corridors to include all anadromous fish-spawning and -overwintering habitats.

As a result of changes made to the ACMP that went into effect in 2006, all coastal districts, including the NSB, had to revise their local plans and enforceable policies to conform to the new Statewide standards. The enforceable policies of the NSBCMP have been declared null and void by the Alaska Department of Natural Resources (ADNR/OPMP, 2007b) The NSB and State of Alaska are in mediation regarding approval of the NSBCMP amendment that will reestablish the district's enforceable policies.

Safeguarding the Inupiat subsistence lifestyle is a high priority for the NSB. To this end, the existing CMP seeks to balance economic development with preservation of and access to the fish and game that support the traditional cultural values and way of life of the Inupiat people. Accordingly, land use on the North Slope under the existing CMP is divided between traditional subsistence uses and the exploration, development, and extraction of mineral resources. The former district enforceable policies contain four categories: (1) standards for development; (2) required features for applicable development; (3) best-effort policies; and (4) minimization of negative impacts. It is anticipated that the NSB's district plan amendment will reflect similar safeguards and standards.

5.4.6.3. North Slope Borough Comprehensive Plan and Land Management Regulations. The NSB Comprehensive Plan and LMRs were adopted in December 1982 and revised in April 1990. The Comprehensive Plan underwent further revision in September 2005. The revisions simplified the regulatory process but did not alter the basic premise of the comprehensive plan, which is to preserve and protect the land and water habitat essential to the subsistence character of Inupiat life.

The Borough's LMRs have five zoning districts: Village, Barrow, Conservation, Resource Development, and Transportation Corridor. All areas within the NSB are in the Conservation District, unless they are specifically designated within the limited boundaries of a village or Barrow, a unitized oil field within the Resource Development District, or within the TAPS corridor. The LMRs categorize uses as:

a) *those that can be administratively approved without public review,*
b) *those that require a development permit and public review before they can be administratively approved, and*
c) *those considered to be conditional development that must be approved by the Planning Commission.*

The LMRs incorporate the formerly enforceable policies of the NSBCMP and supplement them with additional policy categories: Village Policies, Economic Development Policies, Offshore Development Policies, and Transportation Corridor Policies. The enforceable policies of the NSBCMP are incorporated within the zoning ordinance and LMRs of the Borough's Municipal Code in Section 19.70.050. While the enforceable policies of the NSBCMP have been declared *null and void, this declaration has not affected the corresponding policies incorporated into the LMRs. In other words, while these policies are not applicable to coastal zone consistency, they are applicable to activities that require approvals and permits required by the NSB LMRs.*

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.